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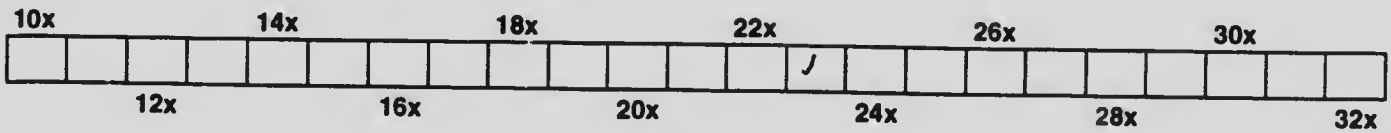

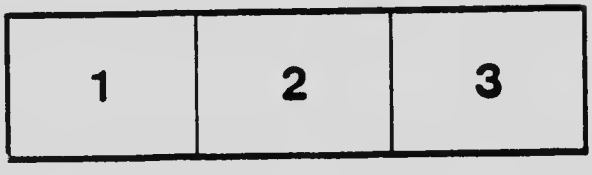

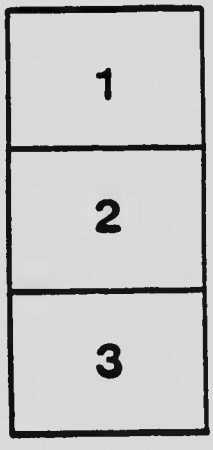

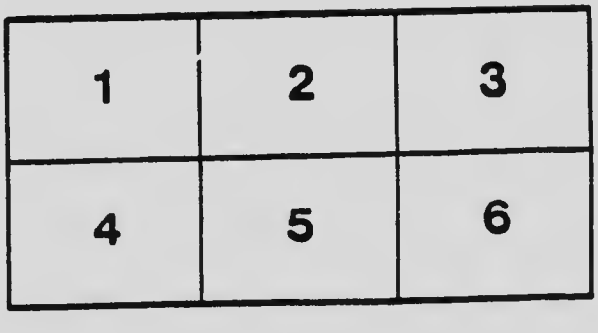

STUDIES IN

Horse Breeding

An Illustrated Treatise on the Science and Practice of Horse Breeding

BY

G. L. CARLSON

Preface to Eighth Edition

Inasmuch as a considerable number of books of each of the earlier editions of this book were taken by citizens of the Dominion of Canada, it is thought best to publish this edition in Canada. No country is better fitted by reason of its climate, nutritious grasses, abundance of grain of the highest quality, pure water, and the high intelligence of its breeders in the production of high-class horses, than is a large portion of Canada. This is evidenced by the fact that in nearly all breeds of domestic animals, the breeders of Canada have produced many individuals which are surpassed in excellence by those of no other country.

The chief object of this work is to help in improving the horse, and to be a means of employing better methods in producing him. That horse-breeding methods have been extremely wasteful throughout all the years of the past, admits of no doubt. Only a small percentage of all mares bred produce foals that reach maturity.

Despite the wasteful methods employed, no industry connected with the soil, or carried on in connection with the farm, has yielded so liberal returns for the labor and money employed in it, as the breeding of good horses. The tractor and the truck have been so perfected as to take the place of the horse in a considerable number of industries, but we now know as we did not a few years ago, that no tractor can take the place of the horse on the farm of the average size, and smaller. When this is remembered in connection with the further fact that war has recently both destroyed a large portion of the world's horse population and created new uses for him, the outlook for the breeding of good farm and cart horses has never been brighter.

When regarded from the all-American standpoint, the breeding of horses and mules has been for many years a most profitable industry, yet little has ever been done in a public way to encourage it, or to aid the farmer and breeder in adopting more intelligent methods of producing them. The same is true of individual help. In the past no special study was made of the horse, because the horse represented too much value to be sacrificed by

those who were interested in such a study. Mares dying and which could be had for special studies, were usually barren because of old age. Although great progress had been made in most fields of science, on the subject of the horse, how the ovaries perform their function, how, when and where fertilization takes place, or of the early development of the fetus and fetal membranes, very little was really known.

The world's most urgent need today, is for more men with special training to carry on its necessary work. In this respect the business of breeding horses differs in no essential from that of any other, only those best fitted for the business shall survive. Little progress in producing better horses need be expected, until more intelligent methods be employed to produce them.

I believe one is justified in appealing to the civic pride of a people, which is pretty well developed in all progressive countries, upon the question of breeding better horses. I have observed that throughout all the rural world, the best and the highest type of citizenship is always to be found in the districts possessing horses of the highest quality. To improve the live-stock of a country is a potent means of raising the standard of its citizenship. This is only because the successful breeding of high-class animals calls into activity intelligence of the highest order. Most progressive countries are now awakening to the importance of the horse-breeding industry as a means to encouraging the best progress, and they are appreciating as never before the need of educational aid in that direction.

G. L. CARLSON.

Norfolk, Nebraska, U.S.A.
April, 1920.

CHAPTER I.

THE SEXUAL PRODUCT OF THE STALLION.

1. The Beginning of a New Life. In all animals the beginning of a new life can take place only when the reproductive elements of the two sexes are properly united. Under natural conditions this is done by the procreative act, or sexual union of the two sexes. These reproductive elements are known as spermatozoa and egg-cells, or ova, the former being the product of the stallion, while the latter are the product of the mare.

Figure 1.—The genital organs of the stallion, shown from the right side. 1, right testicle; 2, 3, vas deferens; 4, seminal vesicle; 5, prostate gland; 6, urethra; 7, Cowper's glands; 9, fold of peritoneum; 10 vessels and nerves of left testicle cut off; 11, Abdominal ring; 12 bladder.

2. The Sexual Organs of the Stallion. The origin of the reproductive elements of the stallion will require some study of the genital organs, shown in figure 1. Only the essential organs of reproduction will be described in this work, which consists of the

testicles, the vasa efferentia, the epididymis, the vasa deferentia (vas deferens), and the vesiculae seminales (seminal vesicles).

3. The Testicles. The origin of the reproductive element is in the testicles. These organs are suspended in a pouch between the thighs, which is known as the scrotum. This is a single sac enclosing both testicles. Immediately under the scrotum one finds the dartos, a thin layer of elastic tissue. The dartos is a dependency from the abdominal structure, and forming two cavities, with a double partition between them, through which the penis passes. The cremaster is a muscle forming a partial covering for the testicle, and the tunica vaginalis is the serous covering of this organ.

Strictly speaking the testicle proper is enclosed with a fibrous capsule, the tunica albuginea. This fibrous tissue is extended into the substance of the testicle, dividing the organ into separate

Figure 2.—The testicle of the stallion with other organs, dissected of their serous covering. 1, testicle 2, glands in which are found the spermatoblast cells; 3, vasa efferentia; 4, epididymis; 5, vas aberrans; 6, vas deferens; 7, spermatic artery.

lobules. In each lobule are found many seminal tubules, commencing in a highly convoluted portion, but ending in a straight tube, and piercing the tunica albuginea at the anterior extremity of the testicle. These seminal tubules consist of several layers of cells, known as the spermatoblast cells, which form spermatozoa.

4. The Vasa Efferentia and Epididymis. The vasa efferentia are but the continuation of the seminal tubules which have now pierced the tunica albuginea and they in turn terminate in the globus major of the epididymis. No part of the genital organs of the stallion show such a variation in individuals as the epididymis. Never have I found two stallions the same in this particular. In some stallions we find the head, or globus major, some three inches in diameter, and suddenly terminating into a small tube, or globus minor. In others we find a large convoluted

canal of even size throughout its length, and I am inclined to the belief that the latter form is found in the case of the most virile stallions.

5. The Vasa Deferentia. These are the excretory ducts of the testicles, each tube having the thickness of a small pencil. The semen is thus carried from the epididymis to the upper face of the bladder, terminating in a short constricted portion, under the prostate, into the ejaculatory duct.

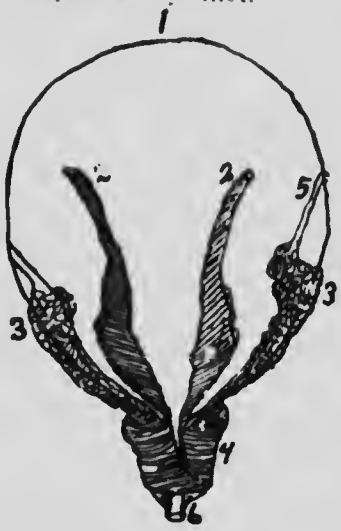

Figure 3.—The bladder and seminal vesicles dissected of their serous covering. 1, bladder; 2, 2, vas deferens; 3, 3, seminal vesicles; 4, prostate gland; 5, ureter; 6, urethra.

6. The Vesiculae Seminales. The seminal vesicles are the two oval bodies placed between the bladder below and the rectum above. They are the chief depositories for the storage of semen. Here under normal conditions of all the bodily functions, semen may be stored for months. Shown in figure 3.

7. The Ejaculatory Ducts. These are two short tubes formed beneath the prostate gland by the junction of the vas deferens and the neck of the seminal vesicle, where the duct soon opens into the urethra.

8. Spermatic Cord. The testicle is suspended by means of the spermatic cord, and blood is supplied by the spermatic artery.

9. The Penis. With this organ, which is the stallion's organ of copulation, may be concluded the chief organs of reproduction. The penis consists of erectile tissue and is divided into two portions, the one permanent as to place, the other free. The free portion is suspended in a sling known as prepuce, which is a

sheath covered by a skin possessing an extremely fine texture and smooth surface. The anterior extremity of the penis consists of an enlargement, the glans penis. The blood is supplied by the external and internal pudic and obturator arteries. The

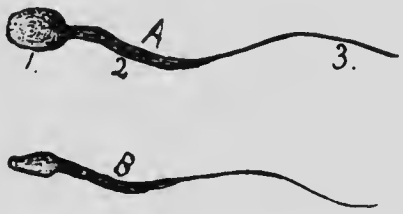

Figure 4.—Spermatozoa shown in two positions, and showing flattened form of head. 1, head; 2, middle piece; 3, tail.

nerve supply is by the internal pudic and sympathetic nerves, the most sensitive in the nervous system of the horse. It is because of the very sensitive nature of this portion of the penis, that injury so often results from the use of breeding bags. The same injury to this organ may result from sudden and forced blows, such as kicks, or striking the end of the penis with any foreign object. Injury of a serious nature has been known to follow forced copulation.

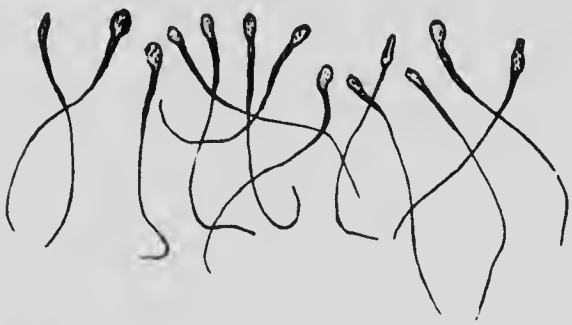

Figure 5.—Spermatozoa of the stallion. (Sketched.)

10. The Urethra. This is properly a part of the penis, and is a long membranous tube or canal extending from the neck of the bladder to the glans penis. It is common to both generative

and urinary systems. The commencement of the urethra is very constricted but the membranous portion is more dilated.

11. Spermatozoa. It has already been shown (3) that the reproductive elements, or spermatozoa, have their origin in the testieles, yet a mature spermatozoon, or one capable of showing any other than a rotary motion, has never been found in the testicles of a stallion. It requires the same process of maturation to develop spermatozoa, as we find in the case of the egg of the mare. Motion is observed as soon as the spermatozoa reach the vasa efferentia, but it is still rotary. Greater activity will be observed as they reach the epididymis, and more active yet when found in the vas deferens. Evidence of full maturity is wanting, however, until they reach the seminal vesieles.

Figure 6.—Spermatozoa of the stallion, showing the wider and thicker form as a result of using stains. This figure also shows the large corpuscles frequently found in the seminal fluid of some stallions.

The best test one can make of the full maturity of spermatozoa, is in experiments with external fertilization. The egg of the mare has no attraction for any spermatozoa found before reaching the seminal vesieles. Here one finds them capable of fertilizing the egg, as are those secured by copulation.

12. The Discovery of Spermatozoa. The discovery of spermatozoa in the seminal fluid of the males, and later that a spermatozoon is but a cell containing the fundamental or primary structure of a future being, has been of far reaching importance to the study of embryology. During the eighteenth century, and even up to the middle of the nineteenth, there was a wide diversity of opinion among the most eminent scientists upon this subject. In fact very little was really known. Spermatozoa were first discovered by a German student in the year 1677.

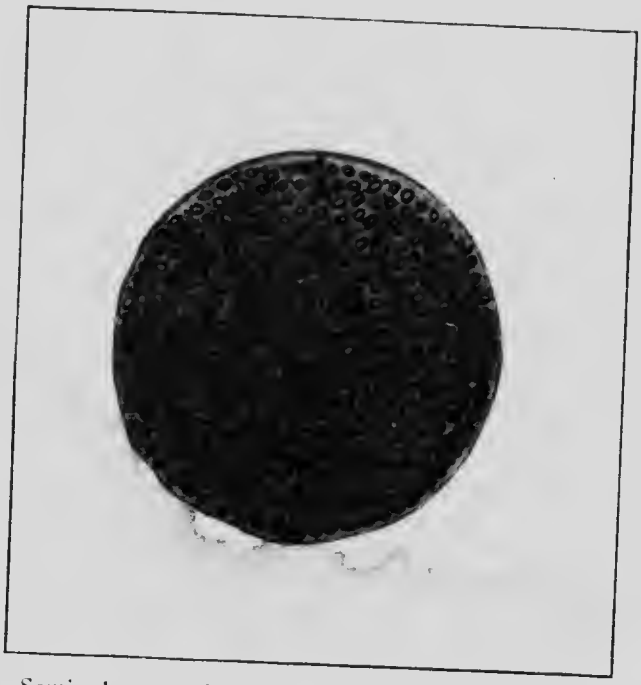

Figure 7.—Seminal corpuscles found in the semen of all stallions. This figure also represents the semen of a sterile stallion in which no spermatozoa are present.

Figure 9—The development of a spermatozoon from a single cell to a mature spermatozoon. a, seminal cell; b, nucleus with chromatin net work; c, structure from which the middle piece is formed.
It will be noticed that as viewed from left to right, the process of development is at first progressive, then retrogressive.

13. Ovists and Animalculists. One school of physiologists held to the opinion that it was the egg that supplied the germ or cell from which the future being had its origin. They were called ovists. After the discoverey of spermatozoa another school of theorists came into existence, who were of the opinion that the spermatozoa were provided with all the organs of the developed animals. They were called animalculists. Then there were those who held to the evolution theory of development, and others who believed in the performation theory. Each of these schools and theories had the support of some of the master minds of that time. It remained for C. F. Wolff, in 1759, to give to the world the relative importance of the sexes in the process of fertilization, and that the germ becomes organized only in consequence of fertilization.

14. Spermatozoa Organized. The early anatomists and physiologists were almost a unit in the belief that spermatozoa were organized. Later investigators were as well agreed in the theory of unorganized germinal matter. Better optical instruments have during the past twenty-five years established the organized cell theory of the present time. This theory is not that the sperm cell of the stallion is organized in the sense of a fully developed horse, but only in the sense that the primary or elemental organs are present. No one has been able to state the fact with more force than Hertwig, when he said, "If the organ is not present, that which makes it is."

15. Description of Spermatozoa. The spermatozoa of mammals are the smallest elementary parts of the body. They are developed in great numbers in the seminal fluid of the stallion, but can be seen in it only by bringing to our aid the use of high magnification. A good penetrating eye can observe them with a magnification of 100 diameters. The best success I have ever had in photo-micro-graphic work is by using from 240 to 280 diameters. A magnification of 500 diameters will show the width of the head at about one-sixteenth of an inch and the entire length at one and one-half inches. A spermatozoon consists of three parts, head, tail and a middle portion. By far the greatest width is found in the head, which in shape is oval, slightly excavated on both surfaces, and much thinner at the anterior end. Viewed from the side it has much the appearance of a wedge, as shown in figure 4. Chemical reactions show the head to consist of nuclear substance.

The tail, which is composed of protoplasm, is a long, contractile appendage, and capable of executing serpentine motions, by means of which the spermatozoa can move forward in the seminal fluid with great velocity, relatively greater than the fully developed horse. The head and tail are united by a short middle piece, which is about one-fifth of the entire length of the spermatozoon. On the whole there is not the diversity of

form found in the spermatozoa of the many species of mammals, that characterizes the egg-cell of the same species.

16. Relative Size of Spermatozoa. In twenty-seven years of investigation, I have never found two spermatozoa of the same size, even in the same discharge, when measured with the photo-micograph. The size of the stallion has little to do with the size of the spermatozoa. They are always relatively larger in small stallions than in large ones. The spermatozoa discharged by an imported Shetland stallion weighing 350 pounds, were about one-half the size of those from a Shire stallion weighing 2,250 pounds, the Shire being nearly seven times as large as the pony. The spermatozoa of Shire stallions are slightly larger than those of any other breed.

17. Photographing Spermatozoa. A gelatinous substance incloses spermatozoa in all their parts, and which is distinct from the surrounding fluid. If treated with chemical reagents of a mild alkaline nature, this inclosing substance takes up stains with avidity, giving the spermatozoa a wider and thicker appearance than when not so treated. Even by this process a part of the tail is lost, also giving the spermatozoa a shorter appearance than should be given them. In the use of stains, whenever it is chemically possible, red is to be preferred to blue, as the former will take black, while the latter always takes white.

18. The Seminal Fluid. The semen of the stallion consists in addition to the spermatozoa of a homogenous fluid—the liquor seminus—in which we observe minute rounded corpuscles, or seminal granules. These are found in the semen of all stallions both virile and sterile. These vary greatly as to size and numbers in the semen of different stallions, and in some stallions we find two kinds of these corpuscles, differing widely in size. In some instances a magnification of 200 diameters will disclose small clusters of corpuscles of varying shapes, and from two to a dozen corpuscles in a cluster, and appearing sufficiently large with that magnification to be accurately counted. These take up stains quite readily. Figure 6 shows clusters of these larger corpuscles. If this same semen is placed under a higher magnification the smaller corpuscles common to all semen will be disclosed as shown in figure 7. These smaller corpuscles are about 1-2000 of an inch in diameter, and do not readily yield to chemical reagents.

19. The Development of Spermatozoa. The development of spermatozoa clearly demonstrates that they are really metamorphosed cells, and that each spermatozoon is developed out of a single seminal cell. The development of a spermatozoon offers the investigator many interesting surprises. We have already observed (11) that a considerable time is required in maturing or developing a spermatozoon and we have likewise observed (11) that a mature spermatozoon possesses a head, a tail and a middle portion. Of these three portions the flat and

wedge-like head is developed from the nucleus, and the caudal appendage out of the protoplasm.

In the earliest stage of development at which the sperm cell can be recognized, only a bell shaped cell can be observed. This grows out into an elongated cone, the base of which becomes the point of attachment for the middle piece. This cone now develops into a still more elongated cone and narrowed into a rod shaped structure. At this stage of development a retrogression is seen to take place, so far as form or shape is concerned, until finally it assumes the form of a mature spermatozoon.

The fundament of the middle portion first makes its appearance at the time the nucleus begins to elongate. It is first observed at the base of the nucleus in the form of a small oval and in a short time from it the tail appears.

From the above we learn that a spermatozoon passes through a process of development, not unlike that of the development of the fetus. At first there is but a single seminal cell out of which is developed the head. From the head is formed the middle piece, and finally the tail from the protoplasm.

20. Number of Spermatozoa in One Discharge. The number of spermatozoa in one discharge of a stallion is from 10,000 to 75,000, depending upon the sexual vigor of the stallion and the frequency of service. A virile stallion making but one service a day will discharge from 50,000 to 75,000 of them at each service. The amount of fluid discharged at each service of a stallion is from four to twelve ounces. The less frequent the service, the larger the amount of fluid, and the higher the number of spermatozoa. If stallions are made to do service too often, the semen will not contain mature spermatozoa.

21. Jacks. In the service of jacks one does not find as much fluid as in the service of stallions, nor does this fluid contain as many spermatozoa. Some virile jacks do not discharge more than an ounce of fluid, and very few of them more than three ounces. This makes breeding by the capsule method more difficult than when using stallions to make the necessary service. The spermatozoa of jacks are not as tenacious of life as those of stallions. Scientifically speaking, no jack is as certain of impregnating mares, as a virile stallion. This is particularly true when mated with mares, since the production of hybrids is never as certain in the case of all animal life, as when the mating is of one kind. There is a widely distributed belief to the contrary, but it is an erroneous one. Because of their temperamental difference, jacks make a more complete service than stallions; that is to say they deposit the semen in the uterus more often than stallions. This better service would result in a larger number of foals, even with a lower vitality of the spermatozoa.

22. Vitality and Power of Resistance of Spermatozoa. The life force of spermatozoa depends much upon the sexual vigor of the stallion from whence they came. In the case of the

horse they have been known to retain their vitality for thirty days after having been introdueed into the sexual passages of the mare. In dissecting a mare that had been killed at a railroad erossing twenty-seven days after she had been bred, I found thousands of live spermatozoa attached to the membranes of the vagina, uterus and also in the intestinal cavity. In this case the mare had been pregnant for about three weeks. I have kept the spermatozoa of the horse under artificial conditions for fifteen days. At the end of this time I found every spermatozoon active. However, I made many failures before I succeeded in doing this. To succeed in keeping spermatozoa alive for any considerable time one must keep them from coming in contact with both air and light, and a normal temperature is an absolute neeessity. They may be frozen and kept for months, when they will show activity upon being thawed out, yet life soon ceases under such conditions. The bottle or tube in which they are to be kept must be sterilized in boiling water before being used. If kept in jar, bottle or culture tube, these must be black so as to exclude all light. My success in this came as a result of filling and sealing a small black bottle from the vagina of a mare that had just been served by a stallion. Experiments which I made in testing the longevity of spermatozoon life with regard to color resulted in red being next below black, then yellow, green, blue and white.

23. Power of Resistance as Compared with the Egg. Both the duration of life and the power of resistance are much greater in the spermatozoa of the stallion than in the egg of the mare. This is made neeessary beeause of the egg being non-motive. In no other way could fertilization be accomplished. A great division of labor has arisen between the two, since each has adapted itself to a different mission. The non-mobile egg must be united with the mobile spermatozoon, which requires not only the migrato ; character of the latter, but a far greater duration of life as well. The egg-cell is very sensitive to all external influences, and is easily destroyed by influences having no effect upon the life of the spermatozoon. A normal salt solution, that is such a solution of about seven-tenths of one per cent, greatly stimulates the activity of spermatozoa, as do many weak solutions of an alkaline character, while all acid solutions, however dilute, will quickly produce death.

The most destructive forces of the life of spermatozoa, in their order of destructiveness are bacteria, acids, sunlight and air. I have found many species of bacteria destructive of spermatozoa, some of them proving fatal to their existence, almost instantly. Because of bacteria, spermatozoa will often very mysteriously disappear soon after their death as if by some unseen agency.

CHAPTER II.

THE SEXUAL PRODUCT OF THE MARE.

24. Receptacle for Life Germ. Some place in which to be is as indispensable a condition of material existence as magnitude or form. Nothing can be, without being somewhere. The life germ, the product of the stallion, must have some place in which to develop all its delicate organs. It requires both protection and warmth, as well as nourishment. This receptacle must be something which can receive and hold that seminal fluid in which it is floated from stallion to mare. Nature has very wisely provided the uterus of the mare for this important work. But this is not all, for in addition the mare's nature in a measure must be incorporated with its organic structure. This leads one up to the study of the mare; to the part she plays in the reproduction of her kind; to her sexual product.

25. The Ovum. The essential sexual product of the mare is the egg or ovum. In the case of the mare these ova are developed and discharged from the ovaries of the mare, one every twenty-one days, from as early as the seventh month to the end of her usefulness as a breeder, which sometimes continues for a period of thirty years. A study of this subject will make it necessary to have some understanding of the generative organs of the mare.

26. The Sexual Organs of the Mare. The generative organs of the mare consist of the ovaries, fallopian tubes (oviducts), uterus, vagina, vulva and clitoris.

27. The Ovaries. These correspond to the testicles of the stallion, and are two ovoid or rounded glands, in shape resembling a lima bean. They are located immediately behind the kidneys, and attached to the anterior border of the broad ligament of the uterus. The ligament of the ovary by which the attachment of the same is made possible, is a cord of muscular fibres extending from the horn of the uterus to the posterior extremity of the ovary. Each ovary has the greater part of its surface smooth and free. There is found upon its upper surface a deep depression known as the hilus, which affords attachment to a portion of the fimbriated extremity of the fallopian tube.

Like the testicle of the stallion, the ovary is enclosed in a fibrous capsule, the tunica albuginea. In substance the ovary is divided into cortical and vascular portions. It is in the cortical substance that are found the youngest and smallest Graffian follicles, but as we near the vasculosa the Graffian follicles become more fully developed. See figure 11.

28. The Graffian Follicles. The wall of each sac of a Graffian follicle consists of an outer and inner layer, the latter being the more delicate. Inside the wall is a layer of cells, and surrounding the ovum is an accumulation of these cells, which is known as the discus. There is a cavity in the deeper follicles,

Figure 10.—The generative organs of the mare. 1, 2, ovaries; 3, 4, horns of the uterus; 5, body of the uterus; 6, fallopian tube; 7, cervix, or neck of the uterus; 8, vagina; 9 meatus urinarius; 10, clitoris, or female penis; 11, 12, broad ligaments.

filled with a fluid, the liquor folliculi, which increases in amount as the follicles enlarge. It is the office of the Graffian follicles to develop ova, which when mature burst through the surface of the ovary near the hilus, and with the liquor folliculi and some of the membrana granulosa are received by the expanded fimbria (29) and conducted to the horn of the uterus. See figures 12 and 13.

29. The Fallopian Tubes (Oviducts). These are small wavy tubes leading from near the ovaries to the horn of the uterus and supported in the broad ligament. The middle portion is very narrow, but the extremities are much wider. It is the office of the fallopian tubes to conduct the ova from the ovaries to the

Figure 11.—Ovary, fimbria and fallopian tube of the mare.

uterus. The anterior extremity opens into the peritoneal cavity, and its orifice is provided with several fingerlike projections, the fimbria. The posterior extremity opens into the horn of the uterus. See figure 11.

30. The Uterus (Womb). It is the office of the uterus to receive the ovum and to continue as the repository of the fetus until it is released by parturition. This organ consists of a body

and two horns (cornua). The anterior extremity, or fundus, is connected with the two horns, while its posterior extremity, or neck (cervix) is constricted, projecting into the vagina. The two horns of the uterus are curved slightly upward, connecting with the fallopian tubes. The uterus is held in position by the broad or suspensory ligaments. Internally, the body of the uterus communicates with the vagina by means of the canal formed by the cervix. The cavity is formed of an uneven layer of mucous membrane in which we find many tubular cells.

31. The Vagina. This is but a canal situated immediately below the rectum, and leading from the cervix to the vulva. The widest portion is where it surrounds the cervix. The mucous membrane consists of many folds. The vagina is separated from the vulva by a membranous structure, the hymen (*32*).

Figure 12.—Section of the ovary of a mare showing Graffian follicles.

32. The Vulva. This is the external opening of the genital and urinary systems of the mare, terminating externally with two lips (labiae). It is separated from the vagina by a membranous structure, the hymen (31). Upon the floor of the vulva some four inches from its external opening we find the meatus urinarius, which is the opening of the urethra. Upon the floor and near the external opening of the vulva is found the clitoris, or female penis, and which is the chief seat of pleasure for the mare in copulation. The mucous membrane of the clitoris contains many glands which secrete most during oestrum. Aside from the mammary glands, which are concerned only in the secretion of milk, these are the principal female organs of the mare.

33. Comparative Study of Species. To [illegible] a full understanding of the sexual product of the mare [illegible] make it necessary to compare this product with that of other females. In doing this I shall have occasion to refer quite frequently to Hertwig's work on Embryology, as well as others. I particularly mention Hertwig because of his deep and thorough research

work with the eggs of the hen, amphibia, worms, molluscs, echinoderms, fishes and rabbits. Other embryologists have at various times made some investigation of the eggs of other species, but for the most part investigations of this nature have been carried on with the eggs of the hen and rodents.

34. Size of Ovum. The one thing working the greatest injury to the subject of embryology, is that of investigating one subject only, and assuming that all other subjects would be the same. More likely than not the one subject investigated was

Figure 13.—Section of the ovary of a barren mare, showing no true Graffian follicles.

far from a normal subject. We have no better evidence of the lack of extensive investigation, than in the size of the egg of mammals as recorded by different investigators. One investigator computes the diameter of the human egg at 1-200 of an inch, while another gives it at 1-25 of an inch. One of the text books now in use on veterinary science gives the diameter of the egg of the mare at 1-200 to 1-120 of an inch, while others have said it is 10 times as large.

Two things have led up to these errors. The one I have already mentioned (investigating one subject only) and the other, which is more likely to be the main one, is the fact that a mature egg, one ready for fertilization as we find it in the narrow middle portion of the fallopian tube, is more than twice the size of the same egg when discharged from the ovary. This fact has seemed to escape the observation of all investigators. The law of reversion, that of reverting to some primitive ancestor, is more pronounced in the case of the egg of all mammals, than in any one other thing known. In the case of birds, so far as size is concerned, the larger growth is made in the oviduct. In my investigations I have always found the egg of the mare

more uniform in size, just before or at the time of its rupture from the follicle, than when found in the oviduct. At the time of its release from the ovary it is about 1-80 of an inch, the extremes being 1-100 and 1-60 of an inch. In the case of more than a hundred eggs found in the fallopian tube of young mares in health, the average size was about 1-12 of an inch, the extremes being 1-40 and 3-8 of an inch. Only once did I ever find one approaching the larger size, this one being found in a virgin filly three years of age. This size has reference to the egg only, divested of all granulosa.

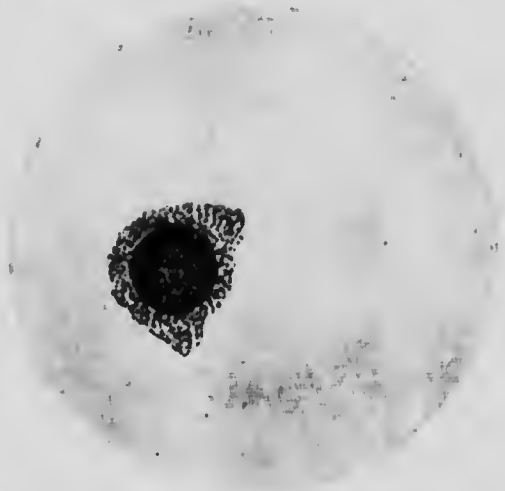

Figure 14.—Egg of the mare. (Photo-micrograph, about six diameters.)

35. Discovery of Mammalian Egg. The egg of mammals is so small when within the Graffian follicle, that it was not discovered until 1827. Before this time the Graffian follicle had been taken for the egg. The discovery of the true egg by C. E. von Baer was the beginning also of a more careful manner of conducting investigations, inasmuch as it taught investigators how easily one could be mistaken.

36. Structure of the Egg. The egg is a large cell, the largest in the animal body, and consists of the yoke (vitellus), germinal vesicle and germinal spot.

The yolk consists principally of a finely granular protoplasmic substance. Distributed through this protoplasm one finds dark fat-like granules known as deutoplasm, which makes the yolk opaque in proportion to the number of these granules.

The germinal vesicle contains the large germinal dot, located, together with a few smaller dots, in a nuclear network. Surrounding the egg substance is an egg membrane, the zona pellucida.

37. How the Egg is Formed. There are two chief divisions of egg formation, known as primary and secondary formations. The former are those developed wholly within the ovaries, while the latter are those developed partly within the ovary, and partly within the oviduct, such as the shell upon the egg of a hen. The egg of the mare belongs to the former class, since it is developed wholly within the ovary. There are several changes made in the egg of the mare after it leaves the ovary, but as these have to do with a process of maturing or ripening only, it can hardly be said that they are developed in any manner outside of the ovary.

Eggs are capable of being divided into two other classes, simple and compound eggs. The former are such as are developed in an ovary out of a single germinal cell. The latter are those produced by the union of several cells, and formed in two

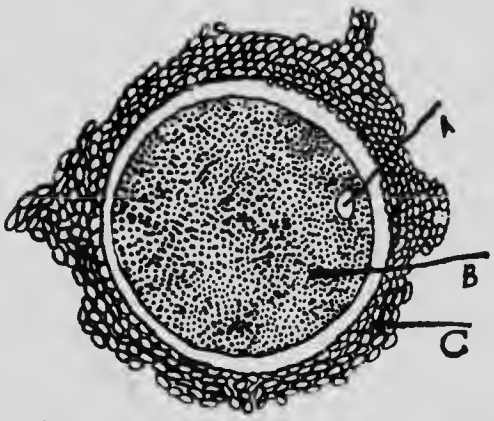

Figure 15.—Egg of the mare, greatly enlarged. a, egg nucleus; b, yolk; c, zona pellucida; the granules surrounding the egg are known as the discus.

different glands of the sexual organs of the female. Compound eggs are found only in a few of the more primitive species, a discussion of which will occupy no place in this work.

38. The Egg—When Discharged From the Ovary. Early investigators held to the opinion that the egg was discharged from the ovary during the heat period (oestrum). Most of the text books now in use are still teaching this theory. In the case of some species I believe this to be the rule, more particularly in those species where a considerable flow of blood is experienced at this time. So far as the mare is concerned there is only occasionally seen a discharge of blood, and when there is, it is never earlier than the third day after the cessation of the heat period. The one thing more than all others which first caused me to doubt the correctness of this theory, was the fact that mares bred four five days after the cessation of the heat period were more likely to be impregnated than when bred earlier.

This one fact induced me to conduct extensive investigations along this line, and 107 Indian pony mares were tried with the stallion daily until two heat periods had passed, that a record of these periods might be gained, both as to frequency and duration. The first day following that upon which they would refuse to mate with the stallion, they would be put to death and the ovaries and oviducts carefully examined. Only in one case out of this number of mares did I find the egg had been discharged from the ovary at the close of the heat period. The one exception was that of an irregular mare, one the heat periods of which had been about 30 days apart. Here I had very conclusive proof that it was the development rather than the discharge of the egg that produced the heat period. Only in one of these mares did both ovaries develop and discharge ova at the close of the same period. In other words only one of these mares would be likely to produce twins if bred at that time. These investigations not only settled the question in my mind as to the time the egg is discharged from the ovary, but it also proved quite as conclusively, that in all normal mares, but one egg is discharged at each period. In none of these eggs did I find two germinal spots, but since then I have found an egg from the mare showing two germinal spots, but the egg in its entirety could easily be regarded as a freak.

39. Formation of the Egg. Regarding the formation of eggs generally, and particularly those of the more primitive species, I can do no better than quote Hertwig upon this subject, in which he says:

"In their details the eggs of the various species of animals differ from each other in a high degree, so that they must really be considered as the most characteristic for the species of all the kinds of animal cells. Their size, which is due to a greater or less accumulation of deutoplasm, varies so extensively that in some species the egg-cells can be only barely recognized as minute dots, whereas in others they attain the considerable dimensions of an ostrich's egg. The form is usually globular, more rarely oval or cylindrical. Other variations arise from the method in which protoplasm and deutoplasm are constituted and distributed within the limits of the egg. There are in addition the differences of the finer structure of the germinative vesicle and the great variability of the egg-membranes. Some of these conditions are of great significance from their influence on the manner of subsequent development. These have been employed as a basis for a classification of the various kinds of eggs.

"In the group of simple eggs there occur, according to the manner in which protoplasm and deutoplasm are distributed within the egg, three modifications, which are of very great importance in the determination of the first process of development. In the simplest case the deutoplasm, which ordinarily is present only to a limited amount in the correspondingly small egg, is more or less uniformly distributed in the protoplasm. In other cases there has arisen out of this original condition, in conjunction with an increase in the bulk of the yolk material, an inequality in the distribution of the two egg-substances previously distinguished. The egg-plasma has accumulated in greater abundance at certain regions of the egg territory, and the deutoplasm at other regions. Consequently, a contrast has arisen between portions

of the egg-cell which are richer, and those which are poorer, in protoplasm. A further accentuation of this contrast exercises an extraordinary broad and profound influence on the first process of development, which take place in the egg after fertilization. The changes which further on are embraced under the process of cleavage, make their appearance only at the region of the egg which is richer in protoplasm, whereas the region which is more voluminous and richer in deutoplasm remains apparently quite unaltered, and is not divided up into cells. By this means the contrast becomes during development disproportionately greater and more obvious. The one part undergoes changes, is divided into cells, and out of these produces the individual organs; the other part remains more or less unaltered, and is gradually employed as nutritive material. The part of the yolk which is richer in protoplasm, and to which the development processes remain confined, has been designated formative yolk, and other nutritive yolk."

"The unequal distribution of formative yolk and of nutritive yolk within the egg is accomplished in two different ways. In the one case the formative yolk is accumulated at one pole of the egg as a flat germ-disc. Inasmuch as its specific gravity is less than that of the nutritive yolk collected at the opposite pole, it is always directed upward, and it spreads itself out on the yolk just like a drop of oil on water. In this case the egg has undergone a polar differentiation when at rest it must always assume a definite positon, owing to the unequal weight of the two poles. The dissimilar poles are distinguished as the animal and vegetative poles. In the second case the formative yolk is accumulated over the whole surface of the egg, and surrounds the centrally placed nutritive yolk as a uniformly thick, finely granular cortical layer. The egg exhibits central differentiation, and therefore does not assume a constant position when at rest. As in the former case the yolk was polar in position, so here it is central."

40. The Nutrition of the Egg. But little thought or study has ever been given, regarding the nutrition of the egg during its early development and growth. If the egg-membrane, (zona pellueida) be examined under high magnification it will be found traversed by many pore canals, into which as long as the egg remains in the Graffian follicle, there penetrates very fine projections of the follicular cells. These fuse with the egg-plasm, and are the source of nutrition. Any impaired condition of an ovary, must necessarily result in a like impaired condition of these follicular cells of the Graffian, and an egg incapable of fertilization is the result. One of the very annoying difficulties of the breeder can be explained away by this want of egg nutrition. There are many mares apparently normal, which do not develop ova capable of fertilization.

CHAPTER III.

THE FERTILIZATION OF THE EGG OF THE MARE

41. Internal and External Fertilization. The union of the male element with the egg of the female is designated as fertilization. It is of two kinds. When fertilization takes place within the sexual passages of the female it is known as internal fertilization. In the case of mammals, fertilization is always internal. In the case of many vertebrates and invertebrates living in water, the sexual products of both sexes are evacuated directly into the water, where fertilization takes place outside of the maternal organism. This is known as external fertilization, and is the more primitive method.

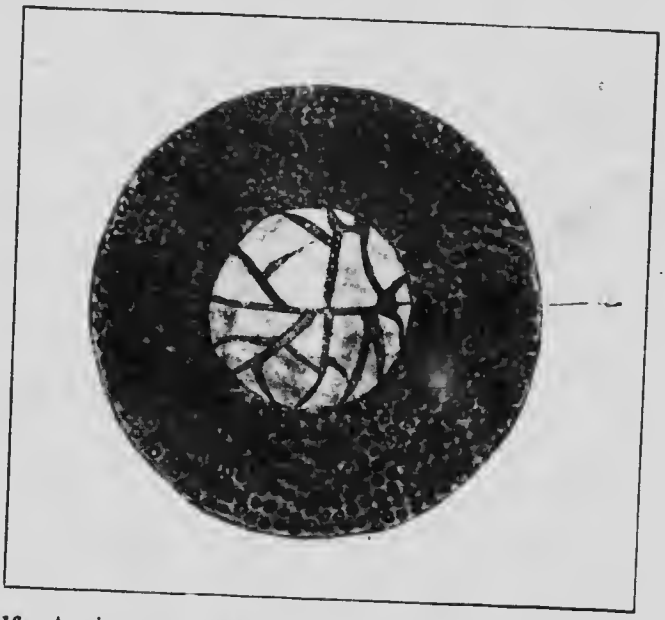

Figure 16.—An immature egg of the mare, showing large germinative vesicle—a, yolk protoplasm.

42. Mature Sexual Products. Fertilization is impossible without mature spermatozoa, and mature eggs. One of the essential things which has escaped the observation of most investigators is that of the development of a spermatozoon. Many have been led to believe that spermatozoa are created, or rather originate, in just the form and degree of maturity that one observes when they are secured at the time of copulation. One

may safely assume that nothing is ever created. All things falling under our observation are the result of some process of development. Spermatozoa are no exception to this rule. They are developed from a very simple elemental cell, and require nourishment for their development as well as does the fetus after fertilization, or the foal after birth.

43. The Development of Spermatozoa. Brief mention has already been made (11) (19) of this subject, but before we can proceed with the subject of fertilization, it will be necessary to observe more closely all the processes of development leading up to fertilization.

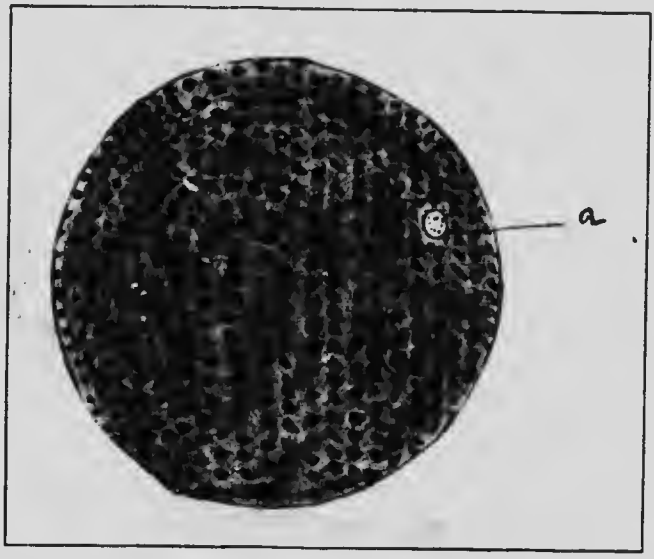

Figure 17.—A mature egg of the mare—a, egg nucleus, ready for fertilization.

The sexual organs of the stallion which are concerned in the development of spermatozoa are the testicles, vasa efferentia, epididymus, vasa deferentia and vesiculae seminales.

The testicle is enclosed with a fibrous capsule, the tunica albuginea. This fibrous tissue is extended into the substance of the testicle, dividing the organ into separate lobules. In each lobule are found many seminal tubules, commencing in a highly convoluted portion, but ending in a straight tube, which pierces the tunica albuginea at the anterior extremity of the testicle. These seminal tubules are made up of several layers of cells, the spermatoblast cells, and it is here that spermatozoa have their origin. Reference to this (3) has already been made, but I repeat this part because of its importance to this subject. But here one finds only an elemental cell, capable of rotary motion only, such as one observes in most vegetable cells. The nucleus of this cell

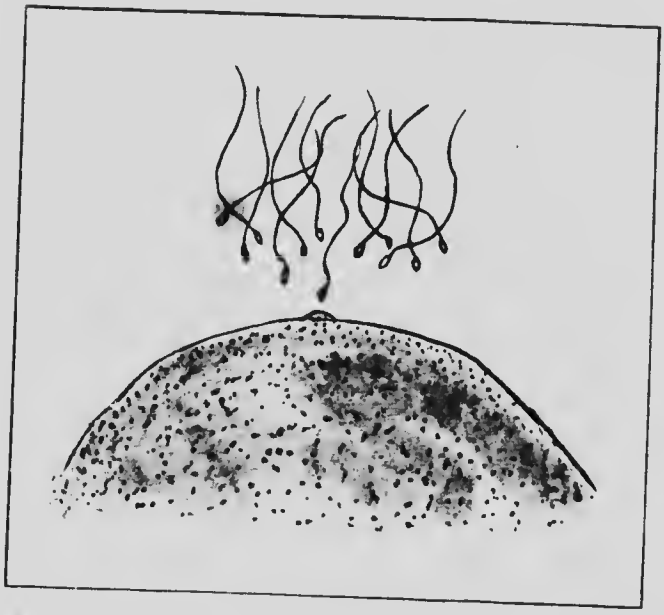

Figure 18.—Fertilization of the egg—a small portion of the egg becomes elevated to meet the nearest spermatozoon.

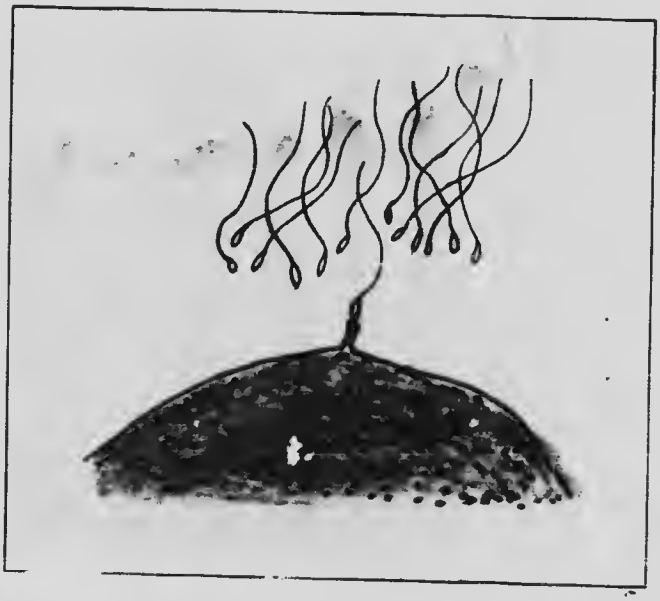

Figure 19. ...ilization of the egg. The surface of the egg has been elevated, ... higher, until it has met the spermatozoon, which is boring its way into the egg.

is nearly triangular, with a chromatin net work. If one follows this spermatozoon into the vasa efferentia but little change will be observed, the most essential one consisting of a change in the nucleus, which has now assumed a long, nearly oblong form. It now has greater mobility, but the motion as before is rotary.

When spermatozoa reach the epididymis, another stage of delevopment is observed. Here the nucleus has assumed a long and very narrow form, the true head of the spermatozoon beginning at this time. Here and in the vas deferens the middle piece and tail make their appearance, and the first serpentine motions are observed, but only in connection with the rotary motion already observed.

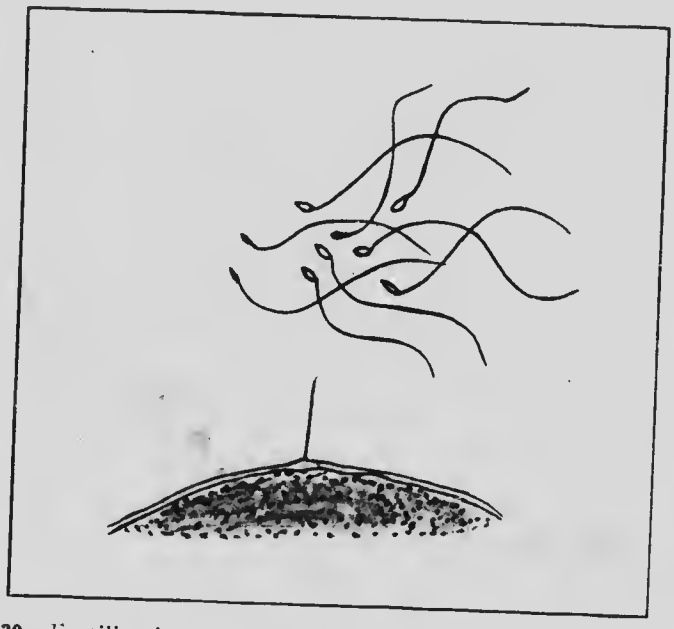

Figure 20.—Fertilization of the egg. The spermatozoon has succeeded in penetrating the egg, leaving only its tail behind. It will be observed that a vitelline membrane has formed over the egg, since its entrance by the spermatozoon.

It is in the seminal vesicles that one observes for the first time the mature or fully developed spermatozoon. At this stage of development one observes only the true serpentine movement. Two processes of development have been at work during the final development of the spermatozoon. The one progressive, inasmuch as here the middle piece and tail have reached their final development, the latter to a great length. The other retrogressive, because of the nucleus assuming a form more nearly like that of an earlier stage of development. Figure 9 will illustrate the metamorphosis of a seminal cell into the mature seminal filament.

44. One Cause of Sterility. A careful study of the development of spermatozoa is of great interest to the breeder, even more than to the student, because of its teaching us one of the causes of sterility in stallions. If any one of the sexual organs of the stallion become impaired from any cause, either spermatozoa incapable of the power of fertilization or no spermatozoa at all will be the result. This condition may be hereditary, or it may be of a temporary nature, the result of too frequent service, too much fat or a want of sufficient exercise to stimulate all of the bodily functions. In the case of an eight year old sterile stallion dying of colic, I found the spermatoblast cells in the testicles well filled with seminal cells, but no cells or spermatozoa anywhere else. Although making frequent service, this stallion had not sired a foal in three years.

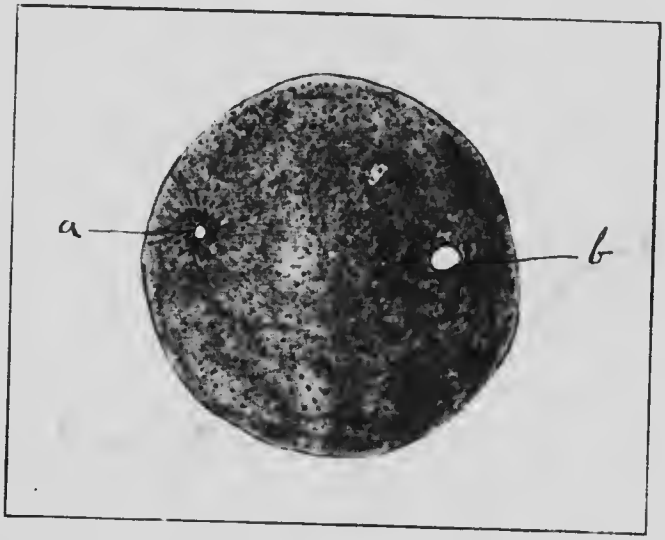

Figure 21.—The first process in real fertilization has here begun—a, sperm-nucleus, surrounding by a protoplasmic radiation; b, egg nucleus.

45. The Egg of the Mare. The need of mature spermatozoa in the process of fertilization has now been made clear. The next essential in this process is the egg of the mare. In many species, including a few of the mammalia, sometime before the rupture of the Graffian follicle the germinative vesicle ascends to the surface of the egg, and soon after disappears, and in the place where it disappeared there are formed the egg-nucleus and, under the egg membrane or zona pellucida, one or two polar cells. Such eggs after they have escaped from the ovary always exhibit egg-nucleus and polar cells. In the case of the mare the egg-nucleus is not formed until after the egg has escaped from the ovary.

46. Immature Eggs. If mature spermatozoa were added to eggs such as I have already described, (36 and 39), they would still remain unfertilized. Before they can be fertilized they must pass through a process of ripening or maturing which I will now describe.

47. Process of Maturing. This process begins with changes of the germinative vesicle. The germinative vesicle of the immature egg is shown in figure 16. This shows the egg as it appears at the time of its escape from the ovary. At this time the germinative vesicle gradually moves from the center of the egg toward its surface, its nuclear membrane disappears permitting its fluid to escape into the surrounding yolk. The germinative dot breaks up into a number of smaller dots. By a proper treatment with reagents there can be recognized forming out of the degeneration of the germinative vesicle a nuclear spindle. This nuclear spindle pursues still further the direction already taken by the germinative vesicle until it touches with its apex the surface of the yolk. At the place where the nuclear spindle touches the surface the yolk arches up into a small knob, into which half of the spindle advances. The cell division is completed by the knob becoming constricted at its base, detaching the half of the spindle as a very small cell.

This same process is again repeated with the half of the spindle which remains in the egg.

48. Polar Cells. After this division already observed there lie closely together on the surface of the yolk two very small cells, consisting of protoplasm and nucleus. These cells are known as polar cells, as they always arise at the animal pole of the egg. When the second process of budding, or cell division, has been concluded, the other half of which was employed in the formation of the second polar cell, is left in the cortical layer of the yolk. Out of this arises a new nucleus, known as the egg nucleus, which slowly migrates back again toward the middle of the egg, when we have the mature egg, ready to meet a mature spermatozoon, when it will become fertilized. See figure 17.

49. Comparative Size of Germinative Vesicle and Egg Nucleus. In comparing figures 16 and 17 it will be observed that the germinative vesicle of the immature egg is very large, occupying about one-third of the egg space, while the egg nucleus of the mature egg is but a small dot, occupying but little space. In the case of the former one distinguishes a well developed nuclear membrane, a nuclear network and a germinative dot or nucleus. In the latter the egg-nucleus is almost homogeneous and is not separated from the protoplasm by any fixed membrane. No egg containing a germinative vesicle can be fertilized, because of its immaturity. The germinative vesicle as a part of the process of maturing the egg, is dissolved or degenerates, and out of it is formed the smaller egg-nucleus. This fact is of the

utmost importance to breeders, in explaining why so many apparently normal mares do not breed.

50. Why Eggs Do Not Mature. The chief causes of these eggs failing to mature, are excessive fat (always one form of degeneration), general debility upon the part of the mare, and such diseases as develop a high temperature. Many mares will not breed for two or three years after a severe attack of influenza. It is also well known that few mares will breed while carrying an excess of fat.

Another condition upon the part of the mare quite likely to result in eggs failing to mature, is that of an immature condition of the mare. In several experiments with the ova of poorly developed two-year-old fillies, I was always unable to bring

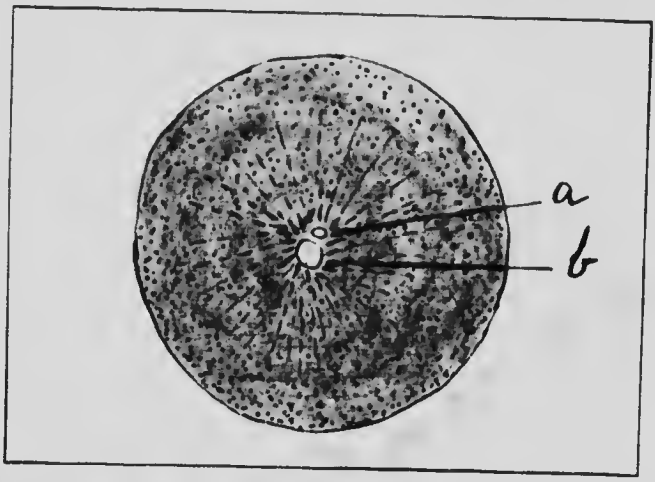

Figure 22.—In this figure it will be seen that sperm-nucleus and egg-nucleus have met near the center of the egg, and have become surrounded by a common protoplasmic radiation.

about fertilization by artificial, or external, means. The ova of such mares, even when found in the fallopian tubes, had no attraction for the spermatozoa, and when properly treated with reagents and examined with a high power microscope, I would always find that immature condition already described.

51. Union of Egg and Spermatozoon. The third essential in fertilization is to properly unite a normal mature egg with a normal mature spermatozoon. How this is accomplished matters little, so long as normal conditions are observed as to temperature, light and cleanliness. In natural copulation under natural conditions of mating, the stallion will discharge the semen directly into the uterus nearly every time. Under conditions of domestication this will not occur quite so frequently, but if all stallions be considered together this will occur in about 60 per cent. of the services made. To be exact, in the case of 1196

mares bred by natural service (81) 19 different stallions being used and the mares examined immediately after the service it was found that 715 had not trace of semen in the vaginal cavity, while in the case of 481 of them the semen, or a part at least, was deposited in the vagina. Quick impetuous servers will deposit the semen in the vagina more frequently than stallions less impetuous.

If fertilization is the thing desired, the semen should be deposited in the uterus of the mare. To determine this I bred 50 mares with foals at foot, the foals being less than 36 days old, with capsules, emptying the fluid well back in the vagina and 27 of them were impregnated with this service. I also bred 50 mares with foals at foot of the same age as above, using capsules and semen from the same stallion, but inserting the capsule into the uterus, and 44 of them were impregnated with this service. All the mares in this experiment were from 3 to 11 years of age.

I made another experiment with mares that had not produced a foal within one year of date of service, and ranging from three to nine years of age. Of these 50 were bred with capsules, emptying the fluid well back in the vagina and only 11 of them were impregnated, while of 50 bred with capsules, semen from the same stallion being used, but the capsules being inserted into the uterus, 39 were impregnated. Spermatozoa may find their way into the uterus and oviducts if deposited anywhere in the sexual passages of the mare, but here we have very strong evidence that it is better to have the semen deposited directly into the uterus, and Nature has very wisely provided for this, by making it possible for the stallion to discharge the semen directly into the uterus of the mare. One can easily learn how this is accomplished by inserting the hand into a normal mare in heat, and with the back of the hand partly closed, try to imitate the action of the penis during copulation, by a forward and backward motion, each time pressing firmly against the cervix. After two or three such pressures, he will be able to distinguish the action of the cervix meeting his pressure and of the same opening two or three times as large as when he first intoduced the hand. This is but the normal response to the stallion, and is the part assumed by the mare in copulation. It is here we learn why the quick impetuous server so often leaves the semen in the vagina. It is only because he is too quick for the mare, giving her no time to respond.

52. Where Fertilization Takes Place. Fertilization may take place anywhere from the uterus to the anterior portion of the fallopian tube, and has taken place in the abdominal cavity, when we have an extra uterine impregnation. Only once in all my investigations have I ever known of fertilization taking place in any other place than the narrow middle portion of the fallopian tube. This narrow portion where fertilization is generally effected is somew' posteriorly to the middle. Nature seems

to have provided this narrow passage for the express purpose of making fertilization easy and certain. The egg lodges here for several days, whether spermatozoa are introduced into the uterus or not, and as the egg fills the canal of this organ it is impossible for the spermatozoa to pass the egg.

53. Disintegration of Semen. A short time after semen has been introduced into the uterus of the mare a process of disintegration takes place, whereby the spermatozoa are set free. If the mucous membrane of the mare be examined with a high power microscope 24 hours or more after the semen has been introduced, it will be found that the spermatozoa are all attached to this membrane. Their moving from one part to another after this time is made possible by the fluid always found upon this membrane. A high temperature will have a tendency to dry this fluid, when both movement and fertilization will be impossible.

Figure 23.—Fertilization complete. Here one observes that sperm-nucleus and egg-nucleus have fused as shown at a.

54. Fertilization. The beginning of fertilization, or the piercing of the egg membrane by the spermatozoon is not accomplished in the same manner by all species. In the more primitive species there is no true membrane enclosing the egg as in the case of mammals. The latter, and especially the egg of the mare is enclosed in a very firm membrane, so firm in fact that the egg can be rolled by the aid of a needle, over and over again with no injury to the membrane. With some of the more primitive species one finds only a soft gelatinous substance surrounding the egg, which is easily penetrated. In figure 18 can be seen the first act in the fertilization of a fish egg. It will be seen that as soon as one of the spermatozoa approaches the egg a small portion of the surface is elevated to meet the spermato-

zoon. In figure 19 the elevation of the egg surface is still higher and the spermatozoon has met it and is boring its way into the egg. In figure 20 the spermatozoon, both as a result of its own energies and the attractive power of the egg has succeeded in penetrating the egg, leaving only its tail behind. No sooner has the spermatozoon penetrated the egg than a thin vitelline membrane forms over the entire egg, thus preventing the penetration of another spermatozoon, even though there was no other agency at work to prevent this.

The real process of fertilization is now ready to take place. The egg-nucleus and the spermatozoon, which has now assumed the form of a sperm-nucleus mutally attract each other and begin migrating through the yolk toward each other. This is shown in figure 21. The sperm-nucleus soon becomes surrounded in a protoplasmic radiation, while the egg-nucleus shows no such radiation. Soon the two meet near the middle of the egg and become surrounded by a common radiation as shown in figure 22. Immediately after this meeting they become flattened at the surface of contact, and finally fuse with each other, when the act of fertilization is complete as shown in figure 23. Only two or three minutes of time is required to carry the process of fertilization through all its many stages herein described.

55. When Fertilization Takes Place. The time elapsing from the introduction of spermatozoa into the uterus of the mare until fertilization is complete may be anywhere from a few hours to 30 days. Spermatozoa showing great activity have been found in both the uterine and abdominal cavities of a mare 27 days after she was bred. Mares bred during one heat period frequently do not conceive until the next heat period. A test was made of 63 mares bred and found in heat 21 days later but for the sake of the experiment were not bred at this time, and 41 of them produced foals without being rebred. If the stallion is virile and the mare normal in every way, semen introduced into the uterus should be virile for 30 days or more.

Of all normal mares bred, probably 9 of every 10 conceive from five to seven days after the cessation of the heat period.

56. Vitality of Egg and Spermatozoa. There is a wide difference in the vitality of spermatozoa as compared with the egg. The former have great duration of life and power of resistance, while the egg of the mare possesses little of either. A normal salt solution will increase the vitality of the egg, and aid in external or artificial fertilization, as does nothing else known at this time. The egg is extremely sensitive to air, light and low temperatures, while spermatozoa may be frozen for weeks and show motion upon being thawed out. In experimenting with artificial fertilization the egg must be kept from all natural light, a red light being used instead. This is true also of spermatozoa. Weak

salt and alkaline solutions will quicken the activity of spermatozoa, while acid solutions, however dilute will quickly produce death.

57. Conditions Adverse to Fertilization. In experimenting with semen at low temperatures, I was never able to impregnate mares with semen much below normal. On one occasion I impregnated two mares with semen that had been quickly lowered to a temperature of 94 degrees. This was done by placing the filled extractor for two or three minutes in water at that temperature. If kept at low temperature for any considerable time, spermatozoa will lose their fertilizing properties, although they still show motion. The more active one finds them, the more certain of fertilization.

I have never been able to impregnate a mare having a temperature above 101.7. Only once have I done so with a temperature as high as that. In breeding mares with a temperature of 101 or more, one is confronted with a problem not yet solved.

58. Artificial Fertilization. So far as the horse is concerned, artificial fertilization is but external fertilization. The eggs of the first or primitive species were all fertilized externally. The external fertilization of the eggs of other species is no more difficult if care be used as to normal conditions. Place a mature egg in mature semen and fertilization is certain. It will again be referred to in a future chapter.

CHAPTER IV.

THE INFLUENCE OF SEX IN FERTILIZATION.

59. Control of Sex. No one thing interests breeders so much as the control of sex and yet it is of little value to them. If one was to announce that he knew of a plan by which sex could be controlled, he would have no difficulty in securing an audience, however, absurd the plan might be.

Some of the early authorities held that the ovaries controlled

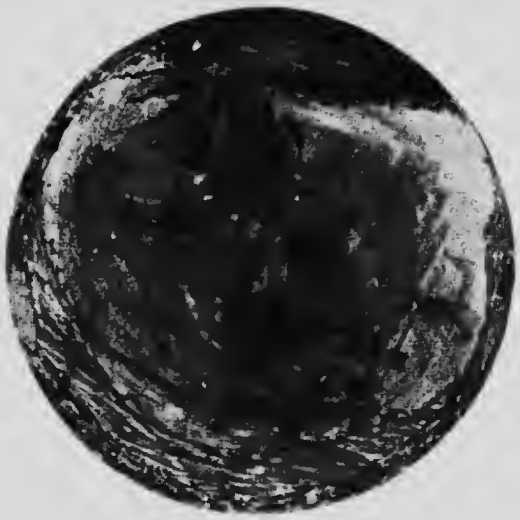

Figure 24.—Sex attraction. The egg attracting the spermatozoa.

the sex, one ovary developing eggs of the other sex. In the early 90's I removed the right ovary from 10 mares and the left ovary from 10 others. At the end of three years all but one of them had given birth to foals of both sexes.

Others held that sex originated in the testicles of the stallion. In 1895 I removed the right testicle from an eight year old imported Percheron stallion in October. That spring he was mated with 23 mares, resulting in 16 foals, nine of which were fillies. The spring of 1896 he was mated with 29 mares (having one testicle only) resulting in 19 foals, 11 of which were fillies. In October of the year 1896 I removed the left testicle from a Standard bred stallion. The spring of that year he was mated with 17 mares, resulting in 13 foals, of which eight were colts. During the season of 1897 this stallion was mated with 21 mares, resulting in 15 foals, of which eight were colts. So far as these

two stallions were concerned but little difference was to be observed whether they had one testicle or two.

One of the old theories, and it is still living, is that of mating early in the heat period for fillies and late for colts. Of 207 foals, the result of mating at the earliest possible time, 111 were colts and 96 only were fillies. Of 41 foals, the result of mating the last of the heat period, 191 were fillies and 150 only were colts. Of 198 foals the result of mating out of season, that is in between the heat periods, 101 were fillies and 97 were colts.

Another theory which has been given much prominence by many breeders and a few writers, is that of the alternation of sex. The following explanation will make this theory clear. If a mare was to produce a colt one year, and mated with a stallion

Figure 25.—Sex attraction. When fertilized the egg offers no further attraction to spermatozoa.

again at the first heat period following parturition, the next year she would produce a filly, but if mated at the second period the foal would again be a colt. To put it in another way, mating at the odd heat periods will produce the opposite sex when compared with the last foal, while mating at the even heat periods the foal would be the same.

In 1895 I had 17 mares producing foals. These were all mated with a stallion at the first heat period, 14 of them producing foals from the first mating, and two of the others from the second mating. These all produced sexes in accordance with this theory, and I believed for the time that I had solved the mystery of sex control. The next season these same mares were handled in the same manner, and records kept of the matings, and with one exception the reverse of this theory proved true. Here again is evidence of the fallacy of short time experiments.

Several other theories, some quite well known, while others were not so well known, have ended the same way. Some of them would make a very fair showing for one year, only to go wrong the next. Among these theories were such as moon influence, watering before and after service, the stallion hanging his head at the right or left side of the mare during copulation as well as scores of others equally as absurd.

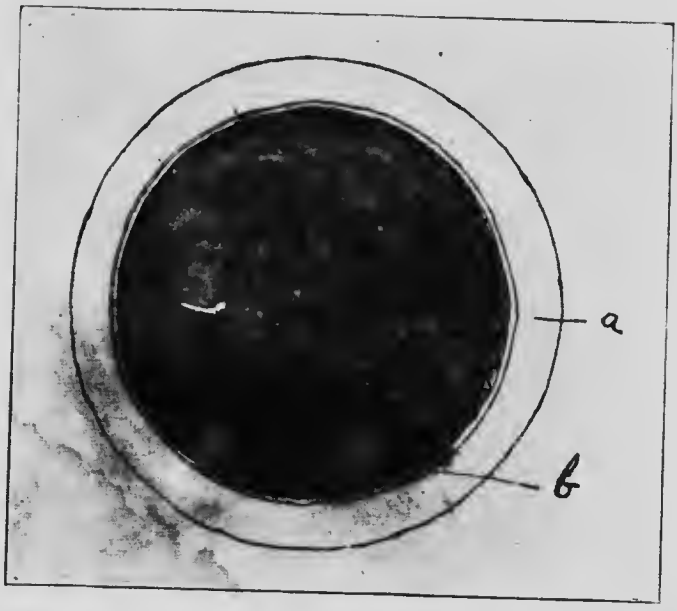

Figure 26.—Cell formation. The first process in the development of the embryo.

60. Sex Attraction. The only control of sex is that of sex attraction, and that is impracticable to the breeder for the present at least. The magnetic forces of sex are much more potent than we know, and give us a key to sex control which could be carried out quite successfully if it were profitable, but it is not. In the animal kingdom all normal males are magnetically positive, while all normal females are magnetically negative. A perfect male, that is one endowed with all the masculine power possible for his kind, will invariably be positive in sexual character. A perfect female, that is one feminine to a marked degree will invariably be negative in sexual character. It is this sex attraction, and nothing else, which attracts the spermatozoon of the stallion to the egg of the mare. The ovum or egg will be of the same magnetic character as the mare developing it. If a mare is feminine in a high degree, colts rather than fillies would be the result, while if a mare of a masculine character was mated with a stallion wanting in masculinity,

fillies rather than colts would be the result. If a mare of an intermediate magnetic temperament was mated with a stallion of like temperament a foal of either sex could be the result. I now have in mind a mare that produced nine colts in as many years, all sired by the same stallion, and changing stallions she produced three fillies in succession by the second stallion. The number of breeders who have had similar experiences are legion.

61. Sex Attraction Shown by External Fertilization. In experimenting with external or artificial fertilization I was surprised at the power of this attraction. In placing a mature egg of the mare into mature semen of the stallion, only a certain per cent. of the spermatozoa would be attracted to it, and these could not be kept from it. Even though separated from the egg by the aid of a needle, they will immediately return to it upon being liberated. Place an egg from another mare into this same semen and one observes a distinctly different number of the spermatozoa that are attracted to it. Why this difference? Figure 24 shows the attraction the egg has for the spermatozoa, but this work is intended for practical subjects only, and the above question will have to go unanswered for the present. The purpose in putting the question, is a hope that the reader may give it much thought on his own account.

62. Want of Sex Attraction a Cause of Barrenness. A stallion and mare could be so magnetically alike that the egg would have no attraction for the spermatozoa, and barrenness would be the result so fa[illegible]ese two were concerned. In my experience with external [illegible]tion I have found this to be a fact. The remedy is to try [illegible]ange of semen. A stallion may be virile and a mare fecund, yet fail as breeders when mated. This happens more often than most men believe.

63. Result of Sex Control. It will be seen that sex can be controlled to the satisfaction of the investigator, but not in a way satisfactory to the breeder. In making matings to result in a certain sex, might be the means of losing every other quality for which one had labored for years. If sex alone is wanted one must bear in mind that male spermatozoa are attracted to negative ova only, and that matings must be made with reference to this fact.

64. Attraction Lost at Time of Fertilization. Reference has already been made (54) to the fact that as soon as the egg has been penetrated by a spermatozoon, the formation of a vitelline membrane prevents others from penetrating it. This is unnecessary, for as soon as the egg is penetrated by a spermatozoon, it has no attraction for others. No sooner has this process of fertilization been accomplished than one observes all other spermatozoa turning in other directions. This is well illustrated in figure 25.

CHAPTER V.

THE FETUS AND FETAL MEMBRANES OF THE HORSE

65. Cell Division. Following fertilization a further development begins with the division of the egg-cell, or cleavage. The fusion of the egg-nucleus and sperm-nucleus results in a cleavage-nucleus, which always occupies the middle of the egg, and forms the center of a radiation which affects the whole yolk mass. This soon begins to be slightly elongated, becoming less distinct, and finally results in a figure resembling a dumb bell. The nucleus which represents the handle of this dumb bell figure is composed of chromatin and a nonchromatic substance. The latter forms into a bundle of very minute fibres converging at their ends to a point. The chromatin forms into small individual granules, known as chromosomes, and which correspond in numbers with the fibres of the nonchromatic substance. In some species these resemble a V shaped figure. Two exceedingly minute bodies, out of which occupies the exact center of each of the two previously mentioned systems may be observed at this time, and which are known as centrosomes. In this scheme of cleavage or cell division, half of these chromosomes are derived from the egg-nucleus, and half from the sperm-nucleus.

66. Principles of Growth. Thus far a simple principle only has controlled the development of the embryo, that of cleavage

or cell division, from which has been derived a cell colony. This is illustrated in figure 26. This principle of development is not sufficient for the production of the more complicated forms which adult animals possess, and two others here supervene to complete the development already begun, namely, the principle of unequal growth and that of the division of labor.

67. Principle of Unequal Growth. In the growth of the embryo, if the cells of a cell membrane divided uniformly, the result would be a uniform increase in the surface of the membrane in all directions, but the pressure due to growth causes the new cells to assume a direction in the line of least resistance, by which means the different glands and organs are formed.

68. Principle of the Division of Labor. While the division and growth of cells may in general determine the growth and

Figure 28.—Embryo seven days after fertilization, showing development of the middle germ layer.

form of the animal body, there is another principle, the division of labor, which is but the principle of duty or function. The more highly an organism is developed, the more its cells differentiate themselves for the duties of life, some assuming the function of nutrition, others that of motion, others that of sensibility, and still others that of reproduction. This division of labor makes a greater degree of completeness in the execution of the individual functions possible. By this means we are given gland-cells, muscle-cells, nerve-cells, and sexual-cells. The cells performing the same duty will be found grouped together and constitute a special tissue.

69. Folding. There is still another force at work in the development of the embryo, that of folding. It would be impossible to form tubular parts of the animal organism in any other

Figure 29.—Embryo nine days after fertilization. Note the meeting of the amniotic fold over the back of the embryo.

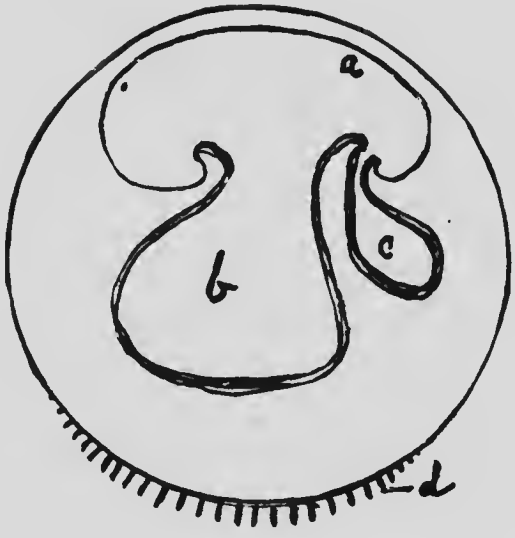

Figure 30.—Embryo eleven days after fertilization. The chorion is developed at this time.

manner. The intestinal and other canals must be formed in this manner. If the membrane be folded into the interior of the body, the process is known as invagination, while if the fold projects free beyond the surface of the body it is known as evagination.

70. Germ Layers. The principle of folding already referred to (69) is the chief means of body formation. In the earliest development of the embryo there arise larval forms which at first are composed of two, and later of four membranes. The first two are known as the two primary germ layers, and the latter two as the middle germ layers. This larval form composed of two germ layers is known as the gastrulae. The mass of cleavage-cells developing into a sac-like germ is known as the blastula. There are four different kinds of blastulae, according to the amount and distribution of yolk, found in different species of vertebrates, and four kinds of gastrulae to correspond with them.

71. Fetal Membranes. There are developed with the permanent organs of the embryo others which have no significance for the embryo after birth, but which serve during the egg and fetal stage of existence, either for protection, respiration or nutrition. These are cast off at birth, or undergo a retrogressive development at some stage of fetal existence. Uniformity does not prevail, even among mammals, in respect of this. In a work such as this, only brief mention can be made of many interesting processes and changes in the development of the fetus, and these only as they have reference to the horse. The most striking difference in the development of the fetus of the horse as compared with other species, is the rapidity of development through the early stages of fetal growth, which is more rapid than that of any other mammal. In no other mammal can sex character be determined as early as the thirty-third day, when the gestation is anywhere near as long as that of the horse. The egg of the mare contains more yolk than most mammals, although relatively smaller than in many others. And lastly, the place of attachment of the fetal membranes is more uncertain than in the case of any other mammal.

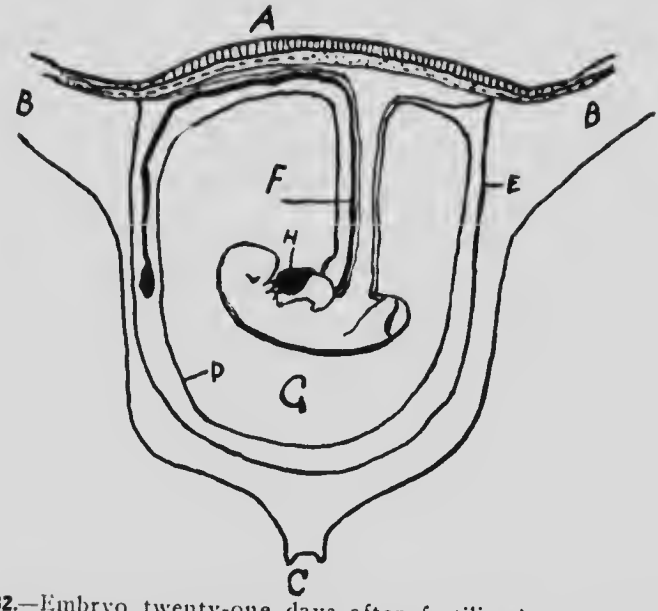

Figure 32.—Embryo twenty-one days after fertilization. a, fundus of uterus; b, horns of the uterus; c, cervix; d, amnion; e, chorion; f, umbilicus and allantois; h, heart.

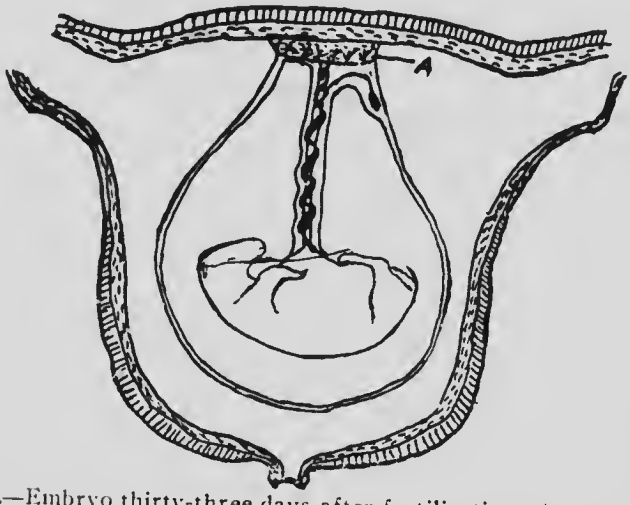

Figure 33.—Embryo thirty-three days after fertilization. At this stage of development, the sex character can be determined. A, attachment of fetal and maternal membranes. It will be observed that as pregnancy advances, the uterus becomes relatively wider, the horns shorter and narrower, and the cervix shorter and firmer. At this stage of development the umbilicus has become as firmly attached to the membrane of the uterus as it ever becomes.

72. Classification of Mammals. Reference has already been made (71) to the several ways in which the fetal membranes of mammals are developed. This will necessitate a brief classification of mammals into groups, to the end that the growth and development of the fetal membranes of the horse may be the better understood. In the early stages of development the fetal membranes of mammals present a striking similarity to those of reptiles and birds. One finds a yolk-sac, an aminon, a serous membrane or chorion, and an allantois. One finds that the embryo is united with the extra-embryonic area in the same manner, by means of a dermal and intestinal yolk-stalk. But in

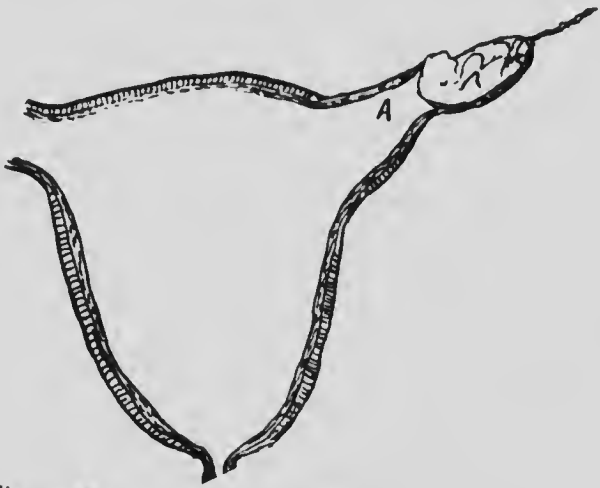

Figure 34.—A fetus developing in the fallopian tube.

mammals as soon as the yolk is exhausted some portion of the fetal membranes are converted into an organ of nutrition for the embryo, by entering into closer relation with the mucous membrane of the uterus. In some instances they are very simple, in others more complicated organs. Because of these differences in the manner of drawing sustenance from the maternal membranes, mammals are divided into three groups or classes.

The First is where the serosa (chorin) is retained in its primitive condition. To this group belong the marsupials, such as the kangaroo. In these the chorion retains its smooth surface, and as it lies close to the mucous membrane of the uterus, it can absorb nourishment from the latter and transmit it to the deeper lying embryonic parts without being attached to it.

The Second group of mammals make intra-uterine nourishment possible by the serosa being converted into a villous layer, or true chorion. In this group the mucous membrane of the uterus and chorion generally unite in some measure. The horse belongs to this group.

The Third group consists of those mammals developing special organs for the purpose of intra-uterine nutrition. This condition has been made possible by separate portions of the chorin having assumed different characters, owing to the unequal size and distribution of the villi. Some parts of the chorin may have no villi and the surface will be smooth, while on other parts may be found villi extremely long, the latter being very firmly attached to the membrane of the uterus. When many of these parts have arisen on one chorion they are called cotyledons. These are found in the ruminants.

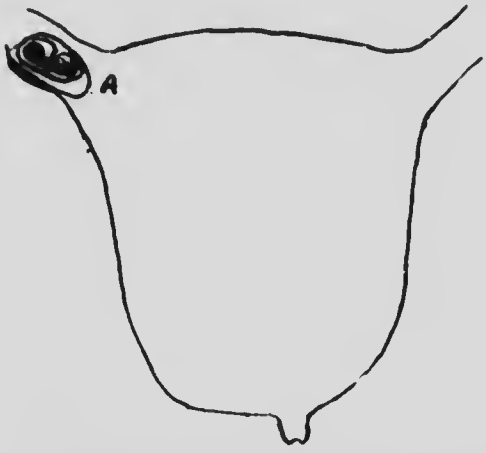

Figure 35.—A, shows fetus attached to membrane in the horn of the uterus. This is the usual place of attachment in the horse.

73. Achoria and Choriata. Mammals developing no villi on the surface of the outer embryonic membrane are known as achoria, while those developing villi are known as choriata. Fetal and maternal membranes can thus become more firmly united with each other. The result is that at birth a larger or smaller tract of the mucous membrane of the uterus is also cast off, and is known as decidua. This is less noticeable in the horse than in any other mammal, while in man the entire superficial surface of the uterine membrane is cast off.

74. How the Fetus Develops. In figure 27, is shown a vesicle or fetus at the fifth day of development. The middle germ layer is in full process of development, yet no folding process has as yet taken place. In figure 28, the middle germ-layer has spread out over and now encloses an easily distinguishable body cavity. The embryonic fundament is in the act of being constricted off from the blastodermic vesicle. The head and tail of the embryo, by foldings of the separate layers, have been elevated from the area pellucida, and a cephalic and pelvic part of the intestinal tract, (the fore and hind gut) have arisen, with an anterior and

posterior entrance, which open toward the cavity made by the folding of the vesicle.

At the same time occurs the development of the amnion, which is the inner sac in which floats the embryo. In the figure above referred to, one can see that the anterior fold of the amnion has bent over the head, and the posterior fold over the tail. The outer sac, which later must frequently be referred to is the chorion. In some of the mammals these two sacs become one toward the end of gestation, but in the horse they do not.

In figure 29, it will be noticed that the amniotic folds have not only greatly enlarged, but have grown toward each other until their edges meet over the back of the fetus. In the horse this meeting of the amniotic fold occurs at the ninth day, earlier than in any other mammal known. At this stage of development, or slightly earlier, one first recognizes the first trace of the allantois, which is the excretory sac, and most important organ of respiration. It takes its origin from the posterior portion of the hind gut, at a time when the walls of this gut are still in process of formation. It enlarges rapidly into a vesicle, which grows out into the body cavity. At the same time the blind end enlarges, while the proximal part becomes narrow, forming into a hollow stalk, the urinary duct or urachus.

In figure 30, can be seen a fetus of the mare at the eleventh day. At this stage of development the chorion (serosa) has become completely detached from the amnion. This also differs in different mammals. It is at this stage that the serosa permanently becomes the chorion. This has been brought about by the first appearance of villi upon the outer surface of the serosa. These villi are but small evaginations or hair like growths, upon the outer surface of the chorion. It is not until the eleventh day that they make their actual appearance. These villi grow into the membrane of the uterus, thus uniting the fetal membranes of the horse, as in those of other mammals, and rarely does one find villi upon the chorin in the case of the horse, except in a very small portion at one pole. In no mammal is there such a variance in respect of this as in the horse, for in some instances I have found no villi at the twenty-first day. In about seventy-five per cent. of cases there will be no villi except at one pole. In the attachment or connection of the fetal and maternal membranes, they occupy a smaller space, relatively, than do those of any other mammal. It is because of this, that there is never but a loose attachment, as compared with the membranes of other mammals, and occasionally no attachment whatever.

In figure 31, is shown a fetus at the seventeenth day. It will be seen that the cavity of the allantois has diminished and the yolk-sac has become the vitillene duct. At this stage the allantois becomes attached to the chorion, or rather suspended between the amnion an ' chorin. From this on no material changes take place, the principal change being one of growth.

In figure 32, one sees a fetus slightly older than the one in the preceding figure. The most noticeable change is in the beginning of an attachment to the membranes of the mare. In this and the succeeding figure the fetus is shown attached to the fundus, or body of the uterus. This rarely occurs in the case of the horse and is only shown thus to show a change in development.

In figure 33, can be seen a fetus at the thirty-third day. Excepting size, and a few minor changes which will be mentioned later, one sees a fetus with all the outward appearance of a mature fetus. The sex can be determined and the outward form is practically that of a mature fetus. The extremities are relatively a little shorter, as well as the head, but for all this the fetus could be recognized by any one as that of a horse.

75. Hair. In the growth of the hair, the first to be seen is that of the future mane, which makes its appearance at about the sixth month. The covering of the body begins at the shoulders and neck, extending backward and downward, and from the feet upward, completing its covering around the navel. There is a difference in mares of about a month as to the covering of the fetus with hair, but this will occur from the eighth to the ninth month.

76. Place of Attachment. As to the place of actual attachment, the horse furnishes an interesting study. In figure 34, can be seen a fetus attached to the membrane of a fallopian tube. This was found thirty days after semen had been introduced into the uterus of the mare, and it is doubtful if it would ever have changed its position except as its own growth would have forced it backward into the horn of the uterus. I have several times found younger embryos in the same location.

In figure 35, can be seen a fetus in the extreme end of the horn of the uterus. This is the place where most of them become attached, when attachment takes place. This will also account for nearly all mares carrying their fetuses upon one side, more than upon the other. Occasionally the ovum drops to the bottom of the uterus and well back toward the mouth, becoming attached in such a manner as to entirely close the uterus. In such cases the uterus cannot be dilated at the time of parturition, and the mare will need assistance in delivery. It sometimes requires much effort to open or dilate the uterus in such attachments, and there is some danger of flooding, following such deliveries.

77. Amniotic Fluid. The amnion at first lies close on the surface of the embryo, but later becomes extended by the accumulation of fluid, the liquor amnii. This fluid at first contains about seven-tenths of one per cent. of salt, together with albumen and other substances. It continuously increases in its salt solution, until at the end of gestation it sometimes contains as much as three per cent. In most mammals, and especially in

man, the volume of amnion fluid is greatest at about two-thirds of the period of gestation, when it decreases until the time of birth. In the horse it continues to increase up to the time of parturition.

78. Sex Character. Only one more matter is worthy of mention in this chapter, that of full development of sex. Both the ovaries and testicles begin their development at a very early period in the horse, probably earlier than in any other mammal. The testicles of the male begin to descend at about the ninth month, reaching the scrotum from a few days, to three weeks before birth. The difference in time in this matter is more the result of inheritance than any other cause. The get of some stallions are always born with the testicles in the scrotum, while the get of other stallions are born with the testicles above the inquinal ring.

CHAPTER VI.

THE CAPSULE METHOD OF BREEDING

79. There Are Three Essentials to success in the production of foals. These in the order of their importance are fecund mares; virile stallions or jacks, and the uniting of these in a normal manner. So far as this subject is concerned, normality will mean anything not destructive of life in any of its forms, with which we have to deal.

80. Virile Sires a Necessity. The impregnation of mares cannot be expected unless we have spermatozoa of a high vitality with which to do the work. The need of this has been shown in nearly every chapter of this work. Nor should we begin our work of breeding mares by the capsule method, until we know the stallion or jack that is to furnish the spermatozoa has been tested and found in breeding condition. One has no right to expect a mare to produce a foal just because a capsule filled with some fluid of unknown quality has been inserted into her uterus. A stallion that is not a breeder by natural service, will not prove a breeder by capsule service.

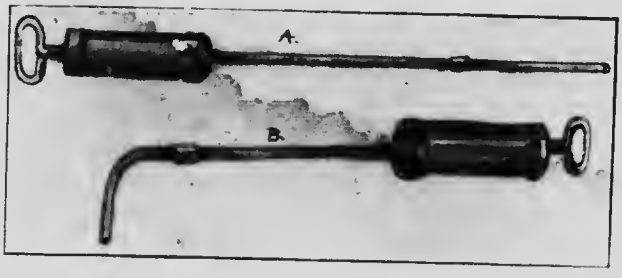

Figure 36.—The Carlson semen extractor.

81. Where Semen is Deposited. So far as the stallion is concerned, the only advantage the capsule offers, is in the fact that every service is a complete service, while the stallion makes only about 60 per cent. of complete services. In the case of 1196 mares bred by natural service, 19 different stallions being used and the mares examined immediately after the service, 715 were found with no semen whatever in the vaginal cavity, while in the case of 481 of them the semen, or a part at least, was deposited in the vagina. Here we have an average basis upon which to work. Some stallions make more complete services than others. Yet if we take all stallions into consideration, we will have only about 60 per cent. of complete services. Stallions

of the draft breeds will discharge the semen directly into the uterus more often than those of the harness or warm breeds, and jacks more often than either (21). In equine copulation, Nature intended the semen to be deposited in the uterus of the mare. These 40 per cent. of incomplete services are the result of the stallion being too long in the penis; leaving the mare too quickly, or some malposition of the cervix. This gives the capsule method a great advantage over the natural service in the way of better service. From the view point of using the stallion it has another advantage and a very important one. In breeding small or crippled mares, there is no danger of injury to such mares.

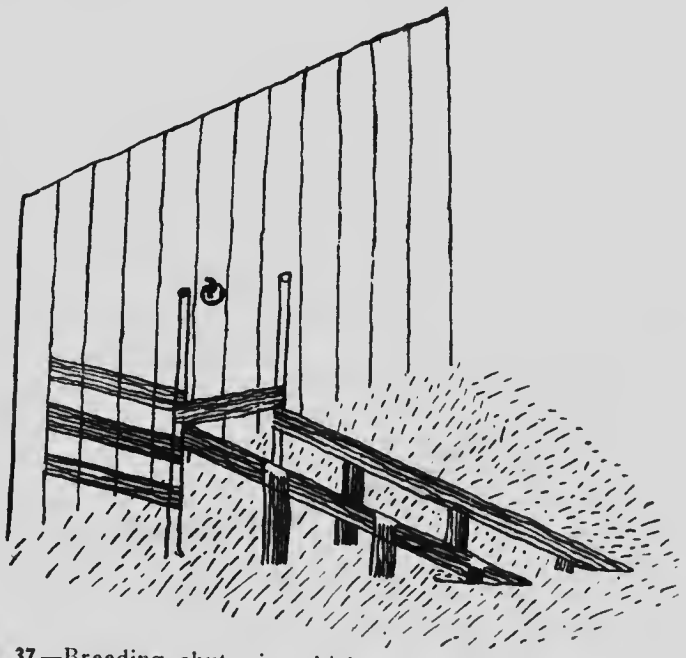

Figure 37.—Breeding chute, in which to breed mares. This is not a necessity, but a great convenience.

82. Sterile Mares. Mares that are sterile must not be expected to produce foals because of a capsule service. There are many mares that will not settle when bred by the natural method, that settle at once when bred with a capsule. Most of these mares will be found to be those with some malformation of the neck of the uterus. All such mares breed readily when served by the capsule method.

83. The Capsule Convenient for Patrons. Another advantage the capsule service has over the natural service, is the one of mare owners always being able to secure a service. It is disappointing, to say the least, for the owner of a mare to go eight or ten miles with his mare, only to find that service has

already been made. In such cases a mare owner has no choice but to remain over night, or return home without the service. When the capsule method is practiced the stallion can be billed to make his daily service at a stated hour. In this event it matters not whether one, three or ten mares are on hand to be bred, they can all be served with one service of the stallion. During the season of 1908 I bred 11 mares with one service of a stallion and 10 of them produced live foals with no further service.

84. Breeding Mares Out of Heat. The advantage of most value to the breeder in the use of the capsule method is in being able to breed mares when not in season. Mares bred out of heat settle more readily than when bred in heat. In a record covering several years, I have obtained nine per cent. more foals from mares bred out of heat than from those bred when in heat. This makes it both convenient and profitable. Most mares do not take kindly to being served by the stallion when not in heat, yet are easily served by the capsule method.

85. Age a Factor in Fecundity. The breeding condition of the mare is the first thing to learn when mares are brought to you to be bred. With reference to this the most essential thing is her age. The following table is for a period of 29 years. The stallions used were all pure bred stallions. Some of the mares were bred several times. The average per cent. of foals resulting is given in the nearest whole number. This has reference to live foals only. The age given was that of the mares at the time they were bred.

No. of Mares	Age of Mare	No. of Foals	Per cent. of Foals
189	2	81	42
203	3	94	46
391	4	157	40
462	5	240	52
676	6	434	64
901	7	658	73
973	8	779	80
1219	9	1001	82
1082	10	837	77
994	11	667	67
831	12	501	61
752	13	393	52
636	14	299	47
598	15	170	28
423	16	103	23
380	17	65	16
272	18	43	15
201	19	25	12
122	20	14	11
97	over 20	9	9

This table shows that it does not pay the owner of a stallion to breed mares after they are 14 years of age, unless the fee is paid at the time of service. A little better than 90 per cent. of these old mares producing foals, were those with foal at foot. As long as one keeps an old mare breeding and in reasonably good

physical condition, she is likely to continue a breeder. If she is not bred for a year or two she rarely breeds again.

The poor showing made by the two year old fillies is only because of poor feeding and poor development. Well fed and reasonably well developed fillies of this age breed as readily as

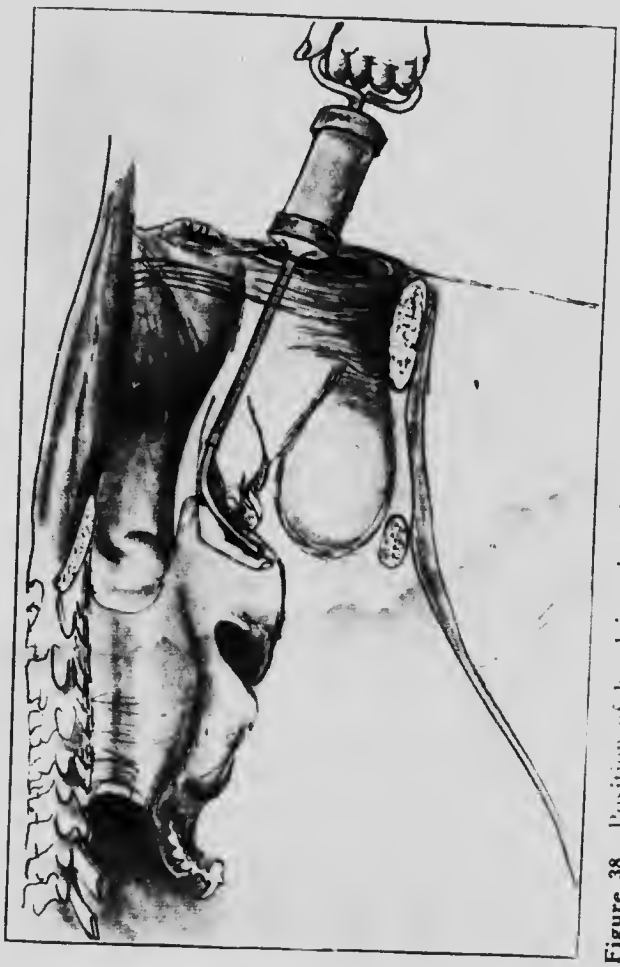

Figure 38. Position of hand in using the extractor. Note how the end of the forefinger is kept over the end of the point.

mares of any age, while fillies that have not been well fed, do not mature an ovum of sufficient vitality to be capable of fertilization. In my experiments with artificial fertilization, I was never able to fetilize the ovum of an undeveloped filly but two years old, while an ovum from a filly of the same age, but well

developed would always become fertilized. In my breeding, fillies of this age have increased in fecundity in recent years as a result of the better care being given them.

The three and four year old mares make a poor showing because of trouble at this age with their teeth. Dentition at this

Figure 39.—The Percheron foal, Carlson's Standard, No. 66990, foaled 1909. This is one of the high class Percheron foals of the season, and one of ten produced with a single service of the stallion.

time causes a somewhat congested condition, which is antagonistic to breeding. Even the five year old mares do not make as good a showing as those of more mature years. This table teaches us that by far the largest part of the foals are produced by mares from seven to eleven years of age. The nine year old

mares leading them all, while those eight years of age are a close second. The mares from the ages of 7 to 11 years inclusive, averaged better than 75 per cent., while for the entire number, it was only 57 per cent. The most valuable information which this table contains is in showing how rapidly one can lower his per cent. of foals, by breeding mades of doubtful fecundity. This necessarily means a shrinking of profits to the stallion owner.

86. Oestrum. The heat period is the next thing to be considered in capsule breeding. The most difficult things one has to overcome in breeding, are the superstitions of our early ancestors. Because their forefathers held to certain foolish beliefs, is proof conclusive to the minds of some men that they should hold to the same beliefs. That any one could be found believing a mare came in heat every nine days is difficult of belief, yet there are thousands of such men who really believe such things. Then there are others who believe mares come in heat every 15 days, and others again who believe it is 18 days. If a mare was bred upon the last day of one heat period and did not conceive, she would be in heat again 15 days later, but this has nothing to do with the heat period, for this same mare would have been found in heat three weeks from the date of the last service. The only way to determine the frequency of heat periods is to try them daily for two or three months, keeping a record of both the frequency and duration of such periods. In many such records which I have kept, I have found the heat period to be 21 days from the beginning of one period to the beginning of the following one. In all of the several thousand mares I have bred, I have always had them returned for trial 21 days after breeding them. There are a few irregular mares, some of them going 30 days or even longer between such periods, while others seem to be in heat nearly all the time. Such mares are not regular breeders.

The Duration of the Heat Period in mares is from four to nine days in the case of all normal mares. About 85 per cent. go from five to seven days. We have already learned (38) that the ovum is not discharged until after the heat period is passed. Because of this, the later a mare is bred the more certain she will be of conceiving. If she could be bred about the second day after the heat period is passed, she would be almost certain to conceive. It is safe to say that 75 per cent. of all mares are bred too early in the heat period for best results. As soon as owners notice anything out of the ordinary with their mares, they will rush them off to the stallion. This in many instances necessitates their returning them. It is not always convenient for the owner of the mare to take her to the stallion for service upon a certain day. Yet he should aim to do so as late in her heat period as possible. It should be his purpose to work for foals when he has his mares bred. If he will co-operate with the stallion owner in this direction, many more foals would be

the result. The duration of the heat period in a few mares is but a few hours.

87. Nervous Breeders Produce Few Foals. The temperament and habits of mare owners have much to do with the success of capsule or any other manner of breeding. Those men who are nervous, who are always in a hurry, or who can never get anything done soon enough to suit them, are men who produce but few foals. If a man wants foals, he must not be in a hurry, either before or immediately after breeding his mares. When I see men driving away with their mares after securing service for them, as if they had but a few minutes in which to reach their homes, I quite expect to do that work over again 21 days later. The men who own breeding mares, are men who are willing to devote a little time in having their mares bred, to the end that foals may be obtained. Such men are never in a hurry when they are having their mares bred. Nor do such men hurry their mares at any time. We have already learned (140) that Nature has provided that no rushing of matters be done at mating time. We have learned that many visits to the mare are made by the stallion before they mate. We have further learned that mating is delayed until the heat period is well advanced. It will be well for all interested in the subject of foals to remember these things. Give the mare abundance of time to reach the stallion. Give her ample time after the service in reaching home, and do not breed her until the heat period is well advanced, or even past.

88. Manner of Taking Mares to Stallion. How the mare is taken to the stallion has something to do regarding the number of foals resulting. A record kept of farm mares, used only for work upon the farm, and taken to the stallion in various ways gives us the following:

No. of Mares Bred	How Taken to the Stallion	No. of Foals	Per cent. of Foals
983	Driven double to wagon	631	64
819	Driven double to buggy	477	58
427	Led by halter	299	69
166	Ridden	69	41
2395		1476	61

Again these mares were selected because of the uniform condition under which they were kept when at home. They were all grade draft mares. The average age of each class was less than one year in difference. The class showing the largest number of mares was those driven in hitched double to farm wagon. These produced 64 per cent. of foals. The next largest number of mares were those driven double to buggy. These produced 58 per cent. of foals. At first thought one would be inclined to believe the buggy would be the easier and better hitch. But the tendency or desire to drive faster when so hitched can not be overcome. It is the faster driving which

produces the lower per cent. of foals. Those led in produced 69 per cent. of foals, the best showing made by any, while those brought in to be bred by riding them made a very poor showing when the quality and condition of mares are considered. It will be well for owners of stallions or jacks to advise their patrons to adopt any other plan of bringing in their mares.

89. Clothing for the Operator. The preliminary work preparing the way for the capsule breeding is now about done. The next step is to prepare the operator for his work. The first thing for him to think of, and the one last to be forgotten, is the necessity of cleanliness. Microbes in countless numbers are present in the air, and upon everything we touch or handle. Many of these microbes will destroy the vitality of spermatozoa. The first thing the operator needs in preparation for this work is the proper clothing. Clothing for this work is both simple and inexpensive. All he will need out of the ordinary is to have the sleeves removed from his undershirts and to buy two white painter's suits, consisting of jacket and overalls. If the operator is right handed, have the right sleeve removed from the jackets. If left handed, the left sleeve may be removed. These suits should be worn only at the breeding hour, and should be kept scrupulously clean at all times. This can be done by frequently sending them to the laundry. When the breeding hour arrives, he should have removed his outer shirt, and be dressed in one of his white suits.

90. Examination of Mares. The mares should be examined as they arrive to learn if they are in breeding condition. The first thing as already recorded in this chapter, which is likely to have an influence in this matter is her age. If she is 15 years or more of age, and has no foal at foot, it will be well to send her home without service, unless it is mere activity you are looking for. So small a per cent. of such mares produce foals, one can not afford to breed them unless the service fee is paid in advance. The next thing to take notice of is evidence of any discharge from the vulva. One can usually find evidence of this upon the under side of the tail, by the hairs being stuck together. Such mares have leucorrhea, and should not be bred, but sent to the veterinarian instead. Then look for evidence of congestion of mucous membranes, or a catarrhal condition of the system. This can usually be told by the condition of the mucous membranes of the eyes. If they are inflamed, that is highly colored, the mare is not likely to breed. The normal color of the mucous membranes of the horse is a very pale rose color, or pale pink. If the color is red, congestion or inflammation is always present. This congestion may be of a temporary nature; the result of a cold, shipping, fast driving or any one of many things. In such cases, it may soon pass away, but for all that, very few mares will breed while in such a condition. It is always well to have such mares wait awhile, to see if they will not be

later in a better condition. Mares three or four years of age always show some congestion present because of trouble with their teeth, but we have already learned that they do not produce very many foals. If mares of such ages do not show too much congestion I always breed them, as it is a help to the mare to have her in foal. If mares twelve years or more of age do not look right I always send them away. If mares are discharging at the nostrils, I would not breed them. Only about 12 per cent. of such mares regardless of age produce foals. One can not afford to breed them.

91. Sexual Examination. When all mares have been examined and this need take but a very few minutes for 10 or a dozen mares, have those found in condition be put in readiness for the service. This consists in placing them in the best possible position as regards security, yet never separating them from their mates, even though the mate is a gelding. When this is done they are ready for sexual examination, which consists in an examination of the cervix for contractions, malpositions or lacerations. If the cervix is found contracted or closed, open with the forefinger carefully and gently until a capsule can be inserted. If the finger can be inserted it will readily take in a capsule. Do not make the mistake of opening the cervix to take in two or more fingers. The hardest condition to overcome in breeding is the large open uterus. If one finger can be inserted, that is sufficient. Regarding any malposition, one has only to make it so a capsule can be inserted when such mares breed as readily as any. If closed open to admit one finger, otherwise do not interfere with its condition. Lacerations need the attention of a veterinarian. I have known those in a very bad condition to be repaired, and the mares made breeders. Regarding lacerations the one thing to always bear in mind is the condition a uterus must be in to seal itself so as to retain the fetus. If it be so lacerated that the cervix can not contract and close or seal itself tightly, the mare is out of commission as a breeder. Lastly, we have the large, open or lax cervix, which almost every stallion owner has had every kind of trouble with. When we understand the cause of this trouble, the remedy suggests itself. This is a condition induced, first because of the muscles running around the cervix, whose function it is to contract and expand or open the cervix, having become partially paralyzed or impaired to such an extent that they can not close it. An impaired or debilitated condition of the vital functions of the mare is usually present in such cases. One should in such case give the mare rest, and good, easily digested foods. In connection with this, inject into vagina, each other day a quart of warm water (body temperature) into which has been dissolved one-half teaspoonful of sulphate of zinc. Do this for ten days, then let her go a week without the injections. Repeat this work until the cervix closes, when she will be in readiness for breeding. This leads up to the tools for a capsule service.

92. The Tools For Capsule Service. The tools for capsule service consist of a pan of warm water, some arrangement for heating the same, thermometer, quart bowl, a good quality of soap, towels, creoline or other disinfectant, powdered slippery-elm bark and semen extractor. The pan should be made of galvanized iron or zinc. These metals will neither rust nor corrode. It should be four inches deep, six inches wide and 36 inches long. This will take in the extractor when the piston rod is drawn out full length. For heating the water any device may be used that is safe and capable of heating water quickly. I use a two-hole Perfection oil stove. Gasoline is unsafe about a barn. If the heater is to be used for breeding only, a one-hole stove is large enough, which with a two gallon tea kettle will supply one with all the hot water needed. The best thermometer for registering the temperature of your water, is a floating thermometer, used by butter and cheese makers. Any thermometer of ordinary use will do, however, and these can be had as low as fifteen cents. The quart bowl is to be used to catch the semen in case of withdrawal. No particular kind of soap is necessary, yet the quality should be good. Soap has to be used so often during the breeding season that unless the quality is good, the skin of the arm is likely to be injured by its use. Towels should be supplied liberally and they must be kept clean, else they become the breeding place for myriads of microbes, which should always be avoided. Disinfectants must be used, and creoline or other coal-tar preparations are as good as any and the cheapest by far. Before making examination of mares disinfect the arm thoroughly, then wash it off with freshly sterilized water immediately before inserting into the mare. No disinfectant must be carried into a mare [illegible] be bred very soon, as this would destroy the life of spermatozoa as well as other forms of life. The need of disinfecting the hand and arm before examining or breeding mares by capsule method, is to prevent germs being carried into the mare. Powdered slippery-elm bark is to be used as a lubricant. The best way I have found to use it is to keep some in a large pepper box such as cooks use about the kitchen range. By dipping the arm in water, then dusting a little of the powder upon the wet arm one has the best lubricant known. When it is known that 60 per cent. of all services made with stallions result in the semen being ejaculated or discharged directly into the uterus, shows one the necessity of having something that will extract the semen from the uterus, if we are to do very much in the way of capsule breeding.

93. Sterlization of Tools a Necessity. The sterilization of all these tools by the use of boiling water is the next step in our work. Throw away all tools containing rubber, or other material which will not stand boiling water. One will get very few foals by using such tools. Take every precaution in thoroughly sterilizing the extractor. When this has been done and you have selected the best mare from among those examined with which

to make the natural service, you are ready to begin the real work of breeding by the capsule method. Mention has already been made that the best mare for the natural service l.., reference to size, temperament and health. If possible, she should be some taller than the stallion. The best services are always secured by using mares slightly taller than the stallion. In temperament she should be quiet and level headed. Physically and sexually she should be in the best of health. Take no possible chance of spreading infection by using a mare of doubtful character as regards disease. When the best mare has been selected, place her in the breeding chute shown in figure 37, and have her securely tied. This chute is not a necessity, but a great convenience. If she is to be bred without the chute do not trust to some one holding her, but always have her securely tied. Many services have given only disappointment because of relying upon some one who was to hold the mare but did not. When the mare has been securely tied have the groom lead out the stallion. While he is doing this the operator should take the extractor filled with warm water in his left hand and the bowl filled with warm water in his right, taking a position at the side of the mare's left quarter as soon as the stallion has mounted and made a connection. When the stallion is about to dismount, empty the bowl and be prepared to catch any semen that may be withdrawn. If no semen is withdrawn throw down the bowl, empty the extractor of its water, and as soon as the stallion is well out of the way, catch the point with the thumb and first two fingers of the right hand and insert in vagina. Before leaving the operating room the arm should first be lubricated with slippery elm bark. If the semen was deposited in the vagina it can be withdrawn into th extractor when the operator with forefinger over the end of the point of the extractor, ould at once start for the operating room, placing the extract in the pan in which has been prepared the warm water at a ' perature of 100 degrees F. Early in the season when the weather is cold, the water can be prepared at 101 degrees, as it will cool the one degree by the time you wish to use it. If no semen is found in the vagina insert the point of the extractor into the neck of the uterus, preceded by the end of the forefinger at all times, as shown in figure 38. Insert as far as can be reached with the finger, then press downward, bending the point with the forefinger over the top, and the thumb under the bottom. Pressing down firmly but gently will cause a depression to form in the bottom of the uteri which it will cause the semen by its own gravity to occup.. With the point still held under the end of the forefinger, as shown in figure 38, so as not to draw in any part of the delicate membrane lining the uterus, begin to fill the cylinder of the extractor by drawing out on the piston rod with the left hand. When the cylinder is filled straighten the point before drawing out of the mare and start for the operating room as before directed. Have your helper or assistant handle the ex-

tractor, which is to be kept under water except when filling capsules. The finger should always be kept over the opening of the point to exclude both air and water, when not filling a capsule. With a capsule in the left hand, which the operator should always keep dry, the assistant may fill not to exceed half full, when it may be capped and at once inserted into the uterus of a mare to be bred. The capped end should always be inserted first. Have the owner of the mare hold up the left foot of his mare while the capsule is being inserted. This will avoid a possible kick. This operation can be repeated until all the mares are bred.

94. An Operating Room can be made of an office room or stall. Have as little light as possible, and still be able to see. Have the operating room or stall kept in a cleanly condition. In handling the capsules after they are filled, so handle them as to exclude all the light possible. If mares are returned for service more frequently than shou'd be the case, and the stallion is known to be in a vigorous condition, learn the cause. Something will be found wrong. When the trouble is discovered it can be easily avoided in the future. If the stallion is right, and the mares are right it is easy for the operator to be right. The early part of the season always gives poorest results. This is because every condition is against one at that time. The stallion is less virile, the mares are not in as good condition, and the weather is somewhat against one at that time.

95. Capsules. There is but one capsule made intended for this work. These capsules should be kept in a clean place, the more sunlight in the room the better. If kept very long it is well to place them in a hot oven for two or three minutes occasionally. This will destroy any bacteria that may gather upon them. Remember if mares are bred while in heat, they should be returned for trial in 21 days. If bred when not in heat they should not be returned until 30 days after service. In both cases they should be retried weekly for three weeks if not in heat when first returned.

96. First Use of Capsule. When I produced my first capsule foal in 1881, I did more for the horse breeding industry than I knew at that time. By making one good stallion do the work of several poor ones, it is doing more to improve the horses of the country than any other one agency. Figure 39 is that of a foal produced with a capsule.

97. Excitement To Be Avoided. In case of bad tempered or kicking mares, there is no way so quick and easy in handling them as strapping up the forefoot with a strap. When a strap of this kind is properly adjusted, it holds itself in place. Great care should be exercised in exciting mares as little as possible. Mares excited at time of breeding rarely conceive. This statement is based upon very extended experiments upon that one condition. Only seven mares produced foals out of 203 wild

Mexican mares bred by the capsule method. These mares were roped and thrown in order to make breeding them possible. In another experiment, conducted solely for the sake of the experiment, 117 domestic draft-bred mares were put in casting harness and lowered to the ground, then bred with a capsule and let up. These were handled very gently, yet only nine of them conceived. Later on 98 remaining were bred by the capsule method in a standing position, semen from the same stallion being used, and 8 of them conceived. In both ways of breeding these draft mares, two-year-old mares were used for all natural services. This should teach us that one should be very careful about exciting mares that are to be bred. It also teaches us why the rough, excitable owner of mares produces so few foals.

A [illegible] in which to breed wild mares by the capsule method from which good results may be obtained. Many wild mares are now bred every year in this manner throughout parts of the Southwest and also in Mexico. In this way wild mares can be bred without placing a strap upon them. A twitch upon the upper lip of domsetic mares has a very quieting influence upon the most of them.

CHAPTER VII.

PREGNANCY, OR GESTATION.

98. Evidence of Pregnancy. As soon as a mare has been bred her owner is desirous of knowing if she is pregnant. The owner of a pregnant mare gains nothing by a knowledge of her pregnancy, except that he may save the mare any medication likely to induce abortion, as well as unnecessary and dangerous work.

The cessation and nonrecurrence of the heat periods are the most significant signs of conception, yet these are not infallible signs, as mares very frequently accept a second and third service, though pregnant. Some mares will mate with the stallion during the entire period of pregnancy, while others without any apparent cause persistently refuse the stallion when not pregnant. The desire for the stallion in pregnant mares is most likely to take place in hot weather. Generally speaking if the mare refuses the stallion for 30 days after service, she is most likely pregnant. After all is said there is no infallible rule by which one may know a pregnant condition.

If a mare naturally vicious and excitable becomes gentle and docile, shortly after service, one may reasonably suspect a pregnant condition, since the generative instinct causing the excitement has been satisfied. So also, an increase of flesh, a loss of energy, or indisposition for work, when preceded by service usually imply conception.

The most reliable indication of which I know is the color of the membranes of vulva and vagina. Normally these are a pale rose or pink color, but soon after conception they gradually become darker, until at the third month one finds them of a bluish-red color.

When the gestation period has half passed, that is after five and a half months, motion of the fetus may be observed. From the seventh month until the end of gestation, motion can always be felt by pressing the hand well into the abdomen in front of the stifle, then removing the hand quickly. The sudden push displaces the foal toward the opposite side of the uterus, and as it floats back its body may be felt against the hand. Internal examinations are to be condemned.

99. Duration of Pregnancy. A mare usually carries the fetus about 16 heat periods, or 336 days. In all normal mares, parturition will occur at a regular heat period date. The uterus has been in the habit of dilating at these periods and even though 15 periods have passed it will again dilate at its regular time. It is only in cases of some abnormal condition that we find mares carrying the fetus beyond these heat period dates. If not quite

ready for parturition at one of these periods, the mare will carry the fetus three weeks longer. The period of gestation is not from date of service, but from date of conception. A gestation table of 9,137 mares producing live foals, over which I had control and in which there can be no possible mistake, gives an average of 336½ days for the colts and 337¾ days for the fillies. The shortest time was 297 days (a strong vigorous foal resulting), and the longest time was 391 days. The foal carried but 297 days was that of a young mare four years of age. She had produced one foal, and was bred seven days later, resulting in this foal which was a colt. The one carried 391 days was the foal of a five year old mare, never before bred, and it was a filly.

100. Care of Pregnant Mare. The pregnant mare should be given the best care the farm can afford. This does not mean a foolish, pampered care, but handling in an intelligent manner. She should not be handled so as to excite her in any way, nor be exposed to the annoyance of a stallion or mean gelding. She should not be overworked, or made to do work which might result in slipping or straining, such as working in deep mud or snow, or backing loads. Exercise is not only beneficial but absolutely necessary for the good of both mare and offspring. Moderate work in the harness is all right if care be exercised in keeping the mare normal at all times. She should never be worked in hot weather, for an elevated temperature may injure both mare and fetus. The summer of 1910 because of being hot was remarkable for the number of early abortions reported from all parts of the United States.

101. Food of the Pregnant Mare. In feeding a pregnant mare it is well to remember that the mare must eat, digest and assimilate for two. Her food should be abundant, and nutritious, but not fattening. Corn should be avoided at all times. Oats, wheatbran, well cured hay free from dust and fungi, and other foods rich in bone and muscle forming elements are to be recommended. Alfalfa and clover are excellent foods for a pregnant mare. The bowels should be kept in a good condition, and constipation avoided. Water should be given often, and in the winter ice water should be avoided lest abortion be the result.

102. Pre-natal Impressions. All the surroundings should be made agreeable to the pregnant mare. Both sentiment and business demand this. The brood mare, if wisely managed, will make the owner more money than anything else on the farm. Her stall should be large and wide, so as to give her ample room in lying down and getting up. The floor of the stall should be nearly level. If it slopes too much from the front backward it will throw the weight of the fetus back on the pelvis, endangering protrusions and even abortion. Violent mental impressions are to be avoided. Many men will say that pre-natal impressions are impossible with the mare, but I know they are possible. Hundreds of such cases can be cited all over this land. It is only

excitable or nervous mares that are likely to be affected, but we cannot afford to take chances. It is wise to banish all animals of peculiar tints or colors, and those showing deformities. Painful affections of the pregnant mare are likely to be impressed upon the same organs of the offspring.

103. Extra-uterine Gestation. Occasionally a fetus is developed elsewhere than in the uterus. Spermatozoa may make their way through the uterus and fallopian tubes, falling forward into the abdominal cavity. Should an egg from the ovaries fail to be gathered up by the fimbria and passed backward through the fallopian tubes, it is likely, also, to fall forward into the abdominal cavity, when fertilization is just as likely to take place there as any where else. In such an event we have abdominal or extra-uterine pregnancy. In such cases the embryo is likely to attach itself to the serous membranes, and receive the needful nutriment as is usual when located in the uterus. In three such cases falling under my observation, two of them were firmly attached, while in the case of the other there was no attachment whatever.

In abdominal pregnancy the fetus may be carried to maturity, or it may die, the soft parts of the fetus being absorbed, while the bones may be carried for years. In some cases the pressure will form fistulous opening through the walls of the abodmen, or even through the vagina or rectum.

CHAPTER VIII.

PARTURITION.

104. The Approach of Parturition. There is no certain rule by which one may foretell the time a mare will deliver her foal. In most cases this will be known by the enlargement of the vulva, the falling in of the muscles about the croup (relaxation), and the filling of the udder and teats. A day or two before parturition the teats show a waxy substance at their ends, and frequently there is a flow of milk. At the last the mare usually becomes uneasy, stops feeding, and sometimes she will lie down and rise again for several times. In many mares this is not repeated, but the mare remains down.

Figure 40. The correct anterior presentation.

But one should not trust too much to either time or appearance. As soon as there is a possible chance for the arrival of a foal, the mare should be placed by herself as already noted.

105. Parturition Without Previous Symptoms. Some times there will be no sign or act upon the part of the mare of what is to happen, when all at once she will lie down and begin to labor. In the breeding of horses no time ever presents itself when the presence of a man with good nerve and a level head is so much in need as this. No domestic animal labors so strenuously during parturition as the mare. If conditions are normal a few minutes labor and all is over.

106. Natural Presentation. If one is present at the time of parturition, after two or three pains the water bags appear and usually burst, followed by the fore feet of the foal, with the nose between the knees. With such a presentation one can help

the mare very much by taking a foot in either hand and pulling as she labors. If your labor is in eoneert with hers, you can do no harm by pulling with all your might. By this help one can relieve a mare of her foal quiekly, thereby saving her mueh wasted energy. At sueh times one should work with clean hands to avoid infection.

When there is a twin birth the seeond foal usually eomes with its hind feet first. If the tail is turned upward toward the tail of the mare, this presentation will be expelled as easily as an anterior one, sinee the curvature of the body corresponds to the curvature of the genital passages of the mare. In an anterior presentation the faee and ears of the foals should always be turned upwards for a like reason.

107. Obstructions. There may be any one of several obstructions to prevent the passage of the fetus through the pelvis and other passages. If the labor of a mare continues for any con-

Figure 41. The correct posterior presentation.

siderable time with no presentation, one will usually find something wrong. Oecasionally there will be found a mal-presentation from the first, or there may be some obstruction whieh prevents the expulsion of the foal. This obstruction may be a small narrow pelvis, perhaps the result of a fraeture. Tumors in the vagina or elsewhere in the pelvis sometimes prevent natural parturition, as does ealculus (stone) in the bladder, or impaction of the rectum with feces. Sometimes as a result of imflammation the fetus and its membranes become firmly attached to the uterus. In sueh cases the adhesions will have to be reaehed and broken down before the foal can be extraeted.

108. Difficult Presentations. The more common difficulties of parturition will be found those of mal-presentation, or more commonly speaking diffieult presentations. These are many, but in most of them both mare and foal can be saved. Sometimes

one foot only is present, when the other will be turned back. At other times both fore feet will be presented, but the head and neck are turned back. Either of these two presentations will cause the loss of the mare unless she has help. In one instance I saw all four of the feet presented at once, and yet the foal was extracted alive. Whatever the nature of a wrong presentation the mare will need help and at once. In all such cases a veterinarian should be called as early as possible. Delays in matters of this kind are mighty costly affairs, as not only the foal is to be lost, but the mare as well.

If a veterinarian can not be had, one should by all means try and do something himself. Any man with strength and pluck and some knowledge of the genital organs of the mare can do much if he only will. The first necessity is to know the foal is in such a position that it can be expelled. Sometimes when the presentation appears normal and yet the mare is unable to ex-

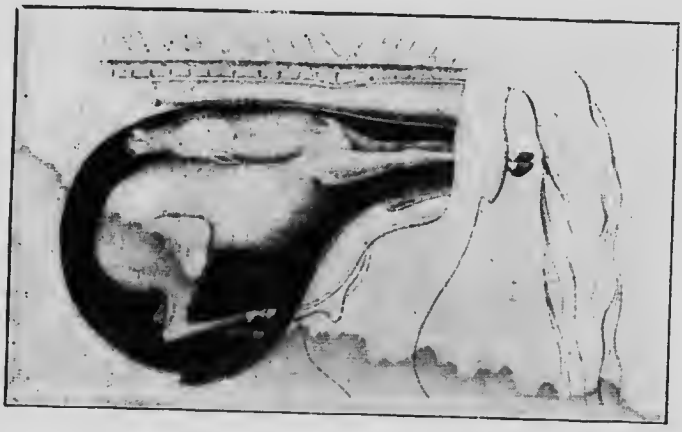

Figure 42. Anterior presentation with head turned back.

pel the foal it will be found that one or both of the hind feet are bent under itself and so far forward as to bend the posterior half into a loop or double. This position caused the hind feet to catch at the pelvis, making it impossible to pass through. Such a position is easily corrected. By pushing the foal back the hind legs and quarters are easily straightened. The most difficult presentations I have ever known, are those when the head is turned back, and the double presentation, the back coming first. In the latter it matters not which end you get first. The difficulty is in getting it turned. In many cases after the mares had become quite helpless, I have used block and tackle to raise them, behind, so that the foal by its own gravity will drop forward and downward, thereby helping greatly in turning it.

Whatever the nature of the difficulty one should never give up so long as there is life in the mare. As a spur to greater

efforts one should always bear in mind that unless the foal is expelled, the mare is lost.

Figure 43. Posterior presentation with hind legs bent under.

109. Feeding After Parturition. A mare should be fed grain very sparingly just before and after parturition. Excessive grain feeding at this time is likely to result in the foal having trouble with its digestion. The digestive organs of a new born foal are extremely delieate, and easily deranged by injudicious feeding of the mare. If the season is early and the weather chilly, be careful and not let the mare have much cold water.

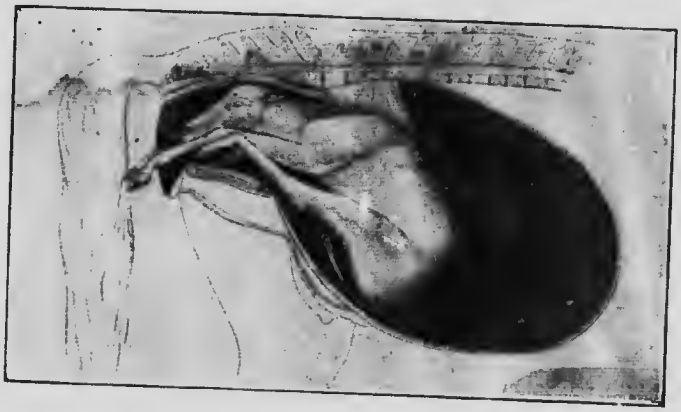

Figure 44. Doubled anterior presentaton, all four feet appearing at once.

Cold water in very large quantities during the four or five days following parturition may cause very serious trouble. It is much safer to give the mare warm water at this time for several days. If the mare foals during warm weather she may be trusted to drink as she has been accustomed to do. If the weather is warm

and the grass good she will do better upon the grass than any other feed. If the mare is of draft breeding, she will need grain

Figure 45. Anterior presentation, with fore feet bent under.

with the grass after the foal is a week old. None of the grasses in the corn belt contain enough nutriment to grow a good draft horse without grain. No grain will equal good, clean, heavy oats.

110. Flooding. Occasionally the uterus fails to contract on itself after parturition and flooding or bleeding is the result. About all that can be done in such cases it to relieve the uterus

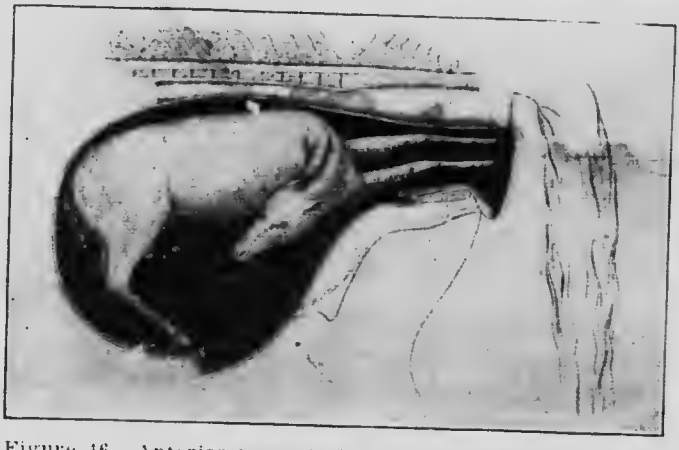

Figure 46. Anterior presentation with head turned on side.

of blood clots, when a strong solution of alum should be injected into that organ. Cold water may be applied to the back just over the uterus.

111. Eversion of the Uterus. After a difficult parturition the uterus occasionally fails to contract when the fundus will

pass into and through the body of the uterus, and through the vagina, until the inverted uterus appears externally. This can be returned by having the mare assume a standing position, when the surface of the protruding organs should be washed clean of all filth, then take a piece of muslin four or five inches wide and begin winding at the most dependent part, and wind toward the body of the mare. The next step consists of manipulating and pushing in those parts nearest the vulva. Once a portion has been returned into the vagina the rest will follow without much difficulty. When back in place the hand should be inserted and extended to every part of the organ, to insure that no portion remains inverted within another portion. The mare should be kept from all efforts at straining. This done a truss can be so arranged as to act as a barrier to any further escape of the uterus through the vulva. Cleanliness must be observed in work of this kind.

CHAPTER IX.

THE SELECTION OF A STALLION

112. Masculinity. It is impossible to produce the highest class of horses in any breed without the aid of high class mares. Yet the average quality of the horses in the country can only be advanced by the use of quality stallions. What a stallion will do for the community in which he is owned, will depend more upon his head and temperament than all else. No horse has ever proved himself a great sire, if not a stallion of most pronounced masculinity. This will be determined by the crest, the massive jaw, the voice, the hard and fixed expression of the eye, the muscular development of the jaw, neck and shoulder, and by his action and every movement. Life must be begun in power. To be complete it must be begotten with that immense energy sufficient to impart the greatest possible momentum to all its functions. To achieve all this requires potential virility. The stallion must start off all the bodily organs and functions of the future foal. This potential force must be powerful in the stallion, that the organism may be vigorous in his foals. A stallion with small or weakly masculinity will sire many foals of low vitality, even though mated with strong vigorous mares. The mares may supply plenty of organic material for the nourishment of the fetus, but it may have too little life force to appropriate it. An enfeebled mare may produce a strong vigorous foal, if sired by a stallion of strong masculinity. In this case the mare will still further enfeeble herself to nourish the fetus. The more a stallion is such mentally, the more he will be one physically and sexually. The male body is created by the male mentality. When speaking of the mind or mentality of the horse, I wish to be understood as including the entire nervous organization of the horse.

113. Nature's Laws of Sex Attraction. Nature does nothing without a well defined purpose. The stallion's peculiar voice is given him that it might attract mares to hi[illegible]. Any mare will readily recognize the voice of a stallion fro[illegible]at of any other horse, as far as she can hear it. The same i[illegible]ue of the odor peculiar to the sexes. The massive jaw and extra muscles of neck and shoulder are given the stallion as weapons of both offense and defense and to aid him in fighting battles necessary for the defense of his herd. The hard and fixed expression of the eye is but the outward expression of a being so full of masculine power that it must find expression in every look, in every action, in his entire being. He is the most perfect stallion who is the best equipped, best adapted to fulfill the office for which he was

created. All masculine endowments must be stamped upon the offspring at the time of conception; while female influences are continued through a period of eleven months. Therefore, for the time being the powers of the stallion should be far the greatest since each endows about equally.

114. Masculinity a Breed Characteristic. Masculinity is much more pronounced in some breeds than in others. Among the draft breeds the Belgian stallion is most masculine of them all. The Shire stallion is usually found possessing masculinity in a low degree. His small jaw and feminine neck give him the out ward appearance of a gelding. Many stallions of this breed

Figure 47.—The imported Percheron stallion Nicholas 21997 (43394). This stallion has sired more live foals than any stallion that ever lived. A grand type of a draft stallion, in masculinity being excelled by none. This is a reproduction of a photo taken in his fourteenth year. Note the extreme length of pastern, yet very short back, made possible by the sloping shoulder and long quarter. The extreme width of hock, the angle of the pastern, and the muscular development in all parts are seldom found in the same horse.

are wanting in masculinity to a marked degree. It is a well-known fact among intelligent breeders that the Shire stallion is a source of more trouble as a breeder than the stallions of any other breed. Some individuals of this great breed are as virile as any I have ever known, yet the fact remains that many among them are inclinded to be slightly sterile. I have been keeping records and compiling statistics obtained from others for many years, and state with much confidence that one can detect the "shy" breeders from any herd of stallions.

115. Stallions that are Unprofitable. For the purpose of this chapter I shall assume the reader does not own a stallion at this

time, but has decided to purchase one. Let me inform you before you make your purchase that of all the stallions sold in this country, not more than one of every 10 has ever paid as a commercial proposition. After the expense of his keep and handling has been paid, I doubt very much if one of every 10 has earned enough in collections to pay for his first cost. There are two primary causes for this being true. First, the stallion was sold for more than he was worth. Few stallions have ever been sold in this country at their true value. Any other than a high class, well bred and strictly sound stallion has no value whatever. The number of scrubs, as well as unsound and undersized pure bred stallions that have been peddled and sold in this country is appalling. There is no one to blame for this condition of affairs but the buyer himself. Just as long as such hot air advertising as "Ten acre barns, full to the roof of all ton horses" is more attractive to the buyer than the plain honest statement of a reputable breeder or dealer, just so long will the buyer be complaining of buying a gold brick. Just so long as the buyer goes out to buy something cheap, just so long will he pay something for nothing.

Secondly, another reason why so few stallions pay is because of poor handling. Scarcely one man in 20 now handling stallions is capable of doing so intelligently. It is really surprising how many unintelligent, superstitious, double-cover, look-over-the-left-shoulder, dark-of-the-moon, first-heat-filly-foal men there are in the country handling stallions. I have known men who have handled stallions for more than 20 years to state that it required all the semen of one discharge to impregnate a mare. I believe there are more misfits in the stallion and jack business than any other business in the world.

116. The Purchase of a Stallion. If you are ready to purchase a stallion, no place you can go is likely to prove so profitable to you as to some reputable breeder, where not only the sire, but dam, and frequently the second and third dams can be seen. If the stallion is a good one and of a desirable type, and you find his sire and dam of a type equally good, you know to a reasonable certainty what his offspring will be. If it is impossible to buy off a breeder, then buy of a reputable dealer. Be fully decided as to what you want before you leave your home, and do not buy until you have found such a horse. You will find it well to do the buying yourself, rather than let the seller do it for

you. If the horse shown you is of the breed and type you desire, look him over carefully as to his soundness. First see if his age, color and marks correspond with his certificate. If they do not, pay no attention to excuses or explanations, but leave him alone. Be mightly careful about his eyes. Defective vision is transmitted with great certainty. Be sure there is no blueness about them. A good, clear, prominent and expressive eye is essential to a good breeder. A hazel eye is always a good eye. If he is three years or more of age, note whether or not he has that hard or fixed expression already mentioned under masculinity (112). He should also have a well developed or masculine jaw, the same wide apart underneath, with a clean, neat throat. Full meaty throats are likely to become thick in the wind. His ears should be carried erect. His crest should be well developed with neck of fairly good length. Few draft horses have ever had too long a neck. His neck should be well set upon nicely sloping shoulders. You are supposed to be buying a sire for producing high-priced commercial horses. High-priced geldings are never seen with short necks nor with straight shoulders. Viewed from in front, he should be wide, carrying his width all the way back, and well muscled upon shoulder, arm and forearm. His legs should be set well under him, and only medium in length. If his legs are set too wide apart, he is sure to roll when in motion which causes more resistance, thereby resulting in added friction to all his movements. The knee should be wide, carrying its width well down below. Such knees are rarely seen with splints below them. If you are after a true drafter, he should measure not less than 10 inches below the knee and 12 inches below the hock. If he measures 12 inches below the knee and 14 inches below the hock, so much the better if the bone is of good quality. Quality of bone is as essential as quantity, yet one never finds too much good bone under a draft horse. Viewed from the side, all legs should stand perpendicular to the body. The pastern should stand at an angle of 45 degrees. The utility of the pastern is to dissipate concussion. A straight pastern and a straight shoulder are generally found together. Such a conformation is

the cause of most sidebones, ringbones, navicular troubles and shoulder lameness (283). Too much importance can not be attached to a correct pastern (283). If too straight in a young horse, it will only become more so with age, resulting in knuckling. Good feet are a valuable asset to any horse. This is more especially true of the forefeet, as about 60 per cent. of the weight of a horse is borne upon his forefeet. A wide hoofhead is very important, together with wide heels. Wide heels are usually associated with large, elastic frogs, to act as a cushion in dissipating concussion, which the pastern continues.

117. Conformation of Body. Going back to the body, the length of back from shoulder blade (scapula) to point of hip, should never exceed in length, the length of that part of the quarter measured from the point of the hip to point of the buttock. If depth of shoulder and length of quarter each exceed the length of the back, we have a near approach to the principle of the arch, the strongest self supporting figure known to the science of mechanics. A long back is quite a common defect in many draft horses. The body should be round, with ribs well sprung and extending well downward. This will give you a horse of good lung capacity as well as a good feeder and doer. The horse cut up in the flank is a poor feeder, always recovering slowly from extra exertion in the way of hard work or long shipping. The loin should be wide and well muscled. The croup should be long, straight and well muscled. There is a wide difference in the draft breeds in regard to the croup. Some of the breeds as a whole are very straight in the croup, while others appear very steep in the hind quarter. A long straight croup adds much to the appearance of the horse. So far as strength is concerned, it matters not so much about the angle as does the extent to which the croup is covered with muscle.

118. Hind Quarters and Hocks. The thigh and quarter should be heavy, this region of the horse being composed principally of muscles. A draft horse should be heavily muscled throughout the hind quarters, for it is the hind quarters that furnish most of the power in drawing heavy loads (275). The hocks should be given more attention than any other part of the horse. More draft horses go wrong because of defective hocks than all other defects combined (280). No hock can be too good or too strong. Viewed from both in front and at the side, the hock should appear broad, yet clean cut and free from fullness. In front of the hock and slightly to the inside, look closely for a spavin. Never buy a stallion with a spavin, even though a small sum will buy him, unless you wish to start a breed of spavined horses. I know of one stallion in South Dakota having a spavin upon his right hock, and 17 of his foals, the get of a single year, developed spavins upon the same leg before they reached their first year. The hock should be kept sharp in all its features and

angles, as such a hock shows more quality, both in bone and the tendons attached to it.

119. Quality. The hair upon the legs should always be fine, and as short as the breed character will permit. Nothing indicates quality in a horse so much as the fineness of the hair. Fine, soft hair is associated with fine, soft skin, and all such animals will be found possessing bone and tendons of high quality. In addition to this, a horse possessing quality in a high degree will not only have more strength, but much greater endurance as well.

120. The Generative Organs. Examine the generative organs of the stallion you are about to purchase. The testicles should be well developed, and even in size. Stallions with one testicle, sire many ridgling foals. Never buy or use a stallion witih only one testicle. The smaller, or rather shorter, the penis, the surer he will prove as a foal getter. This is because of his being able to make more complete services, by depositing the semen in the uterus. If you notice bunches of tallow deposited about the sheath, let the other fellow have him. Even with the tallow bunched upon and around the generative organs, he may still be able to produce foals all right, but as a producer of high-class foals, his vitality has been imparied forever. Tallow deposited in any part of the animal, necessarily impairs the vitality of all nerves and glands in that locality. It will take two years of carefnl and intelligent handling to put such a stallion in good breeding condition. Can you afford to do this?

121. The Action of the Stallion. Now have the stallion go to the walk. This is the only gait of the draft horse. Give the strictest attention to his every movement, viewed from in front, behind and at the side. In approaching you, the feet should be lifted clear of the ground, then placed down evenly and in line. From behind, the legs should be kept will under him, the flexion of the hock even and in line, the bottom of the feet showing at every step. From the side, the stride should appear balanced, quick and elastic. In addition to all this, in the well-sexed stallion, there should be an indescribable something to his motion and action, as though every nerve, muscle, and tendon were made of the highest and best tempered steel, ready to spring at the slightest volition. If he moves about as though partially unconscious of his surroundings and mission in life, I would not care to own him. The tendency of all stallion salesmen is to show their horse at a trot, rarely at the walk. The trot is of little value to the draft horse, other than to show soreness or lameness. If he walks right, his trot will be all right.

122. Good Wind Very Important. Not less important than any of the points mentioned, is to know the stallion you are bnying has good wind. Test him thoroughly in this respect, for without good lungs, and good wind, a stallion has no value (288).

Few stallions in the past have ever been tested by the buyer for defective wind, resulting in many a disappointment because of this negligence. I know of a stallion in South Dakota sold by an Eastern firm on the company plan, for $4,500. This horse if gelded at that time, would have sold for $100 and no more. Unfortunately for that community, he proved a sure foal getter, and has filled that country full of horses with defective wind. The damage to the farmers of that county cannot be measured in dollars, for it will take fifty years of judicious breeding to correct the injury done them, besides the first commercial loss of thousands of dollars. No defect, no disease of the horse is more likely to be transmitted than laryngeal hemiplegia. Beware of the windbroken stallion. Put him to a severe test, and if the slightest roaring or whistling can be detected, do not buy him.

123. Testing the Stallion's Virility. If the stallion has proved all right thus far, and you have been made a price which you believe to be reasonable, buy him, with the understanding that he is yet to be submitted to one more test; that of a breeder. Have this question settled before you pay a dollor upon him. There is but one way to settle this point, let the microscope do the work. Have him mated with a mare, and test the semen yourself. A microscope with a magnification of 400 or 500 diameters can be had for $30, and it will be worth several times that amount every year if you continue in the business. No man can intelligently handle a stallion or jack without one in these modern times. We are now living in the twentieth century, a time famous for its high intelligence, its many inventions, and its many master minds in every field of human endeavor. Competition in every line of commercial activity is mighty keen. If you do not intend to handle your stallion in the most intelligent manner known to this age, you will do well not to buy one, for your competitior will most likely handle his horse in a business-like way.

124. Guarantee. No guarantee of breeding is worth the price of the paper upon which it is written. There are plenty of breeders and dealers who are honest, and who will make good, but when you have handled and cared for a stallion one or two years with no returns, who is going to pay you for your actual loss in expense money and time? Even though you do get another stallion in exchange for the one already shown to possess no breeding value, your loss is too great to take any chances on. Besides this second horse may prove no better than the first if taken without being tested. There is but one business way to avoid this loss and annoyance; test the horse before you buy him. Twenty years from now, no stallion will be sold in this country in any other manner. If the stallion is a breeder, the semen will disclose the fact, in the number, vitality, and activity of the sper-

matozoa, as shown in figure 6. If the spermatozoa appear few in number, or if they show but little mobility, let the horse alone. This test can be made in the coldest weather, by the use of water at a temperature of 101 degrees, and doing the work in a warm office or other warm room.

125. Size and Weight. If you are breeding draft horses, no stallion you can buy will ever prove too large, provided he possesses quality with scale (238). I have many times mated small Indian pony mares, weighing from 550 to 800 pounds to ton stallions with uniformly good results, while if your stallion is coarse and unbalanced, his foals will be the same, even though mated with large mares. Taken as a whole our draft breeds are all too small. The demand for heavy geldings of quality, such as sell for $300 to $500 each, is many times greater than the supply, and always will be. The amount of small blood, even in our largest stallions and mares, will cause the law of reversion working with this fact to always give us a preponderance of undersized horses, even when we use the largest sires obtainable In speaking of draft horses, there is a wide difference between size and weight. The two terms have a distinctly different meaning. It is no easy matter to tell a new beginner how to distinguish between them, for added fat also increases most measurements of the body. As already noted it is a safe rule to refuse to buy any stallion carrying fat to the extent of showing it in bunches (120). Most shrewd dealers have carried the feeding end of their business to a dangerous extreme. It is surprising to one who does not know, to learn the amout of weight that can be added to a draft stallion in ten or twelve months of good feeding. Fat covers a multitude of defects. Many a man has bought a ton horse, only to find when he has been put in good breeding condition, that his weight does not exceed 1,600 or 1,700 pounds. I know of one man buying a four year old stallion at a weight of 2,020 pounds, which has never passed 1,600 pounds since he was six years of age. This horse to-day is without any patronage because of his smallness. He was sold by a dealer who advertises a barn full of all ton horses. In determining the actual size of a stallion I have already called attention to the measurement of the leg (116). The fore leg should measure not less than 10 inches around the cannon in the smallest part, and not less than 12 inches behind. In body measurement, his height should be from 16½ to 17 hands, to give best results. In girth measurement, one must take into consideration the amount of flesh he carries. Every hundred pounds of flesh added to a stallion weighing 1,800 pounds will increase his heart girth more than an inch. In this measurement he should never be less than 88 inches in good breeding condition, and 90 inches or more in flank girth. No stallion intended for the siring of high-class geldings can be too long in the body, so long as he has a short back. The short back in long bodied horses is made possible by

the sloping shoulder and long quarters. This conformation gives us the horse with long, easy stride. Such a stallion as described in good breeding condition as to flesh will give us a weight of better than a ton. This makes a good drafter. So good in fact that it takes much time to find one, and such a one if right in all ways is worth all he will ever cost you. Such a stallion, if a producer, will make his owner money in any part of the grain belt of this great country of ours. Such a horse, if a breeder, has never failed to make good. Competition from the viewpoint of today is unknown to him. A good type of draft stallion is shown in figure 47.

126. Disposition. One should avoid bad dispositions in buying a stallion. Should one become dangerous or even difficult to handle, be sure and take no chances. No stallion ever lived that cannot be handled safely. It will not do to show fear, yet one can so handle a horse that no injury can be done, either to groom or stallion. Nothing is better for reducing the temper of a vicious stallion than hard physical labor in large doses. Many fairly intelligent and naturally dispositioned stallions are made bad, because of their excessive masculinity, coupled with bad handling. The foals of such will have good tempers, while inherited viciousness will again be transmitted. For controlling a bad tempered stallion when being used with a bridle only, use a rod eight inches long, with a small ring in one end, and a link in the other. Weld the link in the right bridle ring, pass the other end under the jaw and through the left bridle ring. By buckling the lead strap into the end ring of the rod, one can easily break a stallion's jaw. Such a rig is only severe as the stallion makes it so. It is well to have but one groom handle a bad tempered stallion. Many a fairly good temper has been made to go wrong by too many men handling the stallion.

127. Summary. To put this entire chapter in one paragraph, a stallion should be endowed with great masculine power as expressed in the voice, the expression of the eye, the erect and alert carriage of the ear, the well defined crest, the massive jaw, the great muscular development about the neck and shoulder. His action should be as if he was overflowing with sexual power and vigor. The body should be long, but short on the back with sloping shoulder, and long, fairly straight croup and quarters. The underline should be long and well let down at the flank. Loin wide and well muscled. Ribs well sprung with great depth of body. Legs well set under him, with an elastic, sloping pastern. Hock wide, especially just below and at the joint, clean and well defined in all its points and angles. His feet should be good, with wide hoof-heads, wide and high at the heel with wide thick frog. His walk should be free, easy, in line, elastic, in short the equal of a perfect machine, made for that express purpose. This coupled with soundness in every part, with the lungs and wind

of a locomotive, with temperament and intelligence of the best, will give you a stallion you do not need to lead down the back alleys, when you take him to your home town.

128. Grades and Unsound Stallions. One more thought and this chapter will be ended. You may now own a grade stallion, or you may own one with a pedigree extending back into the very remote past, but for all that, one that is unsound and of inferior quality. If you do, use him to the best of your ability. This is a privilege not yet denied you in many of our states. Get your money out of him as soon as you can, for in a very few years no stallion will be permitted to stand for service anywhere in this country, unless he is a pure bred, and free from all hereditary defects. Because of this be careful as to the quality of the next stallion you buy. Go where we may, the same echo is heard rolling across the country; only sound and pure bred stallions shall be used. It is in the very air we breathe. It is heard upon nearly every farm, and because of so many inferior and unsound horses reaching the markets, we now hear it in the auction ring. The American farmers can always be depended upon to come out right upon any question of vital importance to their own interests and their country's welfare. They are now practically a unit in demanding such stallions.

CHAPTER X.

HANDLING THE STALLION

129. Care of the Stallion. The stallion is, generally speaking, the most abused of all our domestic animals. This abuse is not always intentional, it sometimes being the result of intended kindness. It is none the less an abuse, however, when we shut a stallion up in close quarters for the greater part of a year. Another abuse which is intended as a kindness, is that of overfeeding, especially when such feed as corn is used in large quantities. Many stallions have been made more or less sterile because of such feeding.

130. Grain Rations. The following table is the feeding systems of draft stallions owned in five states showing the comparative results of these systems from the viewpoint of foal production:

No. of Stallions	Kinds of Grain	No. of Mares Bred	No. of Foals	Per Cent. of Foals
207	Corn	37198	14877	40
219	Corn and oats	34907	15902	46
234	Oats	38214	20711	54
83	Oats and bran	11476	7054	61
33	Grass and alfalfa	5123	4186	82

Some of the above stallions had stood for service years in the same place, and the mares listed includes mares for all those years. The records of stallions producing less than 20 per cent. of foals in all these reports, were not tabulated. Such stallions I regarded as being partially sterile. Most of the sterile stallions reported were fed a grain ration of corn; while no sterile stallions were reported in data gathered for this table where the grain ration was oats and bran, nor from those fed grass in summer and alfalfa during the winter. These fed grass in summer and alfalfa during the winter were owned in the western states, where stallions are often permitted to run in pastures with mares. It is less practiced now than formerly, because of the rapid settlement of all public lands possessing much value. Where this system of breeding was practiced, the stallions would be permitted to run in the pastures for four or five months, when they would be taken up and fed alfalfa for the balance of the year.

131. Comparisons. By the above table we learn that a ration of oats and bran gave 61 per cent. of foals, while corn alone gave only 40 per cent. Even corn with oats produced six per cent. more foals than corn alone. In the case of grass and alfalfa, with no grain at any season of the year, we have 82 per cent. of

foals. It can not be said that these stallions were mated with better mares than the stallions fed other rations, for all except a few young fillies which remained in the pastures were mares that worked every day during the summer. The mares brought in for service were taken to a coral in the pasture to be bred, so that all mares were served in the pasture. Every stallion in this table was a pure bred, and 391 of the 776 were imported. Of the 33 fed grass and alfalfa, 23 were imported.

132. The Foal Crop of Different States. If one wants other evidence that our system of feeding is wrong, if it is foals we are after, we have only to compare the foal crop of the several states to again learn something as to feeds. This table is not intended to show the kind of grain fed to the stallions, but it does show the per cent. of foals in states where corn is the chief grain, as compared with those where corn is not fed. These statistics were gathered by sending blank forms to be filled and returned by stallion owners. It is not claimed that they are in all cases accurate, but without doubt they are as accurate as the average of statistics.

State	No. of Mares Bred	Per Cent. of Foals
Colorado	6359	67
Idaho	6417	73
Illinois	14697	46
Indiana	2247	47
Iowa	22129	47
Kansas	9678	44
Michigan	2186	58
Minnesota	7973	61
Missouri	8892	41
Montana	8138	72
Nebraska	26148	49
North Dakota	4916	56
Oregon	4971	71
South Dakota	12046	52
Washington	4613	71
Wyoming	3667	72
Wisconsin	5134	60
Canada	14971	71

In this table we learn that in the six corn states: Illinois, Indiana, Iowa, Kansas, Missouri and Nebraska, no state can show 50 per cent of foals. Of these states, Nebraska is the highest with 49 per cent., while Missouri is the lowest with only 41 per cent. South Dakota has seven counties classed as corn counties, the balance of the state growing more of the small grains, and we have 52 per cent. of foals for the entire state. Michigan, Minnesota, North Dakota, Wisconsin and Canada may be regarded as oat states, oats being the principal grain feed in all these states. In this group, we have from 56 per cent. in North Dakota to 71 per cent. in Canada. This gain of the oat states over the corn states is much more that at first appears, when studied in the light of profit or loss to the stallioner. Colorado,

Idaho, Montana, Oregon, Washington and Wyoming may be classed as grazing states, and we have here in this group from 67 per cent. for Colorado to 73 per cent. in Idaho, another very profitable gain.

Corn and Grass Compared. In the light of these statistics, the nearer we get to a corn ration, the lighter the foal crop; while the nearer we can get to a grass ration, the larger the foal crop. I made an effort to obtain statistics upon this matter from other states, but not enough replies were made to justify their application.

Our system of feeding draft stallions, owned and kept for breeding purposes, is bad. We feed too much rather than too little, and not very often a balanced ration. For best results in breeding, it is better to have too much rather than too little protein in our ration, but we must not feed too much. If our draft stallions were required to work every day in the year, it would be quite different, but very few perform any physical labor of any kind. This is not only bad from the breeding point of view, but it is the source of so much trouble in the way of sore legs in its many forms.

133. Quality of Feed. The feed for a stallion should be of the best quality. Badly cured or musty hay should always be avoided. Clover and alfalfa if properly cured have no equal, but never in larger amounts than one pound for each one hundred pounds of horse per day. Clover and timothy mixed is the next best hay. There is no hay so difficult of digestion for the horse as timothy. This is even more so when cut too ripe. It is also low in nutritive value, no better than good wild hay. Good hay is everything in feeding a stallion. I kept an imported stallion upon an exclusive diet of alfalfa hay for six years. During the season and summer following, he worked in the fields five hours every day. In the winter he was used to assist in feeding the stock, which required him to be in the harness every day. During the six years he served 512 mares, 414 live foals resulting. The foals all showed remarkable vitality, and the stallion kept in the best of breeding condition. This was done for the sake of the experiment. Other stallions kept at the same time, and under the same conditions, except grain being fed them, did not do so well nor leave so many foals.

134. Oats and Best Grain. No one grain, fed alone, will give as good results as oats. The next best grain I have ever tried is barley, but it must be crushed. Unless alfalfa or clover is fed for hay, a little bran will improve either grain. I would make corn no part of any stallion's ration. This is not because of what is disclosed by an analysis of corn, but because it is absolutely indigestible for any horse. The excrement of all horses fed corn is too acid, that is sour. There is always too much fermentation going on where corn is fed a horse. When swine are unable to

either digest or assimilate corn, how can we expect the horse with his delicate digestive organs to do so? If we take two pens of swine of equal numbers, and feed pen number one all the corn they will consume, and feed pen number two only the excrement from pen number one, the swine in pen number two will make the greater gain. This does not make a very good showing for corn as a grain ration for a horse. When either oats or barley have been used, I never feed a stallion during the breeding season more than three-fourths of a pound to one hundred pounds of weight per day. Salt should be accessible to the stallion at all times. Both feed and water should be given at regular hours, but never feed a stallion grain or give him water within three hours of the time he will be required to make a service.

135. Standing for Service. No part of the stallion business shows such a want of business methods and ethics, as that of standing him for service. This is in part due to the owner of the stallion having no business system, and occasionally no business principle. The man who makes two prices for the same commodity is a dishonest man. Many men have failed in business because of this weakness. No man will ever succeed in the business who has two prices. It is with no feeling of egotism that I make mention of it, but I believe no man living has ever bred more mares with stallions owned and controlled by himself than I have, and if I was asked what had contributed most toward my success, I would say it was because I have never made two prices for the same horse; that I always tried to own horses just a little better than the other fellow, and lastly, that I have left nothing undone to make my patrons money. If you cut your fee for one man, even he will always believe you are doing it for others, besides being suspicious that you made a lower fee to the other fellow than you did to him. Have one price and try to make all pay it.

136. Service Contracts. Much has been said and written against the "live foal" and "stand and suck" contracts. I have been making a study of the farmer and breeder during the past thirty years, as well as the horse. I can show that either my system of bookkeeping is wrong or that such a contract is profitable. In giving patrons a choice of two contracts, $15.00 to insure a mare in foal, payable December 1st, or $20.00 for a live foal, only about one in every 100 men have taken the "to insure" contract. Now, $20.00 is 33 1-3 per cent more than $15.00, and for thirty years I have lost only six per cent of mares known to be in foal. To insure a live foal may not be as profitable as some other forms of insurance, but it is profitable. Few stallion owners keep their books in either a business or statistical form. All books in this business should be kept in statistical form to the end that one may know all about his business, and especially the kind of mares that are both making and losing him money.

137. The Best Service Contract. No service contract known is so good for all parties concerned, as the "cash in advance" contract, with privilege of return for the balance of the season. This is best for two reasons. First, it gives the stallion owner a better chance with his horse, because of practically barring all mares known by their owners to be shy breeders, besides giving the stallioner the use of his money at the time he should have it. He can afford to make a very low fee with such a contract. If he knows how many mares he can command, he can know to a certainty what his income will be. Secondly, nothing causes the average mare owner to take a greater interest in the business or to give his mares so good care as to have his foal fee paid for. Wherever it has been tried in the northern states, it has proved both popular and successful.

138. Conditioning the Stallion. One has no right to ask patronage of the public unless he is in a position to give good value for service money received, not only requires a good stallion, but that the stallion must be in good condition. To start off the embryo life and future foal with the life and force vitality which it will need to carry it through to a vigorous old age, makes it of vital importance that the stallion be in the best possible physical and sexual condition. The stallion that has been confined in a small stall or yard for eight or nine months will be in mighty poor condition to sire such a foal. If the conditions are such that work is impossible, one should begin fitting his stallion as early in the spring as he can for the great work confronting the stallion. At least a month before the breeding season is expected to begin, the stallion should be given regular daily exercise. If he has done nothing but stand around all winter, he should be given but little exercise at first, but increasing the amount every day until the maximum is reached. He should be given service, even if it has to be given free to some one, at first one service per week, then increase the number of services by one mare each week until one service per day is reached. The complaint is general all over the country that mares do not settle well early in the season. It is not the mares, but the stallion usually at fault. In tests made of many stallions with the microscope, only a small per cent are found in good breeding condition in the early spring. Even one month would work great changes in a stallion, if the month was spent in exercise with an occasional service.

139. One Service a Day. In the handling of stallions for service, no one thing has been the cause of more failures or more instrumental in causing a low per cent of foals, than the practice of making two or three services per day. Very careful and extended experiments with draft stallions, by the use of the microscope at every service have demonstrated the fact that from 10 to 13 hours are required for a draft stallion to secrete semen

containing spermatozoa, providing the stallion is given regular daily service. Less time is required by warm bred, than by draft stallions.

Many years ago, I was handling an imported Percheron stallion. The foals resulting from his first year's service were so good that I was forced to make two and three services daily during his second season. Well along into the season, I observed he would sometimes impregnate a shy breeder, but fail to settle a regular breeder bred the same day. I blamed the horse rather than the mare. This led to my microscopical examination of the semen at every service. I carried this work on for three seasons, using different stallions every season. As the results were practically the same with all stallions tested, I will give a complete record of one during a season of 84 days. This stallion began the season with one service daily, which was continued for 21 days, working in double harness in the field five hours each day throughout the entire season. The second 21 days, he made three services daily, no two occuring nearer than five hours apart. From the 63 services made during this period, spermatozoa were present in only 39 of them. The next 21 days, he made two services daily, no two occuring nearer than eight hours apart. In the 42 services of this 21 day period, spermatozoa were present in only 31 of them. During the last 21 day period, he made only one service daily, and spermatozoa were present in all of them. Here it will be observed that at the end of a strenuous season of 84 days, with only one service per day, every service gave results, while during the first half of the season, with three services per day only a little more than half of them gave results. During the 21 day period when the stallion was making three services per day, I was just as likely to find the third service a good one as the first or second. I had a large number of mares of my own, so that by occasionally serving the same mare twice, I had no difficulty in making all services in the required time.

140. The Stallion in a State of Nature. In handling a stallion, the best results will be had by following the natural instincts of the horse, so far as domestication will permit. In the aggregate I have spent several months both day and night upon the range with a stallion and his mares, for the purpose of studying the breeding habits of both stallions and mares. Much information of value to breeding I have gathered in that manner. It was thus I learned a mare is never served by the stallion until she is well advanced in her heat period, not until she is in perfect breeding condition. The stallion will make frequent visits to the mare, in some cases for three or four days before mating with her, and she in readiness for him all the time. In one instance I recorded 26 such visits before the stallion mated with the mare. Nor does the stallion abuse himself, as most men suppose, when running with mares upon the range. I have a record of one

instance where a watch was kept for nine days and nights, with mares in readiness at all times and yet the stallion made eight services only in the nine days.

141. The Best Time for Mating. Another fact worth remembering is that 90 per cent of all services made under natural conditions are made between sunset and dark, usually just at twilight. My own statistics of farm mares bred, show this to be the most favorable time for impregnating them. This time of breeding with reference to farm mares is favorable because of giving the mare an opportunity to rest after the service.

142. The Result of Too Frequent Service. When making services too often with a stallion, he is likely to acquire the habit of failing to discharge semen, a practice which soon gives you a stallion possessing no value as a breeder. Even with natural service, a stallion will leave more and better foals with only one service per day, than when making two or more. The most accurate statistics we have upon the subject disclose the fact that only 40 per cent of all mares bred in the United States produce foals, and that it requires three and one-half services of a stallion for every foal produced. The stallion that can not settle more than 40 per cent of his mares with only one service each, provided he has good handling, is not a sure breeder. Since we know the majority of stallions are sure, there must be some very poor handling.

143. The Vices of Stallions. Many stallions acquire vices by idleness, others by poor handling. Among these vices may be named cribbing, wind sucking, lip lapping and masturbating, which are all stable vices, generally the result of idleness. For all of them I would prescribe work, and before they are too well fixed to be broken. There are several vices showing themselves only at time of service, such as being too impetuous with a desire to run at a mare in a manner endangering the safety of the mare and all those in her immediate vicinity. There is nothing better for this than the rod through the bit rings and under the jaw, reference to which has already been made. Then we have the vicious stallion. This always the result, either of an inherited tendency, which can again be transmitted, or an excess of masculinity coupled with poor handling. Little is to be gained by handling any stallion roughly. Even a vicious stallion can be handled without danger to any one, by so handling him at all times that he has no opportunity to do any harm. Firmness with intelligence will do more than beating or clubbing a stallion. Vicious stallions are generally remarkable for their virility.

144. The Use of Young Stallions. To make a good server of a stallion, one should begin with his first mare. It is easy to make a good server of any stallion if you can begin with him when a colt. A stallion should be taught early in his career to

walk up to the left side of the mare, place his shoulder against her flank so as to avoid kicks, and mount her only when commanded to do so. A little patience and intelligence upon the part of the groom, will soon result in teaching a colt so that he can be used in service without a strap upon him. In many respects it would be better if a colt could reach three years of age before making his first service. While nothing in the service itself can injure a colt, yet too early service is likely to lead to the vice of masturbation. If a colt is to be used in his two year form, never mate him with more than 8 or 10 mares that year, and give him one mare every five days until he has served them all. Never use a young colt for teasing, and do not permit him to stand where he can see such work being done. If he can be used at light work at this time, by all means work him. In making the first service with a colt, use a quiet, steady mare, and have a strong man upon either side of her. As soon as the colt has mounted and succeeded in beginning his work properly, have the men at each side of the mare take him by the fore legs and hold him well forward until he has made a complete service. By so doing, you will make a good server of him and keep him from getting into the habit of leaving the mare too quickly, which so often results in a withdrawal of semen.

145. The Use of a Breeding Chute. All breeding should be done in a breeding chute, one of which is shown in figure 37. There are several reasons for this. In case a small mare is being bred, she has no way of twisting around and hurting herself by the strain. There is also less danger of the stallion getting kicked. If the mare is tied close against the end and her head tied high by means of the ring as shown in the illustration, she can neither hurt herself nor the stallion. In the case of small or short mares, a floor can be dropped in the bottom to raise the mare up to any height desired. The best services are always made by raising mares slightly higher than the stallion. Another advantage in the chute is in being an aid in handling colts or badly broken stallions. There are few mare owners in the country not more or less afraid of stallions. Accidents often occur as a result of this, when mares are simply being held. If in a chute, and tied securely, one has little trouble from any of these sources. Even if the chute is not used, a mare should always be tied securely instead of being held.

146. The Use of Breeding Bags. All unnatural forms of copulation should be avoided. The use of breeding bags and cervical plugs are not only harmful in themselves, but many a good stallion and jack have been ruined by their use. The act of copulation is made possible by the electric forces of sex. The stallion is positive, the mare negative. The use of any object that acts as a non-conductor of this interchange of electricity, has the same effect upon the animals as would masturbation. Many stallions

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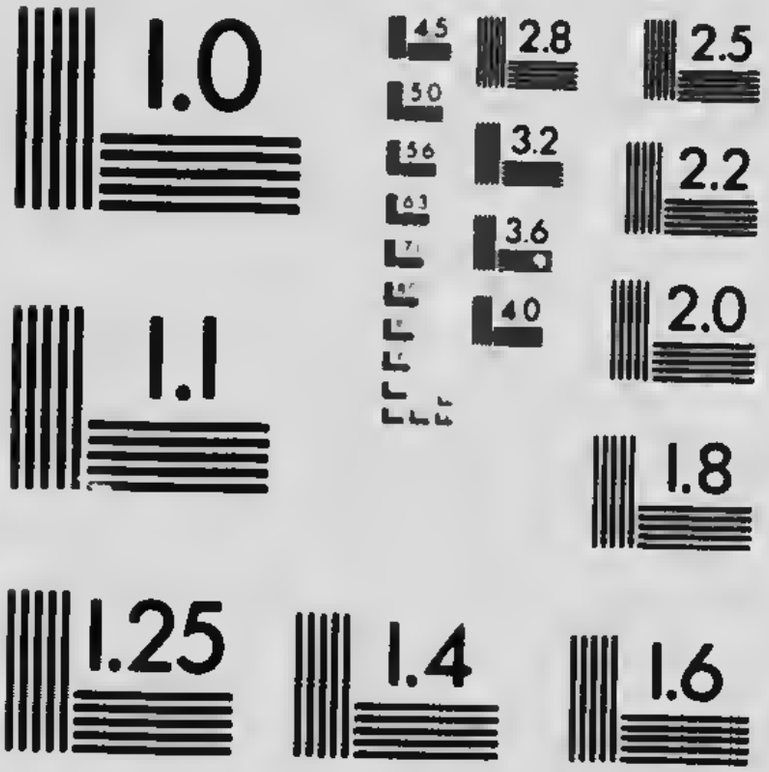

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refuse to serve with a breeding bag. They are wiser than their owners who would require it of them. Others work with it fairly well for a while, but most of these soon have trouble. The most serious trouble is where they have difficulty in ejaculating and if the practice is indulged in for any length of time, this form of trouble becomes permanent. By all means abandon the use of all such devices.

147. Stallions Running in Breeding Pens. The practise of letting stallions run in the yard or pen to be used for breeding is to be condemned. Mares will urinate more or less where breeding is done. If stallions have access to such places, one will notice that they are always smelling and straining to such an extent that their virility is likely to become impaired as a result. Unless stallions are permitted to run with mares all the time, they should never be permitted to run or exercise in yards that are used for mares.

148. Exercise. The exercise to be given the stallion has already received brief mention in this chapter, but the proper exercise for the stallion is so essential to breeding success, that to give the subject the thought it merits requires further mention. Those who are at all observing, have no doubt noticed that the foals sired by the several stallions in their vicinity differ in other ways than in breed or family characteristics. The get of one stallion will begin their existence in an enfeebled condition. Those of another stallion will be subject to some particular disease or weakness. Others will sire foals with nerves wanting; while the foals of other stallions will be ushered into life with all the apparent vitality of a full grown horse. I know of one stallion siring some 50 foals in one season, about 40 of them being weak in the back, so weak in fact that many of them died, and all had to be helped up for several days. Any physical condition common to a large part of a stallion's foals, is the result of some weakness or abnormal condition of that stallion. This is a fact worth remembering.

149. A Want of Exercise Produces Weakly Foals. In times past, it has been the rule of most men to blame the mare for everything except that of producing a good foal. Slipping, backing heavy loads or any one of several diseases on the part of the mare, may produce fetal trouble, yet in a large per cent of cases, the stallion is at fault for the loss of foals. I have never owned two stallions producing foals of the same vitality. Even the loss of foals while yet in a fetal existence is quite often the fault of the sire rather than the dam. In tests I have made of the semen of several stallions producing foals dying just before or at birth, the spermatozoa were of low vitality in all of them. Two stallions will stand for service in the same district, often in the same barn, serving mares kept under the same conditions, and subject to the same local environment, yet the loss of foals at birth will

be much larger in the case of the foals sired by one, than of those sired by the other. An inherited weakness on the part of the stallion is one cause of this, while a want of proper exercise is another.

150. The Kind of Exercise. To prescribe a rule of work for stallions is no easy matter. What one man understands as work or exercise, another will convert into an abuse of the stallion. Then stallions differ so greatly in temperament, some actually requiring strenuous exercise to be able to give a good account of themselves in breeding, while others require but little exercise to give good results as breeders. That every stallion in service should be given sufficient exercise to expand the lungs, quicken the circulation, strengthen the nervous system and harden the muscles, in order to be in a condition to beget the most and best foals possible, the breeding and quality of the stallion considered, can be denied by no one. The real question is how best to do it. Our light or harness breeds are generally given more exercise than our draft stallions, and they require it, as they possess a higher nervous organization. To use them in the harness for driving, is the best exercise that can be given them. Besides this kind of exercise will aid in stamping upon the offspring this same quality of speed or high acting, as the case may be. This principle as a factor in breeding, we should not overlook, for it is at work throughout all nature. The fighting instincts of canines and felines are always the most active at their season of mating. Antelope and deer whose natures make the quality of speed a defensive necessity, to aid them in fleeing from their enemies, always indulge this propensity in the extreme immediately before mating.

151. Draft Work For Draft Stallions. This law of Nature will apply to the breeding of draft horses. Leading or driving in a cart is better than no exercise at all, yet it is not the exercise we should give our draft stallions if we ever expect to build up a breed of good American horses to be used for draft purposes. Real draft work in the harness is the only exercise for a draft stallion. The plow, harrow, disc, mower, binder or farm wagon upon the farm, or the dray or heavy transfer wagon in town or city is an exercise that will fit a draft stallion for producing foals of the highest quality, and possessing a vitality which could not be given them by a stallion not worked. In addition to this, such use of our draft stallions will prove a mighty factor in developing and transmitting from stallion to foal in a high degree, all those muscles required by the draft horse in moving heavy loads.

152. Working Stallions During the Breeding Season. Nor do we need to stop working them in harness during the breeding season. The best success I have ever had with draft stallions has been by working them in the field during the first half of the day, then letting them rest a few hours, making their daily ser-

vice at about four o'clock in the afternoon. There is very little danger of over-working a stallion in harness with the system of one service a day. If not abused, the harder he is worked the better will be his foals. The strongest argument ever made in favor of the scrub stallion, is that he occasionally sires a foal better than himself. This only because of the limited number of his services and hard physical work. He is always in the pink of condition from the breeding point of view. Those who have never seen the test made would be surprised at the disclosures made by the microscope upon the semen of a stallion as usually handled, and again of the same stallion after being worked hard in the harness for sixty days.

153. Harness Work a Cure for Indifferent and Sterile Stallions. Hard work and plenty of it, is the best thing that can be given a slow or indifferent server, and it will cure a large per cent of partially sterile stallions. The owner of a stallion owes it to the public, quite as much as to himself, to have his stallion kept in such condition as to insure his siring the very best foals. The difference in the value of a foal ushered into life with some weakness or of low vitality, can not be compared with one beginning life endowed with all the vigor of constitution inherent in his race. Many ills of the horse result from some inherited weakness, which more likely than not was the result of a want of physical exercise on the part of the sire. By the practice of giving our stallions more work and less drugs, will enable us to produce a much better race of horses. Drugs and stimulants should be scrupulously avoided at all times, unless prescribed by a qualified veterinarian.

CHAPTER XI.

THE SELECTION OF A BROOD MARE.

154. Femininity. What masculinity is to the stallion, femininity is to the mare. The stallion should be positive, the mare negative. The hard, determined expression of the stallion should be changed to one of mildness and softness in the mare. The massive jaw, the muscular crest, and the action expressive of great power in the stallion should in the mare be represented by refinement of character. A great length of loin, and a wider and deeper make of rib should also be found in the mare. The mare is Nature's receptacle, to receive and develop the creation of the stallion. Other things being equal, the more feminine the mare the better and the surer breeder she will prove herself to be. I have observed that barren mares are more masculine than feminine. A lack of the sex characteristics is good evidence of a lack of procreative power. Castrating colts while young, causes them to develop more like mares than stallions. Unsexing mares by removing the ovaries while young will cause them to develop coarser, more like horses than mares. The same may be said of everything pertaining in any manner to sex. In selecting brood mares, great care should be exercised in selecting only those showing feminine character, which means they are well sexed. All brood mares famed for their excellence in such a capacity are always found to be of the most pronounced feminine type. Note the extreme feminine character as indicated by the refined head, ear, jaw and neck shown by the mare in figure 49. This mare produced a foal of the highest quality, every year for many years. It is not necessary that a mare should be undersized to be feminine. Some mares of extreme size are much more refined and feminine than others of less size.

155. Stallioners Owning Brood Mares. One or more pure bred mares should be owned by every owner of a high class stallion. Even if the owner of a stallion lived in town, he could well afford to own a high class mare of the same breed to which his stallion belongs. In the first place, nothing would help him in securing patronage for his stallion from among the better class of men, so much as to be able to show a foal or two of the highest quality. Then again, the rearing of a good pure bred foal every year would add much to the profits of his stallion, enabling him to keep a strictly high class horse. Nothing so encourages the horse breeding industry in a community as the pure bred mares which may be owned there. A good pure bred mare has been the means of causing many men to breed better horses.

156. Wh[illegible] to Buy Mares. The purchasing of a pure bred mare has end[illegible] d in many a disappointment. In times such as the present, when no legitimate business is paying such a revenue on the investment as the draft mare of quality, is a fai ly good rea-

Figure 49.—A Percheron mare of quality and her foal of two months. Note the extreme femininity of this mare, as indicated by the refined head. This mare combines size and quality to a high degree. This foal is the product of a capsule service.

son why such mares known to be producers are rarely offered at public sales. Those who have purchased mares at such sales only to find in the years that follow, that to have purchased a gelding would have proved just as profitable, are many. I have seen mares respond to the call of the stallion while being sold under a positive guarantee that she was safe in foal.

157. Rules in Buying Mares. There are two rules in buying mares, which if followed closely will rarely result in a disappointment. The one is to buy mares only with a foal at foot. Such a mare has proved herself a breeder. The other is to buy young fillies, and only of the man who bred them, that their sire and dam may both be seen. The latter plan is preferable, as by this way more may be known of what to expect of the filly, both as to her proving a producer and the quality of her foals.

158. Pedigrees and Certificates. This brings up the question of pedigree or certificate. Many believe if an animal is registered, it must be a pure bred. It does not need to be, and very often is not. Many mares and stallions are being sold every day with certificates that are far from being pure bred. They are known as top-cross animals and are far too common in the Percheron breed and stud book. High officials in the association of this breed are offering many such in their annual sales as shown by their catalogues. Such horses are only grades with a certificate and while these certificates may have a value of their own to a dealer, to a reputable breeder they have no value whatever. However, if one has had no experience with breeds and pedigrees, he does not need to be deceived by these top-cross certificates. If the dams of any animal registered can not be traced back to an imported dam, that animal is only a grade. The following certificates, both taken from the stud book of the Percheron Society of America, will illustrate this point, the first one being a pure bred:

Collector—No. 60152.

Sire: Tremont 33647, by Duc de Broglie 2368 (1145), by Brilliant 1271 (755), by Brilliant 1899 (756), by Coco 11 (714), by Vieux Chaslin (713), by Coco (712), by Mignon (715), by Jean le Blanc (739).

Dam: Selma 46354, by Bayard 10959 (20891), by Luther 4093 (212), by Luther (792), by Pierre (887), by Laboureur (886), by Jean le Blanc (739).

Second dam: Niobrara 44715, by Bolet 14217 (19790), by Sans Souci 7100 (6070), by Snowflake (107), by Avata 1966 (912), by Nogent 738 (729), by Vidocq 483 (732), by Coco 11 (714), by Vieux Chaslin (713), by Coco (712), by Mignon (715), by Jean le Blanc (739).

Third dam: Myra 6068 (Paquerette 6139), by Cheri (5464), by

Fourth dam: Rosette (6134), by Selim (749).

It will be noticed in the above certificate that the third and fourth dams are both mares that were bred in France as indicated by the numbers in parenthesis.

The following is the certificate of a so-called top-cross or grade:

Cinq.—No. 54895.

Sire: Costa 42290, by Leroy 21193, by Mithridate 20535 (35918), by Archimede 11411 (7222), by Voltaire 3540 (443), by Brilliant 1271 (755), by Brilliant 1889 (756), by Coco 11 (714), by Vieux Chaslin (713), by Coco (712), by Mignon (715), by Jean le Blanc (739).

Dam: Octo 25483, by Hercules 19985, by Messidor 11567 (22456), by Forban 7368 (5374), by Picodor (5391), by Picodor.

Second dam: Cathrine, by A'Venture 1448 (803).

Third dam: Cath. by Premeier 11, 1451.

Fourth dam: Calebs, by Emperor 658.

Fifth dam: Carlo, by Chartres 518.

It will be noticed in the above certificate that the dams do not trace back to an imported mare, and that only the first dam is registered. Therefore the colt Cinq. No. 54895 is only a top-cross or grade, being of the sixth cross and possessing sixty-three sixty-fourths of Percheron blood. This assuming the certificate and pedigree to have an honest foundation. It is in such pedigrees, however, that we find the greatest temptation to misrepresent pedigrees. If the other sixty-fourth part of the blood of this colt was of any of the other draft breeds, no harm could result. It is because of not knowing of what this outcross consists, that we should not use such horses for breeding purposes. It may be any of the small breeds, or even of an Indian pony. As soon as the American farmer and breeder understand what this means to the future of the horse breeding industry, such horses will be given no place in breeding.

Then there are other certificates given with both stallions and mares by unscrupulous dealers, possessing no value whatever. There are a few associations in the country quite ready to register anything for the fee. In buying such horses, one is always buying a grade with a pedigree, which is used only as an aid in making the sale.

159. Conformation. In conformation, the draft mare should not differ from the draft stallion. Size, the sloping pastern and shoulder, good feet, and hock of the best, both as regards quantity and quality, should always be demanded. If good foals are desired, good mares must be a factor in their production. A good and well sexed stallion, with correct conformation may be able to sire very good foals when mated with only ordinary mares, yet we should not expect him to do it all. The best horses are possible only by the use of good mares.

CHAPTER XII.

THE CARE OF THE BROOD MARE.

160. Every Normal Mare a Breeder. The mere ownership of a mare does not mean that one owns a brood mare; yet, if a mare refuses to produce her kind, it is more likely to be the fault of her owner than her own. Nature made every entire female a breeder. If you own a mare of breeding age and she does not breed, ask yourself why. About twenty years ago I purchased some mares in eastern Iowa and Illinois. These mares were from three to nine years of age, and the most of them were sold only because they would not produce. In April 101 of these mares were turned out to range in the northwest part of South Dakota. They were all large mares of draft blood, weighing from 1400 to 1700 pounds. About the first of June I began breeding them to an imported Percheron stallion. The mares were all driven into a corral every Monday and Thursday. All mares in season would be bred upon those days by making one natural service and capsuling the others. I made but two services each week with the stallion. In 30 days every mare had been bred once. Some were bred as many as three times during the season. The next spring these 101 mares produced 53 live foals. The next year they produced 91 live foals, handled and bred in the same manner. The third year, every mare had produced at least one foal, and yet many of their former owners were honest enough to tell me the mares he was selling were barren. The two oldest mares were nine years of age when I bought them, and their owner told me he would not think of selling them if they would breed. He had bred them every year from their third to their eighth year, but with no results. With such a record behind these mares, and with nothing having been done to aid them in breeding but simply turning them back to Nature, every mare proved herself a producer.

161. The Abuse of Brood Mares. No one thing which I have tried to impress upon the minds of farmers and breeders, and with so little effect, is the need of better care of mares in foal, and those they wish to breed. They will drive a pregnant mare six or eight miles to town and tie her to the hitch rack. They will work them until they are warm, and then let them stand in the wind until chilled. They will even drive them to a buggy; use them in deep mud and upon slippery roads without shoes; back heavy loads with them; in fact do scores of things with them every day which they should not do, and then wonder why they

do not breed, or why they lose their foals. Because their grandfather's old Kate did these things and produced foals for many years, is conclusive proof to their minds that all mares should be treated in the same manner.

162. Occupation of Mare Owners. For more than twenty years I have classified my country patrons into breeders, grain farmers and hay farmers. Those designated as breeders made the breeding of live stock their chief business. The grain farmers made the growing and marketing of grain their specialty. The hay farmers grew and marketed hay. The table below will show how they stand as breeders.

Class—	No. of Mares Bred	Average Age.	No. of Foals	Per Cent
Breeder	5146	9.6	3447	67
Grain farmer	3297	9.3	1747	53
Hay farmer	2674	9.9	1042	39
	11117	.....	6236	56

It is a long call from 67 per cent down to 39 per cent. What a difference to the stallion owner! We do not have to go far to learn why the hay farmer produces so few foals. In hauling his hay to market he will be out in all kinds of weather and upon every known condition of roads. When he reaches the market his mares will be warm, and often required to stand out in the cold for hours. Colds and a general catarrhal condition are usually the result. Only this winter I called the attention of a farmer to the fact that his mare was too warm to be left standing in the cold. He thought differently, but only a few days after this occurrence one of his neighbors informed me that the same mare had aborted. In this table the grain farmer shows 53 per cent of foals. The same rule applies in a less degree. The more brood mares are used away from home and upon the roads, the fewer the foals. The breeder, regardless of the kind of stock he is breeding produces a much higher per cent of foals, and for two reasons. His breeding and feeding of stock offers no occasion for his mares to be worked upon the roads. Secondly, the breeder is a higher type of man than the grain or hay farmer. He will always be found with larger sympathies, which is a mighty factor in successful breeding.

163. Occupation of Mares. Much depends upon the occupation or general use to which mares are put, in the way of producing foals successfully. Upon this subject I have been keeping records also. I have classified them according to their occupation, into farm work, where they never left the farm; combination farm work and driving; driving with no other occupation; and saddle work. This does not include so many as the former table, because of not always knowing how to classify some mares;

besides there are a few mares apparently used for several purposes. In this table mares were used only as specified.

Class—	No. of Mares Bred	Average Age.	No. of Foals	Per Cent
Farm work	2361	9.4	1605	68
Farm work and driving	2417	9.1	1305	54
Driving	1683	8.9	690	41
Saddle	264	7.9	76	29
Average	6725	9.0	3676	54

Here we learn that the occupation of the mare has much to do with her as a producer. The above table teaches us that if a mare must work, her work should be something she can do at a slow pace. Where the occupation was farm work alone, the mares produced 68 per cent of foals; while farm work with driving gave only 54 per cent. Driving gave less with a showing of 41 per cent. The saddle mares did not produce enough foals to justify a stallioner in breeding them, unless the fee be paid in advance. The pace they are required to make, coupled with the extra weight upon the back is fatal to breeding. While in the South during the winter of 1903 I met a breeder of saddle horses and he told me his per cent of foals was so small as to make his business unprofitable. When I learned that his mares were being used under the saddle much of the year, I suggested that his brood mares be ridden at no time, nor for any purpose. Three years later this breeder wrote me his foal crop had more than doubled since he began using his brood mares for breeding only.

164. Work vs. Pasture. I have always held that draft mares would produce the best foals when required to perform a reasonable amount of labor in the harness, but statistics teach us that they do not produce as many. This is not because of being worked, but because of not being worked judiciously. During the summer hot days will come occasionally when mares, if worked at all, will be made too warm. Such days were quite frequent during the summer of 1909 and 1910. When in humid weather the thermometer climbs to 95 and 100 degrees in the shade, it is a waste of time to attempt to work brood mares if one does not wish to overheat them. Then again if one is working brood mares he is more likely than not to get in places where it will be necessary to pull the mare beyond her safety. Another condition against the brood mare often made necessary by work is that of standing when warm until a cold is the result.

Mares running at all times in good pastures or upon the range escape the dangerous conditions, which results in a larger foal crop. If mares must work upon the farm, and a good pasture can be provided, by all means give her and her foal the benefit of it nights and Sundays.

165. Feeding Mares for Foals. Feeding has much to do with successful breeding, and it requires even more than a balanced

ration for best results. Corn can be so used with bran, clover, alfalfa or other feed rich in protein, that chemically it will not differ from oats, yet mares fed oats will produce more foals than when corn is any part of the ration. Mares fed oats with bran will produce more foals than those fed oats without the bran. Mares fed grass and hay with no grain, will produce more foals than when fed grain of any kind.

The following table speaks for itself.

No. of Mares Bred	Feeds—	Average Age	No. of Foals	Per Cent
468	Range feed	10.1	425	91
183	Grass in summer; alfalfa in winter	9.9	161	81
208	Hay, oats, bran	9.2	147	71
398	Hay and corn	8.7	195	49
231	Corn, bran, hay	8.9	117	52
305	Corn, alfalfa or clover	8.8	177	58
418	Hay nad oats	9.0	284	68

The mares in this table kept under range conditions were not worked. Those fed grass and alfalfa worked about one-third of the time. The others were selected because of being owned upon farms where good care and kind treatment was the rule. They all worked, but never left the farm. The rations fed were the same as had been used for many years. Nothing was left undone in the selection of these mares to have every condition, other than feed, the same with all the mares. The results of this experiment is at variance with the opinions of many of our best breeders, but such facts are more convincing to my mind than the unsupported theories of any man. The question of feed is one of the unsolved problems of the American breeder. The question of soil in producing the same feed, is of equal interest. Alfalfa, for instance, grown in the corn belt is but little if any better than clover. This same plant grown further west at an altitude of 3,000 or more feet, is the best food for growing and developing a draft horse ever grown upon mother earth. In bone, and muscle and the quality of both, nothing can compare with it.

166. Corn a Menace to Fecundity. Then again, there is corn. Chemically, there is no reason why corn can not be balanced and made a good feed, yet in fact, unless the breeders of draft horses in the corn belt change from corn to some other feed, within a century their mares will all be barren. It has the same effect upon the stallions. Either stallions or mares that have never been fed corn can be put upon a corn ration for a year or two without apparent injury. After that length of time the injurious effect of the corn becomes noticeable. I have known many stallions to be fed corn exclusively for their grain ration for three or four years, acquitting themselves nicely in the stud during this time, and then become sterile all at once. These same stallions were again made breeders within a year by simply substituting oats for the corn. The same has proved true of many mares. I

have often succeeded in restoring to bearing corn fed mares that were supposed to be barren, by simply changing their diet from corn to other grain or alfalfa.

167. Short Time Feeding Experiments. It is such facts as these that show the utter folly of attempting short time experiments in graining feeding. Such an experiment to be of the highest value to breeders should be conducted for a period of twenty years, or even longer. Theories may be all right in their place, but every known fact shows conclusively that corn is both debilitating and degenerating to the horse. The temperature of mares fed corn, averages higher than in the case of those fed oats or other grain. As to corn being a factor in degeneracy, I have made many extended observations. In the case of two lots of mares of the same breeding and quality, the one fed corn and the other oats or no grain, and both lots bred to the same stallion, those fed corn always produced the poorer foals. These foals were not only inferior to others as foals, but did not mature into as good horses. In many tests I have made of the bone of horses fed upon different grains, those fed corn always showed the weakest bone. In weight per cubic inch, it appeared to be as good as the bone of horses fed other grains, but as soon as it would be given the leverage test it was found possessing very little strength. Those reared from their colthood up to maturity upon an exclusive diet of western alfalfa, showed the best quality of bone of any draft horse tested. For the same breeding, the bone was larger, and greater in both weight and strength.

I shall not attempt to say why a corn diet has such an effect upon stallions and brood mares, for I do not know. The positive concerning this question, I shall want to experiment further. However, this fact I have settled to my own satisfaction, that corn is indigestible to any horse. It may be because of its indigestibility that the system becomes so impaired in all its varied functions that degeneracy naturally follows.

168. Pasture. There is no feed so good for a brood mare as good, nutritious grass. In dry seasons, or in case of a scarcity of good grass, a grain ration of oats should also be allowed. There are few pastures in the eastern or middle states growing grasses sufficiently nutritious to support a brood mare and her foal without a ration of grain being added. This is the more true if the mare is of the draft blood. It requires an abundance of nutritious feed to grow a ton horse.

169. Salt should be accessible to brood mares at all times. Water should be given often, to avoid drinking too much at one time. Too much hay or other coarse food is neither good nor necessary for mares. As we have already seen (165) alfalfa is the best of all feeds. Clover should be well cured and placed under cover without any foreign moisture being permitted to

reach it. Any hay which has been wet with rain during the curing process, is not very good for a brood mare Good bright oat straw, free from rust is preferable to damaged hay. Corn stover well cured is good for both mares and stallions. Sorghum or sugar cane is a hazardous food for a brood mare. Upon one large farm where many mares were kept for breeding purposes, sorghum hay was fed for three years with good results, but the fourth year because of some condition in weather while curing, it caused the loss of more than one-half of the foal crop. The same experience has been recorded on several occasions. It may be fed several seasons without apparent injury, only to play havoc with all the mares the next year. Millet should never be fed in any form to a brood mare. The same may be said of all those wild grasses likely to contain ergot.

170. The Stabling of Mares has much to do with their fecundity. In the early settlement of this country our mares and horses were sheltered in cheaply constructed stables, in which the question of ventilation did not need to be considered. There were were always enough openings in the stables of our early settlers to provide ventilation. Mares were much more fecund in those days than they are today. We did not hear of colds, coughs and influenza in those times, as we do now. In modern times the first thought of one in building a new barn is to provide against the cold of winter. Little thought is given the question of either light or ventilation, both essential to breeding success. If mares are to be worked durig the winter they should be housed at night in a barn, but this barn should be built so as to admit of an abundance of light and air.

171. Mares Running Out All the Time will do better if they do not have to be worked, than those kept in barns of any kind. An open shed can be given them to run under during stormy weather. For several years I have taken my pure bred mares out of expensively built barns, and let them run out at all times with only a cheaply built open shed to provide against storms. I have increased the per cent of foals considerably by doing this. Our modern barns are the source of much trouble to breeders because of being built warm, at the expense of sunlight and ventilation. Sunlight is the best germicide we know of, and the cheapest.

172. When to Breed Mares depends upon the amount of work required of them. More foals are lost from among the early ones, than from those coming later in the season. About 11 per cent of foals are lost before weaning time, from deaths and abortion. This upon the basis of mares actually impregnated. Of the losses from death following a normal birth up to weaning time, about 85 per cent are those foaled before May first, as against 15 per cent after that date. The causes of these deaths will be taken up later. Because of this heavy loss early in the season, one

should have their mares foal as late in the season as possible. This enables one to have the foals come when grass is good. There is no place so good for a mare to foal as in a good pasture. Many of the worst ills of the young foal can be avoided by this practice. The danger of infection is thus reduced to a minimum, besides there is little danger of the newly born foal having bowel trouble, if the mare has access to good grass.

173. Management of Pregnant Mares. If because of the conditions of farm work, one must have some of his foals come early, he should have everything in readiness for them. A mare should never be kept tied in with other horses for three or four weeks before her foaling date. Many foals have been lost by doing this, as foals often put in their appearance long before they are expected. A mare about to foal should be given a good box stall, so constructed that the foal will have no way of crawling under the manger or getting into positions which will make it impossible for him to gain his feet. This stall should be kept scrupulously clean. If an extra stall can be provided, so much the better. As soon as the foal can stand upon his feet, and the placenta has been expelled from the uterus of the mare, they can be transferred to the clean stall, thus avoiding as much as possible all forms of infection. If the placenta has not been expelled within thirty minutes, and does not yield to very gently pulling upon it, the arm should be disinfected and inserted in the uterus. By gentle and careful manipulation of the fingers between the placenta and membranes of the uterus, the placenta can easily be taken away. There is nothing difficult about this. Any man can do it, if he possess ordinary intelligence. The sooner the placenta is expelled, the better, as the uterus begins to contract very soon after the birth of the foal. This contraction of the uterus more tightly fastens its hold upon the placenta. If the placenta has to be taken away by force, it will be well to irrigate the uterus with a warm three per cent solution of carbolic acid.

CHAPTER XIII.

STERILITY.

174. An Inherited Tendency a Cause of Sterility. Sterility is more often the result of an inherited tendency than most of us are willing to admit. For many years I worked systematically in an endeavor to learn if I could, the basic cause of this tendency. Among other things I tested the fluids (blood) of many stallions and mares as to per cent of salt found in these fluids. For this work I used both mares and stallions possessing all degrees of

Figure 51.—Microbes found in the semen of a sterile stallion. These germs caused the depopulation of several herds in the western part of the country.

virility and sterility. The average for stallions was 71-100 of one per cent, ranging all the way from 5-10 of one per cent to 92-100 of one per cent. The mares showed an average of 76-100 of one per cent, slightly higher than the stallions. They ranged all the way from 54-100 of one per cent to 1.01 per cent. The stallions testing 92-100 of one per cent was one famed for his virility. With no exception they were stallions possessing a lower viritliy, as the per cent of salt showed a lower test. When 55-100 of one per cent was reached the stallions became sterile or nearly so; five per cent of foals being the best showing made by any stallion below that test.

The mare testing 1.01 per cent was one that had produced fourteen foals in as many years. The same results were obtained with the mares as given by the stallions; the lower the per cent

of salt, the lower the fecundity of the mare. All mares testing below 6-10 of one per cent of salt were found barren. Here we have something tangible upon which to base the cause of this shy breeding tendency. This is a hereditary tendency, but it can be overcome in part at least by feeding salt to all breeding animals. It was only last summer that one of the leading live stock journals of the country advised its readers to feed salt sparingly to their breeding animals. I have been feeding my stallions and mares all the salt I could get them to consume for many years, and with uniformly good results. It can readily be understood that salt could be forced into a horse by mixing it with feed in such quantities as to impair his digestion. My method has been to have salt accessible to my stallions and mares at all times. In addition to this, I add a teaspoonful of salt to the feed of each stallion daily, and to the mares twice each week.

175. Breed a Factor in Sterility. The question of breeds has something to do as to sterility. From this view-point the table below offers quite a study. These stallions were all pure bred, about 70 per cent of all the breeds having been imported. They were owned and stood for service in the states of Iowa, Illinois, Kansas, Minnesota, Missouri, North Dakota, South Dakota and Wisconsin. All five of the breeds were represented in every state. The mares were such as came to be bred, the service registers being used to obtain the number of mares. The number of foals given are for the number actually found. This would be as fair for one breed as another. Some of the stallions were used at the same stand two or more seasons, and the number of mares given include those for all seasons. Only stallions owned by farmers who owned their farms are included in this table. These farmers might be considered above the average as horsemen and breeders. In gathering statistics for this table a stallion was occasionally reported as sterile. In such cases the mares bred were not tabulated. It was the performances of breeding stallions that I wished to obtain. The per cent of sterile stallions reported was: Belgians, 3.09 per cent; Clydesdale, 4.6; Percherons, 3.16; Shires, 5.02; Suffolks, none.

Breed—	No. of Stallions	No. of Mares Bred	No. of Foals	Per Cent of Foals
Belgian	219	29783	18168	61
Clydesdale	103	9241	4990	54
Percheron	613	83659	46017	55
Shire	321	41976	20571	49
Suffolk	27	2397	1554	69

The above table teaches us that the Suffolk leads, with a showing of 69 per cent of foals. The Shire is lowest with only 49 per cent of foals, a difference of 20 per cent. The Clydesdale and Percherons are about the same, while the Belgian is second in the table with a showing of 61 per cent. Breed then has something to do as to the number of foals we may expect. Nor does

the factor of breed affect the stallions only. It is just as plainly indicated upon the part of the mares.

The following table is a record for three years of American bred registered mares, owned in the same states as given for the stallions.

Breed—	No. of Mares	No. of Foals	Per Cent of Foals
Belgian	191	405	71
Clydesdale	78	153	65
Percheron	711	454	68
Shire	367	652	59
Suffolk	19	47	82

These mares were from four to ten years of age. All of them were worked some, but none very much. In this table while the ratio varies slightly, yet the breeds hold their same positions. Imported mares of the same breeds are not so fecund. The act of importing itself is something of a factor in producing sterility. The table below is a record of mares for the three years following that in which they were imported. If they were imported during the year 1900, the records begin with their being bred the season of 1901. This gave them a chance to recover from the ill effects of importing. The mares in both tables were those owned by small breeders, that is farmer-breeders, who would own from one to five such mares.

Breed—	No. of Mares	No. of Foals	Per Cent of Foals
Belgian	61	89	49
Clydesdale	17	19	38
Percheron	212	267	42
Shire	134	133	33
Suffolk	11	28	84

Again the breeds hold their same position as to fecundity, differing only in ratio. These imported mares were all of breeding age when they landed in this country, but this table makes a sorry showing for such mares during their first three years with us, the Suffolks excepted. It is to be hoped they may do better in the future. Such a showing does not make them very profitable to their owners.

176. Feeding has much to do with the sterility of stallions. This has already been conclusively shown (130.) The feeding of corn to stallions, especially young stallions, has been the beginning of many disappointments. All kinds of feed having a tendency to produce a high temperature should be avoided. If stallions reach 10 years of age in good physical and sexual condition, their sexual powers are not easily impaired by ordinary means after that age. This is because of the fact that only stallions of the greatest sexual power and vigor ever reach that age without becoming impaired. Many stallions start out with much promise in their early life, only to become of no value as producers by the time they are seven or eight years old. It is such

stallions that need our very best care. Besides they should be used very sparingly in the stud.

177. Breeding Bags. The use of breeding bags on stallions and jacks is a very common cause of sterility. No stallion or jack can be used with a breeding bag without positive injury. Thousands of dollars have already been lost in this manner. Natural copulation is affected by the interchange of sexual electricity. Any foreign barrier which is a non-conductor of this electricity will soon ruin the best horse in the world. Such a barrier has the same effect upon the stallions as masturbation. We have no need of training stallions to become masturbators, as there are plenty of them without this training. Mention has already been made (9) of how the use of breeding bags will cause the loss of the power of ejaculation as a result of injury to the sympathetic nerve.

178. Masturbation is another cause of sterility. Young horses acquiring this vicious habit are almost certain of going wrong as breeders. If this habit is of long standing it is almost impossible to overcome it. Nothing is better than steady work and a cooling laxative diet.

179. Vigor Tablets and other stimulants are frequent causes of sterility. Doping stallions with drugs can never do any good, and may do very much harm. In the first place no stallion ever needs that kind of stimulating. Good feeding and plenty of physical work is the best stimulant known. The nerves can be strengthened, the muscles made more firm; the circulation quickened and the performance of every function of the horse improved by work, better than by any drugs. There will always be grafters and quacks ready to sell one tablets and powders and tonics without end, but leave them alone.

180. Colds, Influenzas and many forms of sickness are the causes of temporary sterility, sometimes resulting in permanent sterility. Stallions partially sterile are likely to be made worse by these causes. There are stallions appearing in the best of health from October until April, and then annually go wrong for the balance of the year. Such stallions have little value as breeders, and it will generally prove more profitable to castrate them than to spend time and money in trying to make breeders of them.

181. Cystic Degeneration of one or both testicles occasionally is the cause of sterility—sometimes it is a cystic condition of the spermatic cord rather than the testicles, but in either case there is no help for the stallion. This is made even worse by being one of those difficult conditions impossible of diagnosing, except in the last stages of the disease. When discovered castration will make you a work horse, if not delayed too long.

182. Contagious Diseases of the generative organs will make both stallions and mares unprolific. A number of years ago I was called into the western part of Nebraska to examine some stallions that had very suddenly become sterile. In examining the semen with the microscope, the form of bacillus shown in figure 51 was disclosed. These stallions had proved to be virile under all circumstances, when all at once they became sterile. Every mare served by them became sterile and as a result of this highly infectious malady, several ranches were depopulated of their horses. No ulcers, chancres, or other outward manifestation was in evidence in the case of any of these stallions, yet in the semen of every one was found these germs.

183. Idleness or want of proper exercise will lower the sterility of any stallion. The spermatozoa of idle stallions never have the vitality of those from stallions given daily exercise. Very few stallions wintered in idleness are capable of settling mares early in the spring, while those kept in harness during the winter are always in good condition at the beginning of the breeding season. Close confinement has been the cause of many stallions going wrong. All stallions kept in close quarters and without exercise will sire foals of lower vitality than if they had been properly exercised.

184. Overwork to the extent of causing a breakdown of the more important functions of the stallion, sometimes ends in sterility. I have never known this to be done except in the case of very young stallions, two years or less of age. I have known of several two year old colts to be completely broken down in constitution by overwork. There is little danger of this being done in the case of mature stallions. With them the work is too little rather than too much. If a two year old colt proves himself a breeder, but does not make a good showing later, there is something wrong with his handling. This happens quite frequently. The fact that he acquitted himself well in his two or even three year form, is conclusive proof that he is a normal breeder.

185. Table of Causes of Sterility. Some stallions do very well for three or four years, and then become sterile or nearly so at once. In investigating such cases the following results were obtained:

Excessive use in breeding	183
Masturbation	98
The use of breeding bags	87
Too close confinement	39
Vigor tablets or tonics	67
Influenza (pink eye)	11
Infectious diseases of a sexual nature	9
Overworking young colts	3
Fevers	4
No cause could be assigned	43
Total	544

Of the 544 stallions becoming sterile after proving themselves breeders, 183 of them could be assigned to excessive breeding. These stallions were mostly abused as four year olds. It is not uncommon to see a stallion of that age required to make two or more services daily. Because of their trouble with dentition at this age, a four year old should never be used upon more than 50 mares. There is no reason why a draft stallion should not be virile at twenty as at any earlier period of his life, and he will be if used and handled intelligently. The second largest number could be assigned to the vice of masturbation. This vice is not only making many sterile stallions, but it is making many others partially sterile. Breeding bags make a bad showing as do also the use of tonics or stimulants given to slow servers. That a stallion is a slow server is nothing against him. Some of the most virile stallions are exceedingly slow. Such stallions never need any drugs. A few minutes brisk exercise immediately before the service will do more than any drug. Diseases of various natures also bring about sterility. There were 43 becoming sterile for which no cause could be assigned. These stallions had been properly exercised, had never been sick, were given the best of care and had never been used in excess in breeding. This makes it impossible to assign a cause, unless it would be the result of an inherited tendency. It is my belief that an inherited tendency to sterility was the cause, but as this is one of the things not easily proven, I am willing to give them an unassignable cause. Mares with a tendency to sterility will produce stallions inclined to be more or less sterile. Stallions partially sterile will sire stallions possessing the same defect. Upon the other hand, stallions of known virility and mares highly fecund are always the offspring of productive parents.

186. Sterile Mares. There are more agencies at work causing sterility in mares than in stallions. A mare will produce several foals in as many years, and then refuse to produce another, and all because of a congested condition, the result of a cold. The number of sterile mares in the country is enough to discourage the breeder and stallioner. Since Nature made every mare a producer of her kind, if she does not reproduce herself, there is something wrong as to the manner in which she is kept.

187. Feeding has already been mentioned (165) as having much to do with the fecundity of mares. It has also been noted that corn should be fed to a brood mare sparingly (165) or not at all would be better. The food for a brood mare should be slightly laxative, as constipation should never be found in the same barn with successful breeding.

188. Work in the Harness has much to do with a mare in the production of foals. I am of the opinion that a mare could be worked to advantage as a breeder, but she has never been, and most likely never will be. It matters not what the occupation

of the mare may be, in every line of investigation, the mares not worked produce the most foals. Occupation has much to do, that is the kind of labor. Slow farm work gave better results than any other occupation.

189. Congenital Causes of Sterility. Among the congenital causes of sterility is that of rudimentary or undeveloped genital organs. The uterus and ovaries are the most likely to be undeveloped. One frequently finds an uterus in fully developed mares not more than one-tenth normal as to size; sometimes a little larger, yet far below normal. The same is true of the ovaries. Quite often they will be found very small, having the appearance of having suffered from atrophy, but as this condition is sometimes found in young fillies only two or three years of age, one can hardly take that view of it. But after all is said of such conditions, the fact remains that such mares do not breed. Such mares always appear masculine in character, and there is no way of making producers of them.

190. Abscess Formation. Another condition of the ovaries frequently met with, is that of abscess formation or cystic degeneration. This condition always results in a sterile mare. This is more easily diagnosed than that of atrophy or rudimentary ovaries. Since the cystic condition enlarges the ovary to two or three times its normal size, which can easily be determined by way of the rectum. Only a little further back we find another condition, which is frequently the cause of sterility.

191. Tumors in Fallopian Tube. In the middle narrow portion of the fallopian tube a tumorous growth is sometimes found, completely closing the tube. This I believe to be induced by ova of unusual size lodging there, and which the system of the mare was incapable of absorbing. This must necessarily result in sterility.

192. Tumors are frequently found within the uterine cavity. They are of two kinds, fibroid and cancerous. Fertilization will never take place if cancer is present. The fibroid tumors do not always result in sterility. It is only in cases of large tumors that mares fail to breed. These tumors are seldom found in the case of young or virgin mares. They usually begin their growth as a result of laceration, or a portion of the placenta having failed to be expelled.

193. Malposition of the Cervix often prevents the spermatozoa from entering the uterus. The cervix or neck of the uterus will sometimes be found bent upwards or to one side. Then sometimes the muscles whose function it is to contract and dilate the cervix, contract it so tightly that it must be opened by the hand before the spermatozoa can enter. These conditions are barriers to natural service only, as the capsule method of breeding finds no difficulty in impregnating mares of this kind.

194. Acid Secretions. Unnatural secretions, both acid and alkali are a source of much trouble to breeders. The acid conditions are more frequently met with. There are corrections for these conditions, and they will be taken up later.

195. Catarrh. Catharrhal conditions are the cause of more trouble than all other conditions combined. This is the strongest argument that can be made against working brood mares, since this condition is never found in mares that do not work. Mares will be worked in the field or driven upon the road until warm, and then made to stand until chilled, when congestion and a general catarrhal condition follows. A few mares showing this condition will occasionally breed, but only occasionally, while the greater number will not breed at all. This is but an inflammatory condition of the mucous membranes. With such a condition present, the fetus can not become attached to the maternal membrane.

196. Bacteria is another source of trouble in producing sterile conditions. I have often found them in sterile mares that otherwise appeared normal.

197. Incestuous Breeding. Inbreeding as a factor in the cause of sterility is far greater than is generally known. In many of the draft breeds the records have been so kept, and so little importance has been given the value of pedigrees, that violent inbreeding is more generally practised than most breeders know. In the case of imported animals, matings within the same family are frequently made, and yet the certificates do not show them to be of the same family. This in a measure at least is the result of more attention having been given to pedigrees than to the horses brought over by some of our importers. I have several times during the past few years advised breeders to use a stallion of different breed when all other measures had failed to impregnate their mares, and in most cases the first service would result in successful impregnation.

198. Magnetic Temperament. The one cause of barrenness in mares that has been the most overlooked, is that of a proper balance between the positive and negative forces of sex. A very positive mare will hardly ever conceive when mated with a stallion positive and masculine to a high degree. This same mare mated with a passive stallion, may conceive at once. In like manner a very negative and feminine mare rarely conceives when mated with a stallion of the same magnetic temperament, but will conceive at once when mated with a positive stallion. When everything else fails to settle a mare, try a change of semen.

CHAPTER XIV.

THE CARE OF THE FOAL.

199. Nourishing the Fetus. The proper care of the foal should begin with the fetus at conception. No good horse will ever be developed out a poorly nourished fetus. No time in the life of a horse can compare with its fetal existence for the development of vital force. The half starved fetus means a horse with low vitality. If the stallion and mare were of good vitality and in good health at the time of conception, the fetus was ushered into being right. To keep up this fetal vitality, will require plenty of good wholesome and nutritious food for the mare. She should have all she wants of a properly balanced ration, for she must eat and digest for two. I have never seen as good foals produced in the grain belt, as are produced further west. Where mares can have good western bunch grass during the summer and good western grown alfalfa during the winter, one gets the best foals the world ever produced. Here one finds bone and muscle as no where else. If the alfalfa hay is grown without irrigaton, so much the better. Another factor most helpful in this western production of foals is the pure air, water and abundance of sunshine. This should be remembered by those producing foals in the grain belt. Keep the mares summer and winter in the open air as much as possible. The nearer we can follow that western ration the better. Well cured clover hay and oats is as near to it as we will ever get. For draft mares doing no work, two pounds of good clover hay and one-half pound of heavy oats (oats that will test 32 pounds or better) daily, to the hundred pounds of weight will make a good ration. I have had better success with this ration here in the corn belt, than any other I have ever tried, alfalfa excepted. If mares are worked, more oats should be added.

200. Overworking Mares. Working mares too hard while carrying and developing their unborn foals is another way to produce a horse of low vitality. If a mare must work, she should not be hurried. Slow, steady work does not injure a mare, even up to within a few days of her foaling date.

201. Parturition. The three or four days following parturition is a critical time, and a trying one in the life of a foal. A foal starting life in a feeble or abnormal condition can not be expected to develop into a horse of vitality. There are many cases where a little help in regulating the digestion of a foal would have resulted in developing a horse with a more vigorous constitution. As soon as a foal has been ushered into life, every

precaution should be taken to prevent infection. The navel should be disinfected the first thing done. Any of the coal tar preparations may be used in about a five per cent solution. Or a 1-500 of one per cent solution of corrosive sublimate is one of the best. Lysol is an excellent disinfectant, and may be used one teaspoonful to the pint of water. As to the umbilicus, never ligate or tie it in any manner. In doing so one is likely to lay the foundation for a case of pus absorption. Many practitioners advise doing this, but it very often results in serious trouble. If ligated there is bound to become blood, and perhaps urine, form there with no way of getting out, except by absorption.

202. The umbilicus. Under natural conditions, the umbilicus is always torn away at the body. Under conditions of domestication it will do this in at least nine cases out of ten. If it has to be cut, it should be cut about six inches from the body. In doing this should the blood flow in a manner at all alarming, it can be ligated for a time with a cord that has first been well disinfected. In a few hours the cord may be removed, when a thorough emptying and disinfecting of the remaining umbilicus should be made. To give this matter the closest attention may be the means of saving a foal. This is all the more necessary in the early season. Late in the spring and during the summer months there is very little danger of infection.

203. Its Early Nourishment. The proper nourishment of the foal is the next thing to interest the breeder. Whether the foal sucks or has to be fed it should be given the first milk of the mare. The first milk is known as colostrum, and has a purgative effect upon the foal very much needed at this time. If the foal is reasonably strong it will find the teat all right. If it should appear too weak to do this, the mare should be milked and the foal fed while the milk is warm. With one to hold the foal and another to do the feeding this can be accomplished with a dessert spoon better than anything else. One or two feedings will usually result in giving the foal sufficient strength to find its own food.

204. Bowel Trouble. During the first twelve hours of its life it should be known that the foal has voided its urine, and that its bowels are working normally. The bowels are more likely to give the greater trouble. If there is trouble in starting the feces, a little olive oil injected into the rectum will generally start everything moving all right. If this does not bring about the desired results, one should not stop until all the fetal matter has been removed from the bowels. This may take several hours, but there is no need of losing a foal from trouble of this nature. In obstinate cases an ounce of castor oil may be given, and the rectum well irrigated with a warm soap suds, using only pure castile soap for this purpose. The first symptoms of this trouble are the foal standing with its back arched, its tail erect and later its head and ears will begin to droop

205. Dysentery at this time is not unknown although not a very frequent trouble. This is usually brought about by the condition of the mare. She may have been eating food such as moldy hay or grain that caused the trouble. It may be her milk is too rich and the flow too liberal for its delicate digestion. In such cases I have had my best success by milking away much of the mare's milk, and giving the foal every two or three hours a teaspoonful of lime water in a few spoonsfuls of milk. Also reduce the grain ration of the mare for a time. If it does not yield to this, I would suspect infection to be the cause. In such cases a veterinarian should be called, as these cases can best be subdued by a serum treatment, which should not be undertaken by everyone.

206. Light Feeding Best. Feeding the mares sparingly of grain until the foal is eight or ten days old will give the best results. The digestive organs of a new born foal are about as delicate as are those of a new-born babe, and feed forcing should never be attempted during the first few days of its career. When the foal has made a nice start, the feed of the mare may be gradually increased. If good grass can be had at this time, by all means let both mare and foal have it. Good clean oats may be fed a foal when it has reached three or four weeks of age. Only a few at first, and when it has learned to eat and relish them nicely, it may safely have all it wants of them until weaning time, which should take place when the foal is about five months old.

207. Mares Having no Milk. Should the mare have no milk when the foal is born, let it suck just the same. If the mare is sucked regularly every two hours or oftener, in most cases the milk flow will start before the third day has passed. In the meantime the foal should be fed cow's milk. This should be continued until the mare furnishes the foal with all the nourishment it needs. The cow's milk should be prepared with great care lest you lose the foal. Into a pint jar which has previously been sterilized with boiling water pour water to one-eighth full, add one teaspoonful of granulated sugar, and fill with new milk from a fresh cow if possible. This should be fed warm, at the body temperature, and the pint will be a sufficient quantity for one feed, but it should be fed as often as every two hours. It is quite a lot of work to raise a foal in this way, but I have done it, and they made good horses. A nipple over the spout of a teapot is the best thing to use for feeding a hand raised foal.

208. Weaning the Foal. Weaning the foal can be done with no loss of growth. Simply dry the mare up by letting the foal suckle less often all the time. Never milk a mare in weaning a foal. The mare will cease to secrete milk after a time, if the foal be permitted to suck but twice a day for a few days, then once only until the mare is sufficiently dry to have the foal taken away

from her. During the weaning process the foal can be tied up in a stall at the side of the mare at night. By this way of weaning the foal is more contented, and does much better than if taken away from the mare at once. After the weaning process has passed, the foal should never want for either pure water or whole-some food. No grain food alone will equal oats. If timothy or prairie hay is used for roughage, bran can be added to the oats, about half of each by measure. If alfalfa or good clover can be secured the bran will not be needed. The bran made at small country mills is much better than that made at the large com-mercial mills. In the large mills it is poorer because taking everything out but the outer covering of the grain, a... again because they have scouring machinery for scouring the grain which small mills rarely have. In the large mills, everything that can be used for nothing else goes into the bran.

209. An Automatic Feeder is the best way of feeding foals and weanlings. By this means the foals can have grain when-ever they desire it, and yet at the same time they can neither waste nor soil the feed. If the best possible weights are wanted at maturity this is a good way to feed until maturity is reached. It is impossible to grow the big ton horses without plenty of good feed. Another advantage in the automatic feeder is that it compels the foal or horse to eat slowly. This results in a more thorough mastication obviating those forms of indigestion which are caused by too rapid feeding.

210. Exercise is even more important than feeding, if the best quality of horse is desired. There is no way known of developing good bone and muscle and vital organs, except by exercise. The foals should have a large place in which to run and play, and let them run to their heart's desire. I often hear people express themselves in a way to cause me to believe they were afraid the foals would hurt themselves. They will hurt themselves more by being denied this privilege. In the summer time, all colts should be at pasture. Here they can get both exer-cise and the best feed for all growing animals.

There would be few sterile stallions in the country if all stallions were grown from their foalhood up in good pastures. I have never had any trouble of this kind with a stallion I had grown up to maturity myself. I always keep them either in the pasture or in the harness at all times. When they become so old I can no longer turn them in a pasture together, I have several small pastures of two acres each, fenced about nine feet high, in which I can turn stallions of any age. This fence is made by using posts 12 feet long, so set in the ground that nine feet or a little more will remain above ground. For fencing I use woven wire 52 inchs high, and made of very heavy wire. Above this I finish to the top with barbed wire six inches apart. This makes a fence which a horse cannot get his head over, and will stop any stallion. The posts should be set one rod apart.

211. The Feet of the foals and yearlings and two year olds as well, should be kept in the best possible form. This will require trimming occasionally. If a foal is inclined to go over on one side with a foot, trim upon the opposite side only. Never cut away the frog from the foot of a foal or growing horse, and never pare down the heels.

212. Handling the Foal properly during its early life will add much to the value of the future horse. Gain its confidence early, and then never deceive the foal. It delights in being handled and fondled as much as an affectionate child. Its future is at stake, and it should be handled at all times with a view to making it trustworthy at maturity. A foal or horse will do almost anything for sugar, but sugar should be given as a reward for good conduct, rather than a ration. In very large quantities sugar is not good for a growing horse.

CHAPTER XV.

THE BREEDS.

213. History. The history of the several breeds of horses has been written by men well qualified to discuss that subject from every viewpoint. The agricultural and live stock press of the country has at many times reviewed these works, bringing out the more essential features in such a manner that the public generally has a very fair knowledge of this subject. For business reasons the press above referred to has been silent concerning a few of the things, which the breeders of the country have been wanting to know. Because of this delinquency upon the part of our live stock press, I will give a brief description of the chief characteristics of the more important breeds. This will be done only from the viewpoint of the breeder. No attempt will be made to write or regard it in any manner as a history. To do this in a manner worthy of the subject, would require the space of a large volume. Only the briefest mention of the breeds from the viewpoint of today will be made.

214. Classes. The first division of the horses into breeds or classes, is into the draft horse and those to do the lighter and more speedy work of man. Into the horse of great motive power, and those of greater action. Of the former class we now have five breeds, Belgian, Clydesdale, Percheron, Shire, and Suffolk. For the purpose of this chapter the latter class can be subdivided into four sub-classes, the heavy harness or park horse, furnished by the Hackney and Coach breeds; the light harness horse of which the Standard and modern Morgan are best representatives; the five-gaited saddle horse and the Thoroughbred or running horse. The latter is the basis of all good blood in all the light classes.

215. Where Draft Horses are Grown. To speak intelligently, or to have a correct understanding of the merits of a breed of horses one must know something of the country in which they were grown. We should also know something of the people originating them. A horse that would be a good one in one part of the world might possess but little value in any other location. The conditions of soil, water and climate are mighty factors in the making of any breed of horses or even man himself. Few people have ever given this thought the attention it merits. Those who are trying to grow large draft horses upon their impoverished soils are doomed to disappointment. All the famous draft horses have had their origin upon the best of soils, soils rich in lime, potash and phosphorus; that is on soils rich in bone

material. One finds them growing on rich land always, and that the size of the breed is determined by the capacity of the soil to grow an abundance of rich nutritious food. Small horses can be grown almost anywhere, but the big drafter requires big feed,

Figure 52.—In Imported three-year-old Belgian Stallion.

and this in turn rich soils to grow it. The future may modify this somewhat by taking the feed grown upon rich soil in one locality, and shipping to localities of less feed and thinner soils. The future home of the big horse will not be one of altitude, but wholly one capable of producing the feed. Another factor entering into the discussion of breeds, is that of differing opinions

as to correct standards. Scarcely any two peoples, or even men, can be found agreeing upon a common standard. Even judges differ, and when they differ there is mighty little chance for ordinary breeders to agree. Men also have different motives for doing things, money having a greater influence upon the people of some nations than it has upon the acts of others.

216. The Belgian. The breeders of the very small territory making up the monarchy of Belgium have been peculiarly situated for the growing of big horses, and yet they have succeeded in growing a horse capable of carrying more weight than any horse in the world. Because of their small and cramped situation

Figure 53.—The imported Belgian stallion, Robt. H. De Rum 3595 (46686). This stallion is one of the best of the breed and a well known show stallion.

everything has been sacrificed to the moving of heavy loads at a minimum of cost. In muscular development he excels over all breeds. His compact form, with low flank line and great depth of body are evidence of his being a good feeder and easy keeper. His constitution and digestion are good. Because of this, coupled with his great capacity for carrying his feed, makes him one of the very best shippers. He also adapts himself easily to change of climate. In fecundity and longevity the Belgians are about the average of the draft breeds.

In the early development of the breed but little attention was given to either conformation or soundness. Because of this early neglect, he is not yet as prepotent in the reproduction of the most desirable types as some of the other breeds. Although much improvement is noticed of late, he is still too short and straight in the pastern, and also too full in the hock. Many specimens are rather short in the neck, low in the back and short in the croup. Much has been said by his admirers in favor of his intelligence and docility, but I have found him neither as good in disposition nor as intelligent as some of the other breeds. His brain capacity is very small. This is indicated by the shortness of head from eye to ear. The Belgian is found in all the colors, bay, roan, and chestnut being the colors most frequently seen.

217. The Relative Soundness of Breeds. The following circular will explain itself. I believe it to be the first attempt ever made by anyone to collect data to aid in adopting a standard for draft horses from the utility point of view. At the same time it shows the tendency of breeds to become unsound in certain directions, when put to hard work upon the streets of our cities.

"Knowing your business calls for he use of a large number of horses, I feel you should be no less interested than the breeder in the best it is possible to produce. The fact has probably been forced upon you before now, that some horses have as much service in them as two or three others apparently as good. As an aid in producing better horses, will you kindly fill out and return to me the blank form below.

"How many horses have you in service at this time?

"From the standpoint of dominant blood, to what breeds do they belong? Give number of each.

"How many are unsound in front with side-bone, ring bone, navicular lameness, shoulder or foot trouble?

"In each case of unsoundness or lameness in front, give description of pasterns, as to length and angle.

"How many are unsound behind, with hock, fetlock or pastern lameness?

"Are any unsound or lame from hip trouble?

"In each case give the particular trouble and the breed to which the horse belongs."

The above circular has for many years been mailed to those firms using large numbers of horses, ranging in size from 1,400 to 2,000 pounds. These firms were located all the way from Bangor, Maine, on the east, to Portland, Oregon, on the west. In all an ownership of 101,839 horses have been reported. This includes some Canadian owned horses. The following table shows how the breeds stand as to soundness:

Breed—	No. Horses Reported	No. Becoming Unsound	Per Cent of Unsound
Belgian	1499	511	34
Clydesdale	21382	2992	14
Percheron	59160	26028	44
Shire	19798	3371	17
Totals	101839	32902	32

In some instances horses were reported as Normans or French draft. These are included in the Percheron list. Of the 101,839 horses reported, 32,902 were reported as unsound. This makes a very bad showing, and emphasizes the need of better standards and better sires. The Belgians were reported in smaller numbers than any other breed. This in part due to many grade Belgians

Figure 34. A pair of three-year-old Belgian mares, possessing size and quality in a high degree. The roan is Duivelinne 837 (61331), and the sorrel Bon Marche 1111 (66719).

passing as grade Percherons. A little less than one-third, 32 per cent, were reported as unsound. I found it a rule in most barns to report as unsound only those incapacitated for full work. The showing made in this table is all the worse, when it is remembered that these horses were purchased sound. The Belgians were unsound chiefly, because of defective hocks and pasterns.

218. The Clydesdale. In Scotland we find the home of the Clydesdale. In his early history he was very much like the Shire, both having a common origin. In the production of the modern Clydesdale, more science has been employed than in the production of any other draft horse. To such an extent is this true, that scientifically speaking, he is the world's best product in draft horses. When viewed from the standpoint of a perfectly and scientifically constructed machine, built to perform its work with the greatest ease and least friction, he has no equal. His sloping shoulder and elastic pastern, his short back but long underline, and his well nigh perfect hock, cause him to do his work with so little friction and concussion resulting, that his legs seldom go wrong. The world's best breeders, regardless of their favorite breed, concede to the Clydesdale the most perfect action at the walk. I have seen in the large cities of Scotland, geldings still fresh in their legs after working for ten or more years upon the streets.

The sloping pastern is occasionally being overdone, and to improve the quality, some of the ruggedness of the early Clydesdales is being lost. With all his good qualities; with his nearly perfect conformation, he is not generally popular in this country, and will not be unless the Scotch breeder will make a few concessions to win the trade of the breeders of the United States. I say concessions, for they are such when viewed from the angle of the Scotchman.

The Clydesdale is too nervous, too unbalanced in the head to please most Americans. He is also cut up in the flank to such an extent that he is usually a poor feeder. Then his color is much against him in this country. The people of the middle and western states do not take kindly to any but a whole colored horse. Horses with white legs and faces, and occasionally white spots on the body can not be made popular in this country, but when all is said there is more promise for the Clydesdale of the future, than has been known in the past. The Clydesdale breeding associations, both in this country and in Scotland, have much to be hoped for. There is no suspicion of wrong doing by the associations or any member thereof, and there is a visible effort on the part of all interested to keep the Clydesdale up to a high standard of excellence. The geldings of this breed are becoming more popular evry year, and they justly merit this popularity, for their wearing qualities are of the best. In size they are smaller than the Shire, and larger than the average of Percherons. They have plenty of bone of good quality, with their legs well set under them. In fecundity they are about the average of the other draft breeds.

219. The Percheron. The Percheron is found in all the colors known to draft horses, black and grey predominating. He is found in this country in larger numbers than all other draft breeds combined, quite conclusive evidence of his popularity.

In intelligence the Percheron has no equal among draft horses. He has also an abundance of nervous energy, making him an agreeable horse to work and handle. This has been the chief factor in gaining for him his great popularity in this country. The American has little time to waste upon dull or stupid horses, and he likes a horse capable of making the round trip in a day. In motion the Percheron appears best at a trot, some individuals of the breed showing considerable speed for horses so large. He is often found too short in the pastern and too straight in the shoulder to appear well at the walk, and some have a way of going too wide behind to move with greatest ease and without friction. They are about the average of the other breeds in fecundity, and perhaps slightly longer lived than some others. Their smooth legs are generally found free of those sores such

Figure 55.—The Clydesdale stallion Prince Goodwin, No. 8931. A grand type of this famous breed.

as trouble those breeds with more hairy legs. More fancy geldings have been found with Percheron blood dominant than of any other. This is especially true when there is a dash of British blood present to increase the bone.

220. Percheron Defects. The worst defect of the Percheron as a true drafter is found in the large number of small individuals, and the tendency to small bone. This is even noticeable in many of the prize winning families. The want of more bone causes many of them to quickly become unsound in their hocks and fetlocks when made to do hard work. The table in this chap-

ter upon that subject makes a sorry showing for the Percheron. Although many of them were yet young, out of 59,160 Percheron work horses, 44 per cent. were already unsound. It is impossible to build a horse of 1,800 pounds upon legs intended for a horse to weigh only 1,200 pounds. Upon this point the breeders of Percherons in this country have need to take notice, lest they be compelled to go outside the breed in the near future for new blood with which to build up a breed of real draft horses.

221. Percheron Politics. This condition of affairs has been brought about by what might well be called the politics of the Percheron industry. In founding the Percheron stud book of France (the work of Americans) the only horse of draft size and conformation in that country (the present Boulanais) was denied the privilege of that register. Besides the few in control of the registers in this country have influenced the industry and all the horse shows of any considerable importance to such an extent, that little horses with small bone yet flashy appearance have been placed above many individuals of real merit. It is no pleasant task to be compelled to record such matters, but when dealers and importers will price blue ribbon winners $500 below their other horses shown in the same class but winning no place, it is quite time for the true breeder to begin to do a little thinking upon his own account. I have spent much time in tracing high class geldings back from the market where they would sell from $350 to $500 each, to the place where they had been sired by stallions unknown beyond their immediate locality, but always stallions of great draft merit. One of the conditions which ought to cause our judges of draft horses to do a little careful observing and thinking is, nowhere in this country can any of the best known show stallions of the Percheron breed be found producers of high class ton geldings. The echo for more and more high class geldings of a ton to 2,200 pounds weight is heard rolling over the continent from Boston to San Francisco. One may attend sale after sale and the Percheron mares offered will for the most part run from 1,500 to 1,700 pounds, and with scarcely enough bone for that weight. The importer is flooding the country with a small light boned stallion, with not enough size in some instances to draw an express wagon. With such a condition confronting us, where are these ton geldings to come from? There is but one answer, from the other breeds. The Percheron importer has never shown any interest in the American breeder, further than to relieve him of his surplus cash. He has yet to show any civic pride in the way of bettering, either the Percheron industry or the general welfare of his country. His supreme effort in gaining and keeping control of the industry, coupled with his remarkable greed for money, will yet be the means of putting the Percheron horse out of commission. When viewed from the standpoint of the drafter, little if any improvement has been made during the past twenty-five years. A larger

per cent. of good draft specimens were found among the early importations of the breed into this country than are found among those coming now.

222. Graft. Another force which is working much injury to the Percheron industry in this country, is that of dishonesty and graft. Go where one may throughout the breeding districts of this country, and he will hear the same mutterings, the same expressions of a desire to have a change for the better. All this noise and smoke is not for nothing. It means more than most of us are willing to admit. Nor is all this dishonesty upon this side of the Atlantic. Nowhere in all the world can dealers in breeding horses be found with a more undeveloped sense of honesty than in France. With a large majority of these French dealers, a certificate of breeding means nothing but a convenience in making a sale. To them a pedigree is but a joke. Over there certificates of breeding are things to be juggled with, to please men's fancies. Nivernais stallions are sent to this country with Percheron certificates. The certificate of one horse is sent with another. One of the prize winning mares at the 1909 shows has been sold to two Americans, but the mare is still in France. Another winning third place at one of the leading shows of France has been sold to four Americans, and still the mare remains in France. At least her certificate was in the hands of her original owner on March 1, 1910. This would be regarded as pretty good evidence that the mare was not far away. When all these things are known, it is enough to force a smile from an intelligent man, when he hears people talking about the breeding of an imported Percheron.

These things are not written to help some other breed, for it is well to know that the writer is breeding Percherons only. Nor is it written to injure any one or any industry. I am many times each month asked concerning these things, besides receiving letters from all parts of the country every week containing questions upon this subject. I take it that the people have a right to know the truth. At considerable expense to myself I have gathered much evidence of value to the breeders of this great breed, only a hint as it were, being given in this chapter. When all has been said the same forces will be found at work in France, that one finds here. It is the dealer in both countries, rather than the breeder, that is doing this irregular work. There are few breeding establishments in France presided over by men of the strictest integrity. There are thousands of breeders in the United States, than whom no men living possess a higher or truer sense of honor and it is to these rather than the dealer that the future of every breeding industry in this country must be entrusted.

223. The Shire. In size and bone, actual measurement, the Shire is the largest of all breeds. He has done more than any

horse or breed of horses in this country in the production of rugged horses with plenty of bone. Many of the high priced geldings produced in this country, although accredited to some of the other breeds, owe their great size and abundance of bone to the blood of this breed. When mated with small mares, especially mares of very small bone, he will produce a larger, more rugged foal than any other sire. However, his bone is slightly coarser, and he has more hair upon his legs than any other breed, an objection from the viewpoint of this country which cannot be overcome. His disposition is good, yet somewhat headstrong or self-willed. In the language of the Englishman, "He has a good deal of powder in his eye." His walk is excellent, both as to speed and the way of going. As a work horse he is among the

Figure 50.—The Percheron stallion Perfection, No. 54441. This stallion is a three-year-old, and there are few his equal in any country.

best always giving evidence of his great power when put to the test.

The Shire does not endure long shipping as well as some breeds, and rarely does as well in this country the first year after his arrival from his native land as in the years to follow. The Shire is not as fecund as the other breeds. This I regard as the fault of the English breeder, rather than of the breed itself. The Englishman does not take kindly to masculinity in a stallion. This has caused him to select the more feminine type of Shires for his breeding stallions. Continuing this practice for many generations has resulted in fixing a type of stallions very deficient in masculinity. He is also deficient in muscle at the fore arm, gaskin, and upon the shoulder. The Shire stallion has not

been worked in his native land for many generations, and he is becoming more deficient in muscle every generation. The American bred Shire is a better horse in respect of this, as he is given more pasture to grow in, besides being worked more here than in England. The Shire bred in this country has much less hair upon the legs than those imported. This is especially true of those bred in the west at high altitudes. I know of one herd in Wyoming, all of their ancestors being English bred, yet these horses are quite free of hair the second generation from imported stock. At the same time they have increased in size and muscular development. The color of the Shir does not differ from that of the Clydesdale, bay or brown, badly marked with white being the colors most frequently seen.

Figure 58.—A two-year-old Shire colt. Note the size and quality of hock and hind leg. Such legs can not be made to go wrong.

224. The Suffolk. This breed is found in this country in smaller numbers than any other. His native land is Eastern England. His color is always a shade of chestnut and in transmitting his color he is very prepotent. In longevity they have no equal, and in fecundity they excell over all the breeds. I have seen mares of this breed in England that were regular breeders, when well up in the twenties. I notice the same is true of them in this country. I doubt if a mare of this breed ever reaches an age when she is not a regular breeder. I have never known a stallion of this breed being sterile in the least degree. The Suffolk is the most docile of all the breeds, yet not as intelligent as he might be. A tendency to wildness or nervousness is never observed within the breed. In quality of bone they are slightly better than the other draft breeds. In conformation they have the straightest croup and best top line of all the draft breeds. They are good feeders, with a deep body, and endure shipping

and hard work, the equal of any horse in the world. A tendency to thickness or fullness of the hock is noticeable in some of them. He has the least hair upon the legs of any draft horse known, differing from the other British breeds in this respect. Many individuals of this breed are below the size now wanted for draft purposes. This is their worst defect as a true drafter.

Figure 57.—An imported four-year-old Shire stallion.

225. A Comparative Test of Bone of the five breeds of draft horses, in comparison with the bone of a thoroughbred stallion, one that had made good both upon the race track and in the stud, makes an interesting study. The bone of this stallion in fineness of texture would compare favorably with ivory. Excepting one mare in the Suffolk class, the tests were made with the bones of stallions, and all were imported. The bone of the mare did not differ from that of the stallion of her breed. Only two animals were used in the Suffolk class while many were used in all the

others, the averages being used in this table. The same sized horses were used, all weighing close to the ton mark, excepting the Suffolks, which were slightly smaller. I found the same ratio

Figure 59.—A group of Shire mares. No. 1 is Stow Silver Streak, winning first as a three-year-old at the International, Chicago. No. 2 is Wrydeland's Sunshine, Champion mare at the International, 1909. No. 3 is Enfield Fuchsia, champion mare at the International, 1904. No. 4 is Wrydeland's Starlight, champion at the International, 1908. A group of mares showing more draft quality could not be found.

existed in all the breeds between the pressure and gravity tests, so only comparative weights will be used here, that of the thoroughbred being given as one hundred, the basis of the test.

A cubic inch of bone from the Belgians weighed 62.6 per cent. as much as that of the Thoroughbred. The Clydesdales 61.2; the Percherons 63.3; the Shire 57.9 and the Suffolks 68.7. The

above table teaches us that in the quality of bone, but little difference is found between Belgian, Clydesdale and Percheron, while the Shire is some below and the Suffolk considerably above. The Suffolks had a slight advantage in the test, in being slightly smaller than the others.

Figure 60.—An imported French Coach stallion.

226. The Distinguishing Marks or Traits of the several draft breeds is of interest to many. The greatest interest is shown in being able to always classify Belgians, Percherons and the two most numerous British breeds, Clydesdale and Shires. While the Belgians have a few minor characteristics not usually found in the other breeds, the thing by which he can always be known is

the head. No other breed ever has a Belgian head. The shortness of head and ear, the latter coming out of the side of the head, the shortness of space from eye to ear and want of fullness at this point, are all marks belonging to the Belgian only. If one

FIGURE 61.—The Hackney mare, Queen of Diamonds. One of the best Hackney mares in the United States today, having won honors at all the leading horse shows of the country. Note the extreme beauty and symmetry of this mare in all her parts

will take a good look at figures 52 and 53, he will see nothing if not Belgian character.

The Percheron has much about him that cannot be found in any other breed. In the first place he has a head that can not be found in any other draft breed. In the width between the eyes, and the distance from eye to ear one finds something truly remarkable. The space between the eyes and ears of the Per-

cheron is always full and prominent. In other words, he has a larger brain space or cavity than any other. The crest of the Percheron is unlike that of any other breed in being better defined and more masculine. In the muscular development of

Figure 62.—The Standard bred stallion, Pat Bourbon, No. 41157. This stallion is an excellent type of the light harness horse.

shoulder, fore arm and gaskin, the Percheron is found at the other extreme, when compared with the Shire. The Percheron is always muscular, while the Shire is deficient in muscle. In his nervous energy and the way of going, the Percheron shows more blood than any other draft horse. The hair upon the legs will be discussed later.

The Shire and Clydesdale will for the purpose of this dsecription be regarded as one breed. So far as breed character goes, th Shire is almost the opposite of the Percheron, and this subject is now being discussed with reference to stallions only. The

Figure 63.—The Standard bred stallion, Malaver, No. 31799. This stallion is pure gaited, and a good actor. He is the sire of many high class actors and all of his get are pure gaited like himself.

Shire has little or no crest, many of the stallions having every appearance of a gelding, and that muscular development of shoulder, fore arm and gaskin already referred to is wanting. Herein lies the distinguishing difference between the Percheron and Shire. We are now assuming the color to be the same, for one can find bays with strip and four white pasterns in France.

Regarding the hair upon the legs, it is not always safe to assume that every horse with hairy legs is of Shire origin. Many Percherons of the old Boulanais type wear as much hair upon the legs as many individuals in the Shire breed. As a rule the Per-

Figure 64.—The Morgan stallion "The Admiral". No. 4871. A horse of great beauty.

cheron is quite free from long hair upon the legs, while the Shires are famous for this one thing. For all this, some of the best Percheron stallions ever brought to this country from France were as hairy at the legs as many Shires, and it is a well established fact that the best and heaviest geldings ever sired by Percheron stallions, were sired by these great big Percherons with

much long hair upon the legs. Upon the other hand there are quite a few Shires coming to this country from England with very little hair upon the legs. This is not the type popular in England, yet they are there just the same. I emphasize this point, only because there are a few misinformed men who believe

Figure 65. The five gaited saddle stallion, Pea Fowl, No. 2768.

all Percherons have the legs of a Thoroughbred, while all horses wearing long hair at the legs must be of British origin. When we speak of draft horses, the best Percheron breeding establishments upon this continent will invariably be found with horses wearing long hair at the legs, and the more hair one finds there, the more bone, the more substance and the more size will he also find in the horses there. So far as hair upon the legs is con-

cerned, one should look a little higher up. If the fore arm and gaskin is deficient in muscle, I would feel safe in classing the horse as a Shire. However long the hair might be, if the stallion has a well defined crest, coupled with a good muscular development and the other Percheron characteristics, I would not hesitate to class him with that breed. There are others who are inclined to classify every horse with an arched nose, or great fullness below the eyes, with the British breeds. Again many Percherons are found with similar heads, and again one usually finds them among the stallions producing large horses. Such a head, when narrow between the eyes is more likely to be a Shire, but when wide between the eyes it is more likely to be a Percheron. My own observations extending over many years make it possible for me to sum up the whole matter in one sentence. The more a Percheron resembles a Shire, the more certain he will be of siring ton geldings.

227. The Heavy Harness or Park Horse. This class is made up or filled so far as market requirements are concerned by the Hackney more than by all other breeds together. The Hackney is a native of England, and possesses more blood than any other horse in Europe used for harness purposes. The conformation of the Hackney is more nearly correct for high action than that of any other horse. The well nigh perfect flexing of keen and hock of the best actors within this breed is a beautiful sight, yet he is nothing if not a rich man's horse. Bay, brown, chestnut and black are the principal colors of this breed.

The coach breeds, so-called, both French and German, are sometimes bred in this country for the purpose of supplying the demand for heavy harness horses. Few can show the action required for this purpose. These breeds were produced to be used for military purposes in their native countries, and have been introduced into this country as the result of the American commercial spirit. I have spent both time and money investigating this subject but have yet to learn of a district in the United States that has been benefitted by the Coach horse of either country. The French Coach carries the more blood, and is the more uniform breeder. Most of the get of Coach stallions reach the markets of the country as some kind of misfit, without the size and weight to perform the heavy work of the country, and with insufficient action for high class heavy harness horses.

228. The Light Harness Horse. This class comes principally from the Standard bred trotter, a breed of American origin. This horse is too well known to need more than a mention. Some excellent specimens are to be found within this breed for light harness driving, being both intelligent and speedy. It is the larger specimens of the breed that are used for this purpose.

Recently the federal government has shown an interest in the light horse industry, and are aiding by a breeding experi-

ment, blending the blood of the nearly extinct Morgan family with that of the better types of Standard blood.

229. The Five Gaited Horse. This horse is a product of the rough part of the Southern states where the saddle horse was a neeessity, and much intelligence has been used in his development. He is the result of crossing Standard bred pacing mares with Thoroughbred Stallions, and demonstrates what can be done by cross breeding when intelligently done. He is strictly an American product and he has come to stay. For the breeder who has a fancy for a warm bred horse, and is capable of developing him to the highest limit, the Five Gaited horse offers a lucra-

Figure 66.—A pair of "Shelties".

tive field. He will always be in demand in our own large cities, as well as in his native southland.

230. The Thoroughbred. This horse, the original of all blood and speed needs no mention in this work. His part in the world's work has been recorded in its poetry, its fiction, as well as in its history.

231. The Shetland Pony. This is a member of the equine family worthy of brief mention, as few are more profitable to breed than the Shetland. The demand is now greater than the supply. The cost of produeing a Shetland pony is but little more than for a large sheep. Well broken, he sells readily for $100 to $200 in all the large cities of this country. He is a native of Shetland Islands, to the north of Scotland. In earlier times he

was used principally in the coal mines and to some extent by fishermen along the coast. His food was always of the poorest and scantiest supply. The climate was of the fiercest for either man or beast, being both cold and wet. He has survived these things and will live under every known condition of climate or food. In this country he meets a new condition, both as to his needs and his work. In a country where food is plenty he is always fat, while his only work in this country has been the companionship of children.

Some trouble has been experienced in this country in breeding them. This is wholly the result of too much feed. They soon become too fat to breed well, unless used more than is usually the practice. Most of the Shetlands brought to this country are bred in the north of Scotland.

CHAPTER XVI.

JACKS AND JENNETS.

232. The Industry. The mule breeding industry of the United States has grown to be a very important business, in many parts of the country. This has made the breeding of good jacks a very lucrative industry. For the truly good ones, the demand is larger than the supply. The best mules produced in this country are sired by Mammoth jacks, a breed of American origin. While all the blood lines of the Mammoth jacks and jennets can be traced back to a European source, yet in their present state of perfection, they are strictly the product of American skill and intelligence.

233. Royal Mammoth. The Mammoth jack is the result of the blending of the blood of jacks from Malta, Catalonia and Majorca. The name is borrowed from imported Royal Mammoth, a jack regarded by the best breeders of this country, to be the best specimen ever brought here from Europe.

A continuous effort has been made, and a fairly united one, by all the breeders in fixing the color to black, with light shading around the nose and upon the under side of the body. At the present time only occasionally does one revert back to blue or other off color.

In figure 67 can be seen a group of jennets and their jack colts owned by W. H. Brown, of Calumet Valley Stock Farm, Clarksville, Mo. The one marked No. 1, is Queen of Scots, No. 529. She won first in yearling class at St. Louis Exposition in 1904. Also sweepstakes as best jennet any age at Missouri State Fair in 1909. Fannie Pitman No. 391, is marked with a 2. Mohawk Queen, No. 525, is marked with a 3.

Figure 68 is that of the four-year-old Mammoth jack, Eagle, No. 3797, one of the truly good jacks of the country. This jack is owned by W. C. Martin, Pleasant Hill, Mo. Note the extreme vitality of this jack, as indicated by the large heart girth, as well as thickness of the shoulders.

234. Hinnies. Crossing the jennet with a stallion, produces a hinny. This cross is now a common one in many parts of the southwestern states. The hinny is so like the mule, that only a few men can tell the one from another. They are usually small, being used in the coal mines and for light delivery work.

The demand for mules combining size and constitution is a growing one. Formerly the so-called quality mule was the one in greatest demand. This mule was rather tall for its size, with considerable energy and action, but rather deficient in constitu-

tion. It was the produce of a mare possessing much warm blood. At the present time quality means size, plenty of bone, large heart girth, with every evidence of good constitution, more than at any

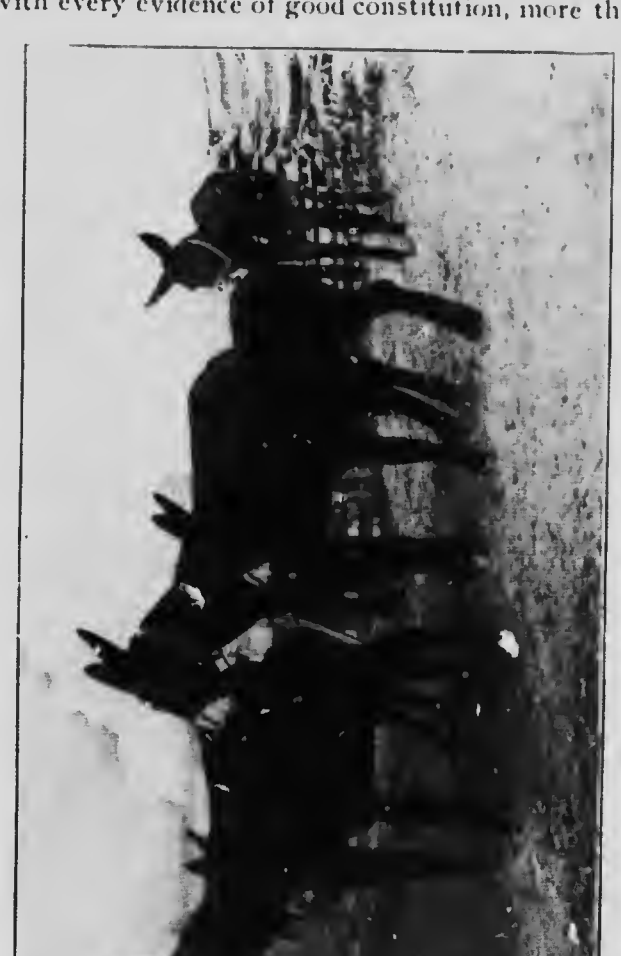


Figure 67.—A group of jennets and their jack colts.

time in the past. Such a mule can be produced, only by the use of some draft blood in the mare.

235. Where Mules are Bred. While the breeding and growing of mules is now carried on quite extensively in several of the central western states, yet it is done in rather a small way so far as each farm is concerned. In this respect it does not differ from horse breeding in the same states and districts. Only

in the southwest and parts of the west are mules bred upon an extensive scale. In some parts of the southwest there are ranches where 200 to 300 mules are foaled every year. There is one ranch in Texas upon which 1,100 mares were bred to jacks during the season of 1910. The capsule method of breeding is practiced upon this ranch, and the 1,100 mares were served with four jacks.

Figure 68.—The mammoth jack, Eagle, No. 3797.

236. Breeding for Jacks. There are several states in which the production for jacks for breeding purposes is an industry of considerable importance. However, the breeding of jacks has its difficulties and troubles as do other lines of breeding. One of these is a tendency of jennets to be wanting in fecundity even

more than mares. The trouble experienced by many jack breeders in this particular is considerable. During the heat period the temperature of the jennet is more likely than not to be too high. This is now being overcome by breeding the jennet by a capsule service just as the heat period has passed.

237. Jack Foals. Another drawback to the breeding of jacks is the death rate among the foals. A jack foal is not as easily reared as a horse foal. Pneumonia carries away many of them in the early season, and indigestion, rectal hernia and hemorrhoids take away many others.

CHAPTER XVII

CROSS BREEDING.

238. General Principles. During the past two years as many inquiries have reached me upon the subject of cross breeding as any other. Some are not very explicit as to what they wish to know, but I take it that most of them are interested in crossing very small mares with large stallions. The concensus of opinion is adverse to this, but it is either based upon a want of experience, or else the experience was with coarse, unbalanced stallions wanting in quality. I mated a large number of small mares, weighing from 800 to 900 pounds for five consecutive seasons, with an imported Percheron stallion weighing from 1950 to 2100 pounds, according to conditions of flesh. The result was a uniform lot of well balanced foals, maturing into marketable horses with an average weight of 1350 pounds. There was not a badly proportioned horse in the lot. This stallion was evenly balanced and well proportioned, possessing quality in a high degree. The breeding was all done by the use of capsules.

239. Mating Ponies with Stallions. For the sake of the experiment I have mated Indian pony mares weighing only 535 and 545 pounds with the stallion above referred to, and the resulting foals were good. They developed into 1100 pound horses, well balanced and well proportioned

49. Mating Small Mares with a Belgian Stallion. In the extreme western part of Nebraska there is one ranch where a large number of 900 pound mares have been mated for five years with an imported Belgian stallion, weighing around 2200 pounds, the capsule system being employed in making the service. This spring two car loads of these horses (four years old) were shipped to Pennsylvania and sold at an average of $212.50 each. The average weight of these four year old colts when loaded was 1430 pounds each, and every one a good one, well balanced and well proportioned.

241. Coarse Unbalanced Stallions do not Mate well with any Mare. A score of such crosses which have proved successful when quality stallions are used, can be named for every one that has been a failure. It can be readily understood that a stallion wanting in quality, coarse and unbalanced would not cross well with any mare however large she may be. Even when such stallions are mated with large mares, if observed critically, the foals will be found wanting in quality and balance, quite as much as those out of the small mares.

242. The Breeds Differ in Regard to such Crosses. As regards the crossing of small mares with large stallions, it makes some difference about the breed to which the stallion belongs. The British breeds do not give as good results in violent crossing, as do the Belgian and Percheron stallions. I have frequently seen horses with large heads and legs, but bodies small, resulting from mating very small mares with stallions of British breeding.

243. Crossing the Breeds or mixing the blood of pure bred horses is quite another thing, and should never be undertaken by any one but the most intelligent breeders. That this can be done advantageously, we already have proof. In crossing blood it matters not so much about the breeds as it does the types. Mating animals of two breeds, but of the same general type, will give better results than mating two animals of the same breed, but of widely different types. To put it in another way, mating two animals of two draft breeds will give better results than mating two animals, one a drafter, the other belonging to the harness breeds.

244. The Saddle Horse is an illustration of this thought. It was produced by mating Standard mares with pacing gait, with Thoroughbred stallions. To begin with, these breeds were of similar type, and the cross resulted in a most pronounced improvement, for the purpose for which the cross bred product was intended. The gaits have been secured from the original mares from which the breed originated, while the symmetry, style of carriage and intelligence have been transmitted from the Thoroughbred.

245. Recrossing Breeds. The stallion shown in figure 70, is the result of a breeding experiment with draft blood. This experiment began with a grey imported Shire mare. She was mated with a black imported Belgian stallion, resulting in a grey filly. When this filly was old enough she was mated with a grey imported Percheron stallion, resulting in the stallion shown in figure 70. It is claimed by most writers that sires produced by cross breeding will not prove prepotent breeders; that their foals will not be uniform as regards any quality, color, size or form. The stallion above referred to is owned by a colony of Russians in South Dakota, and enjoys the distinction of having produced more geldings selling for three hundred dollars or more, than any stallion ever owned in that state. His get are remarkable for their uniformity of size, combined with quality, and 85 per cent of them are grey. The number of ton geldings sired by him, and out of mares weighing only 1500 to 1600 pounds, is simply remarkable.

Here we have a re-cross bred stallion, that is one the result of twice crossing, and possessing the blood of three draft breeds. The individuals composing his immediate ancestry were quite uniform, although belonging to three breeds. A wider difference

in type could be found within any one of the three breeds, which again calls out the statement, that it is not so much a matter of breed, as it is of type.

246. The Percheron and Shire Cross. We have another illustration in the result of crossing breeds, in a stallion owned for

Figure 70.—A re-cross bred stallion and possessing the blood of the Belgian, Percheron and Shire breeds.

eleven years at Randolph, Nebraska. This stallion was out of an imported Percheron mare, and sired by an imported Shire stallion, both dam and sire being good individuals, possessing great size and the best draft conformation. The dam of this stallion was a dark grey in color, while the sire was a blue roan. More than 90 per cent of the get of this horse were blue roan

or grey, and this one stallion made Randolph the first primary market in the United States, in the production of high class geldings sired by this stallion mature to 2200 pounds, and have sold in the open markets of this country up to five hundred dollars each.

247. The Mares of this Cross are also Producers of High Class Foals. Nor has the good done the horse breeding industry at Randolph, by this stallion, ended in the production of these high class geldings. His mares are proving the best producers of geldings ever owned in that district. It is a fact admitted by all breeders of pure bred draft horses, that no pure bred mares can be found in that district, which can equal as producers of quality, these grade mares sired by that cross bred stallion.

248. Adhering to Type. These things are not written to encourage any one to embark in cross breeding horses, for not one in a thousand would succeed if they undertook it. When we remember that all draft bred horses have a common origin, it is not very violent crossing when we cross any or all of them. The thing to guard against is in crossing types. It is because of this that so few succeed in breeding pure bred horses. Only a few men seem to understand that by using a stallion of one type for one cross, then one of distinctly another type for the succeeding cross, must necessarily result in failure, and this is what most of our breeders are doing. To succeed in breeding, one must have a standard or type in mind, and then breed to it. It will not matter so much about anything else, if the standard or type is strictly adhered to.

249. Violent Crossing has Proved a Failure. In crossing types I have never known of any good resulting, when carried beyond the first cross. In Missouri I know of several stallions standing for service, the stallions being the result of crossing pure bred draft stallions upon Standard mares. The get of such cross bred stallions have very little value, seldom two being alike in any respect. It is such violent crossing that has given cross breeding its bad reputation.

250. Mendel's Law of Heredity is the best test of the good or ill effects of cross breeding. When the ancestry of two animals is known, their produce can be foretold by this law, to nearly a mathematical certainty. One could take a grey mare of one breed, whose type or conformation throughout all her past ancestry was the same as that of a grey stallion of another breed, and their produce would be just as certain to possess the grey color and conformation of the original pair, as if that pair had been of one breed. This one sentence covers the entire field of cross breeding.

CHAPTER XVIII.

THE PHRENOLOGY OF THE HORSE.

251. Brain and Nerve Stimulation. To speak of the phrenology or mentality of the horse to some men is but to provoke a smile, yet these same men when questioned are willing to admit that value in a horse represents something more than bone and muscle. Bone and muscle would be of little value, if there was no stimulation for the action of these parts. This stimulation is but the function of the brain, and is carried to every part and every muscle of the body, by means of the spinal cord and its many branches.

252. Nervous Energy. The amount of nervous energy a horse possesses, will determine the ease with which he performs his work.

It will be noticed by any one at all observing, that no two horses perform their work with the same degree of exhaustion resulting. Some appear to do their work with a freedom and willingness unknown to others, and yet show no signs of exhaustion; while others must be urged in order to get them to do their work, and yet they always appear to be exhausted. This is wholly a condition of the nervous organization of the horse. Then again, some horses perform any task given them in an agreeable frame of mind, while others will do nothing except under protest. The one is a willing helper, the other surly and obstinate. In this particular they do not differ from the human subject.

253. Comparative Anatomy of Brain. A study of the comparative anatomy of the brain, discloses the fact that in all the faculties of the base of the brain, there is little difference between man and many animals. Animals must eat as well as man, hence we find the faculty of appetite developed in both. Both must defend and protect themselves from all forms of injury and we find the faculties of combativeness, destruction and secretion common to both. The desire to mate, and the love of young are common to both man and the horse and we find these faculties developed in both. The organs of form and locality are needed by the horse as well as man, and we find these faculties developed in a high degree. The horse must have the organ of form, to aid him in seeing in the night, as well as to be able to see and distinguish between forms seen at any time. The organ of locality is just as necessary to him, that he may know and remember locations and directions. A horse never forgets a place he has once been to, and most horses if taken away from home for a

long distance and circuitous windings will return by the shortest route, if given their liberty. I know of a Pawnee pony mare that was ridden from eastern Nebraska, southeasterly into and through Missouri, then in a northerly direction to near Davenport, Iowa. From the latter place she broke away from her keeper and made back directly to Nebraska, and her numerous

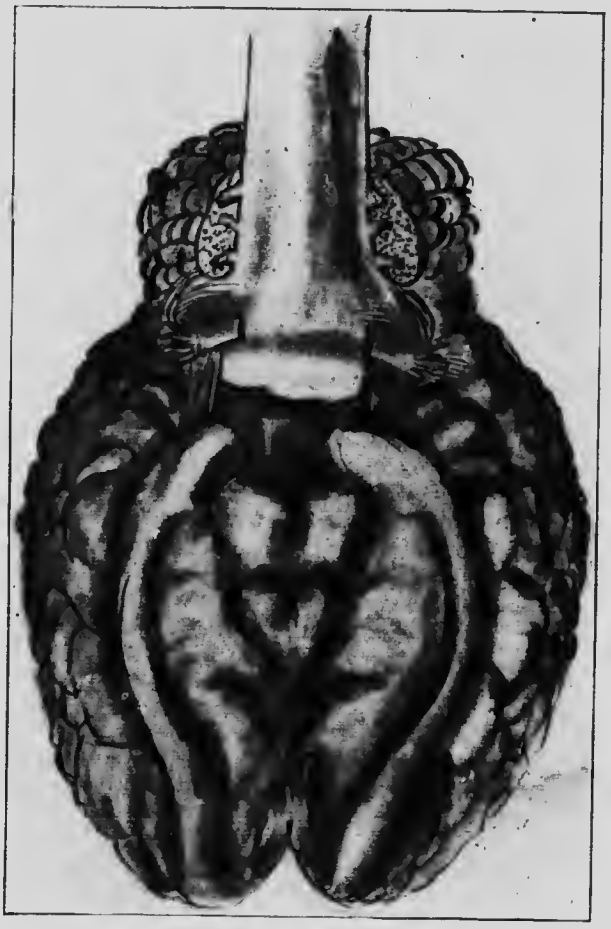


Figure 71.—The brain of the horse.

family, reaching her old home three months after she was stolen. She was traced over this route, but those following her were always sufficiently behind to make the capture of the thief impossible. It was known that the pony had secured her freedom and was on the way back, two weeks before she reached home.

254. Quality of the Brain. The brain of the horse is of better quality than that of any other animal. While the brain

of the horse is relatively smaller than the brain of some other animals, yet in no other animal can so fine a texture of brain be found. It is the texture or quality of the brain, quite as much as its size that denotes mental quality. Some horsemen have held that a horse must be very unintelligent because of his small brain, while as a matter of fact few animals, if any, are capable of manifesting such rare intelligence as the horse. All other things being equal, size would be indicative of power, but throughout all Nature, quality counts for as much as size. A large timber of pine would be stronger than a small one, yet a

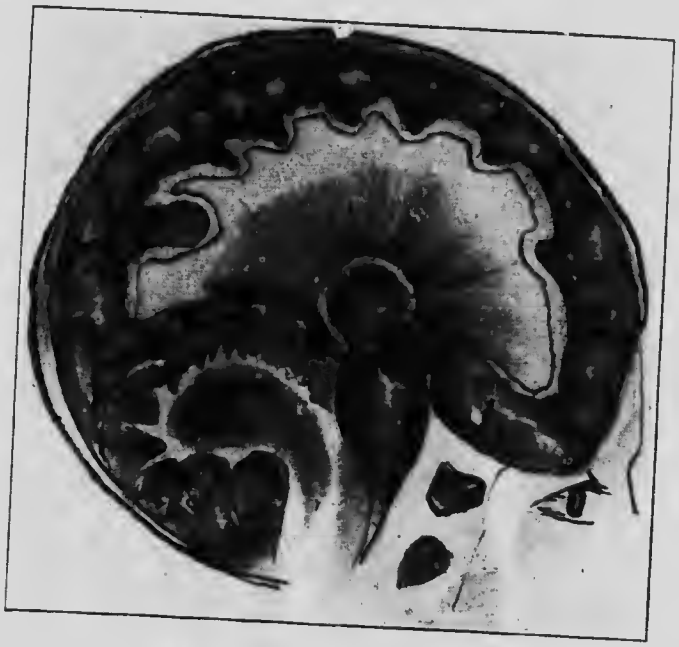


Figure 72.—The human brain.

small piece of good hickory may be stronger than either. An organic structure of high quality, indicates a like mental quality.

255. Temperaments. Quality of the brain texture is analogous to the temperaments, which are alike in man and the horse. The nervous temperament is of greatest interest to the horseman. It is the nervous temperament developed to a high degree, that gives the horse that quality we call stamina. This is but "bottom". It is also the intelligent horse in which we find the nervous temperament predominating. Possessing this temperament should not be construed to mean a horse the reverse. It means one having perfect control of both temper and actions. Breeds can be recognized quite readily by their temperaments.

The warm bred horses, such as the harness and saddle horses are usually found with the nervous temperament predominating. The Percherons possess this temperament to a higher degree than any other of the draft breeds.

256. Vital Temperament. The vital temperament is found developed in the Belgian more than in any other breed. The vital temperament supplies vitality to the organs. It is the source of all vital energy, and sustains the entire animal economy. Its predominance gives us a horse with a deep, well filled body, with a tendency to take on flesh rapidly. It is from among horses with this temperament well developed, that we find most of our dull, sluggish, and stupid horses.

257. The Motive Temperament. It is this temperament that results from the organs of motion being well developed. This temperament is indicated by the development of the bones and muscles of the horse. This temperament is more prominent

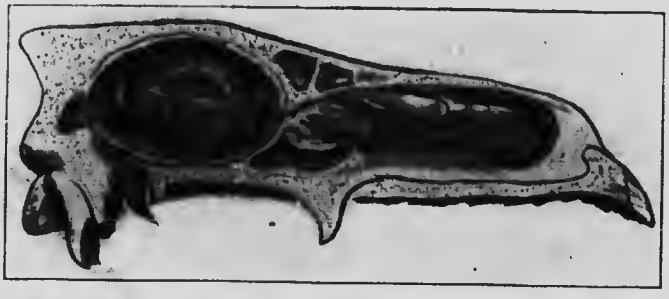


Figure 73.—A sectional view of the cranium of the horse, showing the brain cavity.

in the Shire than any other breed, while the Clydesdale combines the motive and nervous temperaments in a remarkable degree. We find most of our self-willed horses among those with large motive, and small nervous temperament.

258. A Well Balanced Organism. It is possible to have the temperaments well balanced. So far as draft horses are concerned, the better balance found existing between the temperaments the more valuable the horse. In the Belgian as a breed, we find the nervous temperament poorly developed. The Clydesdale is more deficient in the vital temperament than any other, while the Percheron as a breed is found deficient mostly in the motive temperament. A well balanced organism can be found more often among the better Percherons, than in any other breed.

259. The Comparative Anatomy of the Brain of the horse can be studied by a comparison of figure 71, with that of 72. In figure 71 can be seen the brain of the horse, while figure 72 shows the human brain. The greatest evidence of brain power, is in

the convolutions or folds of that organ. It will be noticed that these convolutions are as great in the case of the horse as in that of man. The only difference being in the case of man we find many convolutions not present in the brain of the horse. This corresponds with the phrenology of the two subjects. The social, aspiring, moral and most of the intellectual faculties found in man, are wanting in the horse. The skull of man is well filled with brain, while that of the horse is not, as shown in figure 73. In this figure it will be observed that it is in the posterior cavity

Figure 74.—Front view of the head of an intelligent horse. Note the great width between the eyes, and the extreme distance from eye to ear.

of the skull (cranium), that the brain is lodged. Viewed from the top and front we find the skull composed of three bones; parietal, frontal and nasal. The brain lies under the frontal bone, for the most part, and gives this part of the skull the appearance of being full or depressed, as it is large or small. The brain cavity or cranium is made greater, also, as the distance from orbit to orbit is increased. The brain itself is divisible into four chief parts: The cerebrum, forming the largest and most anterior part of the brain; the cerebellum, placed behind the cerebrum; the pons Varolii, a band of nerve matter; and the medulla oblongata, passing between the pons Varolii and the spinal cord.

260. The Cerebrum the Organ of Intelligence. It is with the cerebrum, we have most to do in this chapter. Aside from quality, it is the size of the cerebrum that gives to the horse his intelligence. This can be determined by actual measurement of the exterior of the skull or head. In figure 74 is shown the head of a horse possessing a large brain, as indicated by the width between the eyes, and distance from eye to the opening of the ear. A horse narrow between the eyes, will be found timid as well as wanting in intelligence. It is no easy matter to frighten a horse possessing extreme width between the eyes; while the horse with narrow frontal bone, is always "seeing things."

Figure 75.—A side view of the head of a horse possessing remarkable intelligence.

261. The Horse of Extreme Intelligence. Figure 75 is a side view of the head of one of the most intelligent horses, if not the most intelligent, ever known. This horse was an educated one, not in trickery such as mesmeric and other tricks of man, but educated to do intelligent things. Among other things he could do was to be placed in a room by himself, where he would put together a set of blocks, forming a figure, which could only be formed by one way of arranging the blocks. He could open or unfasten any door that could be opened by man, without the aid of a key. In fact all his work was the work of an intelligent force, in many possessing the intelligence of the ordinary man. The frontal bone of this horse extended two and seven-eighths

inches anteriorly to the eye, and the distance from the center of one eye to the center of the other, was eleven inches. I have never been able to find another head of the horse, showing such an immense brain cavity. This horse was the result of crossing a grade Percheron mare with a Saddle bred stallion.

Figure 76.—Front and side view of a stallion of great intelligence.

262. An Intelligent Head. In figure 76 is shown the actual photographic reproduction of side and front view of the head of a Percheron stallion, which are nothing if not remarkable for brain capacity. This stallion measured ten and one-half inches between the eyes, nine inches from eye to opening of the ear, and thirteen and one-eighth inches from center of the eye, diag-

onally across the opening of the opposite ear. The frontal bone of his head extends two and one-fourth inches to the eye. This stallion has been made to make services without a strap of any kind upon him, in a yard where ten or a dozen geldings and mares were present. The door of his stall can be left open, and he will not go out without permission, even though many horses are in sight upon the outside. He can be driven anywhere without lines, and he will always turn to the right for any vehicle to which is hitched a horse, but if he meets an automobile, he will give no part of the road.

Figure 77.—Front view of the head of an intelligent colt.

263. An Intelligent Colt. Figure 77 is the head of a colt at thirteen months. The width between the eyes, the fullness of frontal bone and distance from eye to ear all denote intelligence of a high order. His true character does not misrepresent his phrenology, for he is a colt of the highest intelligence. One only has to show him what is wanted of him, and he is always ready to do it.

264. The Head of a Timid Horse. Figures 78 and 79 are front and side views of the head of a stallion too narrow between the eyes. A horse with such a head will always be found timid. His nasal bone is full and arched, making the form known as Roman nose. This form of nasal bone is always associated with self-

willed horses, and when found in connection with a narrow head, it gives us a horse that will prove unsafe to drive. The stallion whose head is shown in figures 78 and 79 is timid, will become frightened at bridges, vehicles, signs loose paper and all other uncommon objects. This is not all, for when so frightened he will go through a stone wall, or at least try it, to get away from the object of his fright. In every other respect the disposition of this horse is excellent, as might be expected by the bright and prominent eye, and ereet ear.

Figure 78.—Front view of the head of a stallion inclined to a timid disposition. This is indicated by a narrowness of the head.

265. The Head of a Stupid Horse. Figures 80 and 81 are the front and side views of a stallion that scarcely knows enough to eat when hungry. In figure 80 note the depression of the frontal bone between the eyes, and in figure 81 the shortness of head from eye to ear. Seldom is a head seen upon a ton horse with so small a brain eavity, and the disposition of this horse does not belie his phrenology. I never saw a more stupid brute; even the ordinary animal instincts being poorly developed in him.

266. Summary. To summarize, the eharacter of the horse ean be told by the temperament and brain eapaeity. The former has reference to the quality of the brain, the latter to the quantity. The motive temperament is where the development of the organs of motion are greatest. It is in this temperament we

Figure 79.—Side view of the head shown in figure 78. The full or arched form of face denotes a self-willed disposition.

Figure 80.—Front view of the head of an unintelligent brute. Note the depression between the eyes.

find the most stubborn and self-willed horses. When this is balanced with a good nervous temperament we have an excellent combination, giving us both force and intelligence or quality.

267. The Vital Temperament is when the vital organs are greatest in their development. It is in this temperament we find most of our dull, lazy and stupid horses. With this temperament dominant we always have a good feeder and doer.

268. The Nervous Temperament is the outward manifestation of quality. It is the highest and best development of the brain and nerves. It is in this temperament we find our most intelligent horses. This temperament usually predominates in the trotter, the pacer, the saddler and the running horse. It is

Figure 81.—A side view of the head shown in figure 80. Note the shortness of distance from eye to ear. This horse does not possess ordinary brute sense, and few horses are seen with so small a brain.

indicated by the bright and prominent eye; the fine hair and soft, velvety skin with quality in every part.

269. The Proper Balance of Temperaments. The best results are found in the proper combination or balance of these temperaments. The vital is needed to feed and nourish the body. The motive is needed to give strength and force to every part, while the nervous is actually necessary to furnish the stimulation for action of every bone, and every muscle. In figure 47 can be seen an ideal combination of the three temperaments, and such a combination as is seldom seen in a draft stallion. The deep body, and good middle are evidence of vital power. The massive bone and great muscular development of motive force; while the great brain capacity and quality in every part show a wonderful nervous energy.

270. In the Quantity of Brain, the size of the cavity is our only guide. This is indicated by the width between the eyes and fulness of same, together with the distance from eye to ear. Those wide between the ears, are to be watched, for they will be found vicious and treacherous. Horses narrow between the eyes will be found timid—that is, wanting in courage. The wider between the eyes, and the greater the fulness of the frontal bone, the greater will be the intelligence.

CHAPTER XIX.

THE SCIENCE OF JUDGING DRAFT HORSES.

271. Importance of Essential Points. In the judging of draft horses, not enough importance has been attached to the most essential points A nice top line may be pleasing to the eye, yet it adds nothing to the utility of the horse. Then again, the trot adds nothing in real value to the draft horse, yet much importance is attached to this gait by most judges. If a draft horse walks right, his trot will be all right, but the real drafter is not performing his work at the trot, and will seldom have occasion to use that gait.

272. Need of a Better System. That there is need of a better system of judging can not be better shown than by referring to the score card not in use. A score of 11 is given the perfect fore pastern and hock combined, out of a possible 100. In the case of more than 100,000 horses reported, 30 per cent of them went wrong because of defective fore pastern and hock. In the actual test we find an importance of 30 per cent should be attached to these two points, while in theory an importance of only 11 per cent is given them. If one can find a difference of 19 per cent of a whole between theory and fact existing in the case of only two parts of the horse, what may we expect when every part of the horse is considered.

273. A Horse is Comparable to a Machine. I am probably the only one who has ever attempted to compare a horse to a machine, constructed for a specific purpose, and by actual, mechanical tests tried to learn his weak parts. I have been carrying on these tests for many years.

274. The Balance of a Horse. The first thing I learned was the per cent of weight borne upon each set of feet. In many tests of draft horses, I found that from 56¾ to 59¼ per cent of the weight was borne upon the fore feet. The average for all these tests was slightly less than 58 per cent. In the case of the Standard bred horse, a greater weight is borne upon the fore feet, than any other breed. There is a slight difference also, in the several draft breeds, but not enough to be of any interest to the student or breeder.

275. How Energy is Expended. The amount of energy expended by each end of a draft horse in moving heavy loads I have investigated. In this experiment horses were used weighing from 1400 to 1900 pounds. They were made to pull from an exact level, scales being used to register the draft. Only a nominal

difference was registered between the many horses used, the average being 71 per cent for the hind legs and only 29 per cent by the fore legs. This one line of investigation teaches up that the

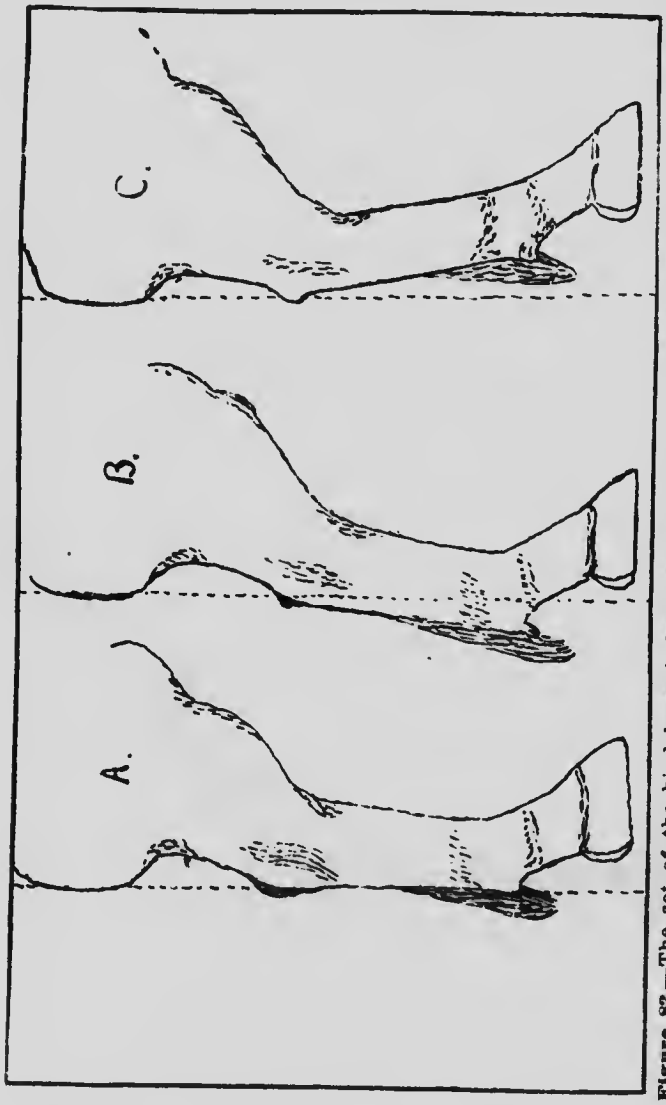


Figure 82.—The set of the hind legs. A denotes the correct set or attachment of the hind leg. A hind leg such as this seldom goes wrong. It will be noticed that the point of the buttock, the point of the hock, and the back part of the fetlock are perpendicular to each other. B denotes a hind leg set too far back. This set of leg is likely to go wrong in the fore part of the hock, with spavin or thoroughpin. C denotes a hind leg set too far forward. Such a leg is likely to go wrong in the back part of the hock by developing a curb.

hock is the most important part of the draft horse, and it also teaches us why so many horses go wrong in the hock.

276. The Proper Set of the Hind Leg. Most draft horses are either too straight or too crooked in the hind leg. A hock set at the proper angle gives more power, than when set too far

back or too far forward. If the hock is correctly set as regards its position to the body; is of proper size and good quality, it will never go wrong under any circumstances. In the case of accident, the bone above or below the hock will break before the hock will break or go wrong.

277. The Different Hock Conformations. In many tests I have made of the hocks of different conformations, I find it easy to group all hocks into three classes. These are shown in figure 82. The hock shown at "A" will never go wrong if the quality is good. Such a hock can be tested by applying mechanical power, and in practically every test, the bone will break before the hock goes wrong. In this conformation of hock it will be noticed that the point of the buttock, the point of the hock, and the back part of the fetlock are perpendicular to each other.

278. The Spavin and Thoroughpin Conformation. At "B" in this figure is shown a hock set too far back. Because of this set or angle such a hock will be found slightly open at the fore part of the joint, making this joint weak in its front part. It is with such a conformation that we usually find the spavin and thoroughpin. Such a hock is likely to be as strong in its back part, as the hock shown at "A" in this figure, but will always be found weak at the front part of the joint.

279. The Curby Conformation. The hock shown at the right in figure 82 is set too far forward and will always be found weak at the hind part of the joint. It is with a conformation of the hock such as this, that we find the curb; while such a hock may be as strong as any in its front part.

280. The Importance of a Good Hock. In mailing out the circular letter, reference to which has already been made, copies of figures 82 and 83 were also enclosed. Reports of 101,839 horses owned were reported from this line of investigation. Of these 32,902 were reported as having become unsound. Owners of horses reporting were requested to compare the conformation of their horses with those shown in figures 82 and 83 and report the result of these comparisons. Of the 32,902 horses reported as unsound, 21,737 were reported unsound behind, 93 per cent of such unsoundness being in the hock. Here again we have evidence of the importance of a good hock, and based not upon theory, but actual fact. Of all horses becoming unsound, 61 per cent did so because of their hock going wrong. In the selection of breeding stock, no part should be given as careful attention as the hock.

281. The Conformation of Unsound Hocks. The conformation of hock shown at "A" in figure 82, was seldom found with an unsound hock, while the sound horses were mostly reported with that conformation. The largest number of unsound hocks was reported as being of the conformation shown at "B" in figure 82.

282. The Correct Conformation of Pastern. Taking up the conformation of the fore legs, of the 32,902 horses reported as unsound, 11,165 of them were reported unsound in front. As

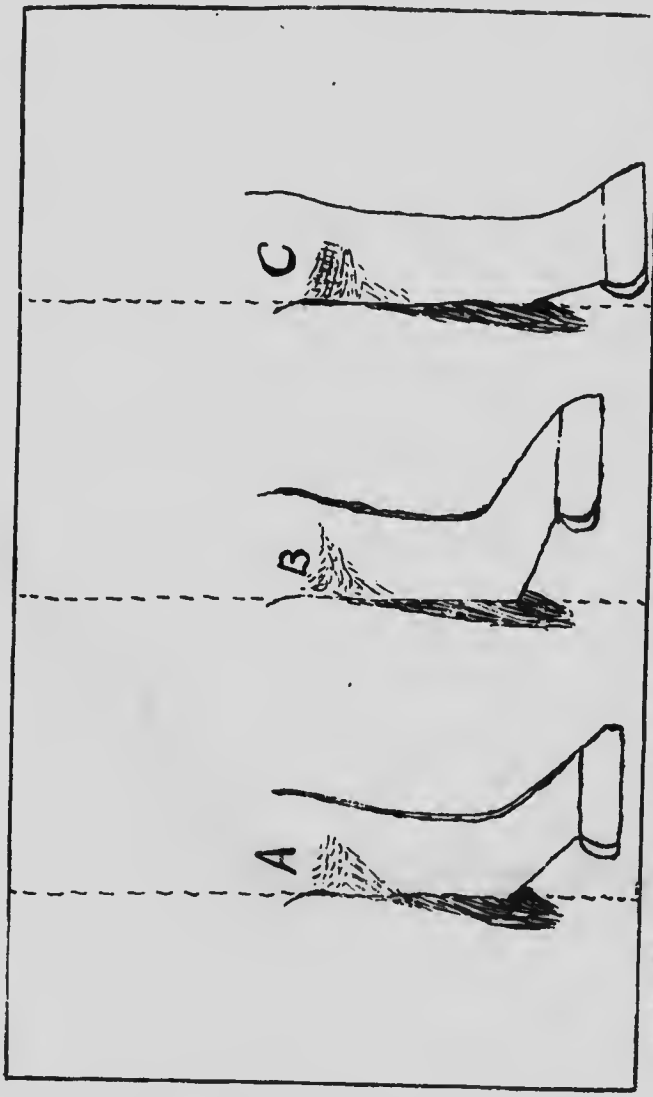


Figure 83.—The different angles of the pastern of the horse. A represents the correct angle of the fore pastern of the horse, 45 degrees. B indicates a pastern too slanting. C indicates too straight a pastern.

regards these, 10,378 were reported with short and straight pasterns. Some were reported as having rather poor feet at the time of their purchase, but where the pastern was of proper length and elasticity, the feet had remained in about the same condition. Upon the other hand, horses purchased with good feet, but short, straight pasterns, soon became crippled in thei

feet. In no instance was a shoulder lameness reported that the horse did not have a straight pastern. The pastern should be of fairly good length, and set at an angle of 45 degrees.

283. Unsoundness Resulting from a Short and Straight Pastern. It can be readily seen that without a pastern of reasonable length and elasticity, to aid in dissipating concussion, the draft horse will not long remain sound in front when used upon the paved streets of the cities. Taking the reports together it will be seen that short and straight pasterns in front and defective hocks behind, are responsible for most of the unsoundness of our draft horses. The table below will show the defects, both as to kind and numbers of the 32,902 horses reported unsound.

		Per Cent.
Fore Feet		
Sidebone	2337	7.4
Pastern	4186	12.7
Fetlock	978	2.9
Knee	1269	3.8
Elbow	7	.02
Shoulder	69	.2
Hind Feet	2319	7.
Pastern	43	.13
Fetlock	10....7	.32
Hock	1282	3.9
Stifle	20215	61.4
Hip	6'	.18
	29	.08

284. Sidebones. No attempt has been made to indicate the unsoundness by giving it a name, the location of the trouble only being given. The one exception of this rule is in regard to sidebones. This defect was of such frequent occurrence, I deemed it best to let it be known, as 12.7 per cent. of all unsound horses were troubled with sidebone. Here for the first time s given the location and per cent. of frequency of the occurrence f unsoundness in draft horses, as one may reasonably expect to find them upon the streets of our cities. The four weakest parts of the draft horse, in the order of their frequency, is the hock, with 61.4 per cent.; the fore pastern (including coronet,) with 15.6 per cent.; the fore feet, with 7.4 per cent; and the shoulder, with 7 per cent. It has already been observed that the defects of feet and shoulder were aggravated at least by a defective pastern. Reducing the number of weak points in the horse as much as possible, and we find that about 85 per cent. of the unsoundness reported, was the result of defective hock and pastern. Taking the entire number of horses reported, sound and unsound, about 20 per cent. were defective in the hocks, and about 10 per cent. were defective in the fore pastern.

285. The Importance of Good Hock and Pastern. No such importance as this, has ever been given to these two points of the draft horse, by any judge or system of judging in this country. Here also is one of the reasons why so little value is placed

upon prize winning horses by the great mass of people, and especially breeders. Exhibitors will themselves price first class winners below those winning no place in the same class. It also explains in a measure, why our best horses are never shown.

286. The Value of Good Eyes. The next most important point in the horse, is the eye. It is very important, both because of the utility value it gives the horse, and the tendency to inherit defective vision. In a report upon 49,317 horses used in this country, eight years or more of age, 5,013 had some inherited defect of the eye. At the age of four and five years, these same horses had all been passed as having good eyes. These reports were based upon the examinations of veterinarians, and must be considered reliable. Such a report is startling, however, and well may be when some more than 10 per cent. of the commercial horses of a country have defective vision. It is much more than I would have been inclined to believe, had I not the figures before me. This is in a measure a breed defect, as the grade Percherons were found much more defective in this respect than any other breed.

287. Intelligence and Temperament. The brain development of the horse, including temperament, plays a much more important part in making up the value of a horse than has ever been accorded it. The greater the brain development in the draft horse, the more easily his work is done, the more pleasure the driver experience in the handling of his team, and the less wear upon the horse as a result of his willingness to perform every duty required of him.

288. Defective Wind. Another defect too frequently seen in the draft horses of this country is that of defective wind. This defect is found in several forms, the most common being that of roaring, and more correctly known as laryngeal hemiphlegia. I have attempted no line of investigation so difficult of attaining definite results, as that of reaching any definite conclusions in the matter of defective wind. This, for the most part, was made difficult because of there being no way of testing the wind of a horse except to "wind him" by violent exercise, such as rapid trotting or running. Running the horse a short distance is the test employed in the markets when a horse is sold, but for the large users of heavy horses in the city to employ such a method at their annual examinations, or at any time, would require considerable time and one finds no disposition on the part of the large concerns to waste time in doing such things. The result is that no test for wind is given until the horse is incapacitated for work. I find that many of the largest transfer companies, as well as others employink a large number of horses, have a system of examining their horses annually ,and keeping a record or such examinations, but the test for wind is omitted.

In a systematic attempt to secure data upon this subject and covering a period of several years, I have been unable to secure complete and reliable reports on but 11,649 horses. These were horses all of which had been tested for their wind when purchased, and their wind found right in every particular. This would place these horses above the average in this one particular at the time these reports were made, and yet 1986 were found with defective wind in a marked degree. This is a little better than 17 per cent. In these reports every horse owned by the companies reporting were tested, and the full number owned by them as well as the number found defective were recorded.

No provision has been made for attaching any importance to this defect, or its causes, in the methods of judging horses as at present employed, and yet actual fact, based upon the most painstaking examination, teaches us that it should be given an importance of 17 per cent., even when the better class of horses are under consideration. The scale of points now in general use places an importance of 12 out of a possible 100 upon the eye, fore pastern, hock and wind, while actual demonstrated fact shows they should be given an importance of 57 out of a possible 100. This is certainly a wide difference, but just so long as standards are based upon theory, just so long will we find judges differing, and horses winning high honors valued below those winning no place in the same class. Too much attention has been given to theories in the judging of horses for the good of the horse breeding industry. It has never occurred to judges of horses that judging might be reduced to a science, based upon actual fact.

289. Judging Cattle. The judging of fat cattle has been reduced to an almost exact science. The animal to be judged is divided (mentally) into the several commercial cuts, so that when the judging is complete, one has a fairly accurate idea of which animal in the class judged would sell for the most money in the open market. There is no known reason why the same rule cannot be applied to the judging of draft horses. To do this one has only to keep in mind a fact well known to all, that a draft horse is but an animated machine to be used for a specific purpose.

290. A New Scale of Points. I believe the following scale of points will be found more nearly correct, as regards the relative importance of each part of the draft horse, than any ever formulated:

Form and Quality:

The legs viewed from in front and behind should be well set under the horse; viewed from the side they should be perpendicular to the body	
Weight, over 1800 lbs., according to age	4
Quality, as indicated by smooth and hard bone, skin and hair fine, with an abundance of energy	3
	5

Head and Neck:	
Intelligence, as indicated by width and fulness between the eyes, and good length from eyes to ears	4
Eyes, large, full, bright and of a hazel color	10
Ears, medium size and carried erect	1
Neck, good length, muscled, with well defined crest, wind pipe large, throat latch clean	1
Forequarters:	
Shoulder sloping, well muscled	3
Arm and forearm well muscled	1
Knees wide, straight, well supported below	1
Fetlocks wide and strong	2
Pasterns, sloping 45 degrees, good length, elastic	10
Feet, large, even size, dense horn	5
Body:	
Long, with short back and long underline, well covered with muscle. Width good	2
Chest wide, extending well down between forelegs; large girth, 86 inches or more in mature horse	2
Underline, flank low and well filled	2
Hindquarters:	
Croup wide, straight, tail attached high, well carried; thighs and gaskins very muscular	1
Hocks, clean, wide, straight and strong	16
Fetlocks, wide and straight	2
Pasterns, medium length, sloping	2
Feet, large, even size, dense horn	3
Walk, straight, regular, long stride, balanced and elastic	8
Wind:	
(Actual test) good clear, breathing deep and strong	10
	100

An unsound horse, or one with defective wind should be given no place in any show ring.

CHAPTER XX.

FEEDING THE HORSE

In several preceding chapters the subject of feeds or feeding had to be taken up, but only because of its influence upon the subject then under discussion. This chapter is not intended to be more than an aid to the breeder in the feeding of his horses.

291. The Extraction of Nutriment. The amount of nutriment to be secured by the horse from any kind or quantity of feed, depends upon its mastication, the action of the salivary glands and the gastric fluids. The food is first reduced by the molar teeth, assisted by lips, tongue and cheeks, in passing it to the place of grinding and holding it in position. In the horse the lower jaw is about an inch narrower than the upper, so that grinding is possible on but one side at a time. As mastication proceeds the feed is mixed with saliva poured upon it from glands opening into the mouth.

292. The Amount of Saliva Secreted. Experiments made by Colin made it possible for him to state that it required nearly twenty minutes for a horse to masticate one pound of dry fodder consumed. Oats required a little more than their own weight, green fodder about half. It can be seen that the more thorough the mastication, the more perfect the digestion following. In other words the more time consumed in the mastication of his food, the better will the digestion of the horse be carried through. In this connection for feeding grain, an automatic feeder has many advantages over feeding in an open trough. Digestion is further aided by the gastric fluids poured upon the food after it enters the stomach.

293. Size of Stomach. The stomach of the horse is so small that it cannot contain much feed at one time, because of which the food is constantly being pushed on and out of the stomach before it has been long acted on by the gastric juice. The large intestine of the horse has a capacity of about six times the stomach, permitting the retention of a large quantity of food. The capacity of the stomach of a mature horse is but eighteen to twenty quarts. The entire alimentary canal is but a system of glands, secreting fluids to aid the process of digestion.

294. The Elements of Food. Foods may be divided into three elements or classes of nutrition; protein, consisting of the nitrogenous substances of the food; fats, which are absorbed unchanged in the form of an emulsion; and carbohydrates, which

are converted into some form of sugar, which enters the blood by absorption from the intestinal canal

295. A Proper Balance of Nutrition. We have now reached that part of our subject, where trouble is easily in evidence. Food products can be so compounded that a proper balance between the three elements of food nutrition may be maintained, and yet not be the correct ration for the animal we are feeding

296. Acids and Bases. The Ohio experiment station has recently concluded experiments and announced the same in their bulletin number 207, dealing with balanced rations for animals from a new standpoint. The one thing of most value to feeders and breeders resulting from this experiment, is that not only should there be a balance between the protein and other food elements, but that the balance between the inorgame acid and base forming elements in the food should also be maintained, that the acid formers should not predominate over the bases in the feed. This bulletin is far in advance of anything ever published upon the subject, a part of which follows.

297 Inorganic Matter. There are in all food stuffs minerals taken from the soil by the plant. These minerals form the ash left when the portions of plant material are burned, and because they are not destroyed by fire they are called inorganic. Some of these elements which remain behind in the ash when foodstuffs are burned unite with oxygen and water to form acids; others unite with oxygen and water to form what is known as bases, of which slacked lime is a good example. Now the process to which foods are subjected in the body is really a burning process; at all events the end products are similar to those resulting from ordinary burning. Thus when foods are taken into the body these inorganic elements form acids and bases as final products.

298. The Balance Between Acids and Bases. Bases and acids have peculiar properties. However, when an acid and a base are brought togetner they neutralize each other and the resultant product is something entirely different from either of the original compounds, having lost all its active and irritating properties. In the animal body, as we have said, the inorganic, or ash elements, of the food form acids and bases. If the base formed is in excess of the acid, the acid is neutralized and the functions of the body continue normal, since the normal condition of the blood and body tissues seem to be slightly basic. If, however, the acid formed in the body as a result of the breaking down of the food materials is in excess of the bases, then an abnormal condition results, and if long continued, the animal will be affected with a disease known as acidosis or acid intoxication. This may become so serious as to cause the death of the animal.

299. Sulphur and Phosphorus Found Mostly in Protein Foods. In the common foodstuffs on the farm the mineral substances which produce acids in the body are sulphur, phosphorus and chlorine; those which produce bases are potassium, sodium, calcium and magnesium. These are found in various combinations in plants and feeds, but the greater part of the acid-forming substance in the animal body comes from sulphur and phosphorus. The sulphur of feeds is contained almost entirely in the protein or muscle-forming part; phosphorus is contained in a number of forms in feed, but most largely in the protein, also. Thus it will be seen that any feed rich in protein will cause the formation of a large amount of inorganic acid in the animal body. This requires that high protein foods have sufficient base-forming material accompanying them to insure that the acid formed in the animal body will all be neutralized.

302. The Cause of Small Bones. It will be seen from this that the balance between the acid-forming elements and the base-forming elements in the ration for animals is of great importance. This balance is indicated by analysis in the ash of the feeds, which shows the relative proportion of the two classes of elements. Unless sufficient base-forming material is present in foods, the bones themselves will be robbed to supply bases to neutralize the excess of acid. A condition of this kind is the cause of rickets or porous bone in old animals; and of a lack of bone development in young animals where the ash content of the food may be high, but where the acid-forming and base-forming elements are not balanced.

301. Corn Has an Acid Ash. In straight corn-feeding we see the resultant of a complication of deficiencies; corn lacks protein as well as minerals. In the ash, both acids and bases are deficient but the bases considerably more so than the acids, so that as an only food, corn is characterized by an excess of acid mineral elements, and this excess, together with the deficiency in the total amount of mineral matter present, limits the growth of the skeleton; but if the protein in the ration of the corn-fed animal is increased by the use of supplements to such an extent as will support a maximum production of protein increase, then both phosphorus and the mineral bases must be increased.

302. The Quantity of Ash Required. The basic mineral elements in a ration must be present in quantities corresponding to the protein, since the sulphur and phosphorus of the food proteins constitute the chief sources of mineral bases in the food but also that this excess be maintained at a high level; that is, that aside from the balance between acid and base, the total quantity of ash should be considerable.

303. Alfalfa and Clover are very rich not only in protein but also in the mineral bases, so that they make a fine supple-

mentary food for corn. That alfalfa gives such excellent results when fed with corn to horses can be accounted for in no small degree by the fact that it is so rich in mineral bases.

304. Corn Makes a Poor Showing When Fed to Breeding Animals. This necessity of maintaining the balance between the inorganic and base-forming elements, explains why it is impossible to make an ideal ration for horses used in breeding purposes, when any part of that ration is corn. It will be remembered that in a former chapter I mentioned instances of both stallions and mares being kept on an exclusive grain ration of corn for two or three years without apparent injury, and then have them go wrong, becoming sterile or nearly so, seemingly at once. In all the data collected upon the subject of sterility, in no case did a ration of which corn was a part make a good showing.

305. The Minimum Amount of Nutriment. Food supplies materials for making good the waste of body tissues. If the supply is liberal and exceeds the demands of the body, the horse will gain in flesh and weight. If the supply is only equal to the material broken down, the weight of the horse will remain unchanged. If the supply is below the actual demands of the body, the horse will lose weight. There is a minimum amount of nutriment absolutely necessary for the maintenance of life.

306. Protein Consumption. The protein of the food is the only source of nitrogenous substances in the body. The formation of flesh, therefore, is primarily dependent upon the supply of protein in the food. Any excess of protein in the food of a horse is disposed of through the excretion of urine. The decomposition of nutritive material of the blood and body tissues goes on as long as the horse lives, and this is known as protein consumption. Neither fat nor carbohydrates, when fed alone, have any influence upon protein consumption. The body would decompose the same amount of protein, in the case of exclusive feeding of fat or carbohydrates, as if no food whatever was given. When a balanced ration is fed, consisting of protein this consumption depends wholly upon the supply of protein in the food.

307. Salt. The feeding or salt daily in moderate quantities to horses, increases the secretion of the body fluids and their circulation, and increases the energy of the vital processes. It also has a stimulating influence on the appetite of the horse, and should always be a small part of the ration for all breeding horses.

308. Nervous Energy is Increased by Protein. One very noticeable thing in the making of a ration for a horse, is the increase of nervous energy noted as the ration is narrowed; that is as the protein is increased at the expense of the carbohydrates. This teaches us that the ration may be widened for horses not at work. The ratio of the legumes usually fed the horse, such as

the clovers and alfalfa, will average about 1:3[illegible] while for other fodders, or coarse foods it will run from 1:7 to 1:12. Horses fed upon the former always display the more energy. The same is true of concentrates or grains. The ratio of oats always gives the greater energy. By ratio is meant in this chapter, the ratio of protein to carbohydrates.

309. Digestibility of Foods. The digestibility of foods differ but the average digestibility of the protein and carbohydrates found in the foods usually given the horse is about 80 per cent. If one was to follow a system of balanced ration feeding, for every 1,000 pounds of weight should be given 20 pounds of food (dry matter), in which could be found two pounds of protein and 11 pounds of carbohydrates. Seldom can be found two horses in the same barn requiring the same amount of food. It is because of this that more skill is requir[illegible] in the feeding of horses than any other animals.

310. In Conclusion, as already stated in previous chapters, I would feed no corn to horses which were to be used for breeding. Corn stover, free from dirt and dust is good. Also any hay well cured, and free from mould or dust. The clovers and alfalfa fed in moderation have no equal. Oat, barley and wheat straw are safe to use, and can be used with the clovers and alfalfa to advantage. Grasses or grains likely to contain ergot should be avoided. Millet should never be fed a horse of any kind. [illegible] ghum hay or fodder is hazardous at best. Kaffir fodder proved a very fair food for the horse in several localities [illegible] have never used it. The best single grain ever fed a [illegible] oats. Crushed barley is the next best, but should be crushed not ground. Wheat bran is good when mixed with other [illegible] but will not be needed if clover or alfalfa is used. Shorts and middlings form a pasty mass in the stomach of a horse and should not be used. Kaffir corn ground has proved a very fair food for a horse, but is improved with a mixture of oats. Cotton seed meal should never be used, and linseed meal only in small quantities. After all is said, the secret of successful feeding lies in so feeding the horse that he may be found at his best at all times, and what may be best for one, may not prove best for another.

CHAPTER XXI.

DISEASES OF THE HORSE.

311. Diagnosis. Only those diseases likely to be of interest to the breeder will be discussed in this chapter. If one has a thousand dollars or more invested in a stallion, he can illy afford to let him die, if there is any way known of saving his life. It is because of this large investment in a single individual that makes the usual home treatment unprofitable in a very large per cent. of cases. It is in diagnosing a case one finds the greatest difficulty. Even in colic and other diseases of the digestive organs, one often meets with great difficulty in learning the real trouble. Because of this, if it is possible to obtain the services of a veterinarian, it will prove a good investment to do so. Sometimes a veterinarian can not be had, and under such circumstances one should do the best he can. In diagnosing the ailments of a horse one need expect but little of breeders, when it is remembered that this is the one great and most uncertain task of veterinarians.

312. Colic in the horse occurs in various forms. Engorgement colic, obstruction colic, flatulent, or wind colic, spasmodic, or cramp colic, and worm colic are the most common forms. If a horse evinces abdominal pain he is likely to be put down as suffering with colic, even when the difficulty may be an internal hernia, overloading the stomach, or even a bladder or live trouble. Inguinal hernia is likewise often mistaken for colic, hence one can see the absurdity of advising treatment at long range. If the horse is a valuable animal, no time should be lost in placing him in the care of a veterinarian. The more valuable the horse the greater the need of this.

313. Engorgement Colic is induced by overloading the stomach with food. The horse may either be overfed, or else the stomach as a result of some cause may have failed to digest the food and passed it backward into the intestines. Greedy eaters are most predisposed to this disease. The one symptom likely to result in a correct diagnosis of this disease is attempts at vomiting. The movements are shown by labored breathing, upturned upper lip, contraction of the flank, active motion at the throat, drawing in of the nose toward the breast, causing high arching of the neck. Following retching, gas may escape from the mouth, and this may be followed by a sour froth and some stomach contents. The horse cannot vomit except when the stomach is violently stretched. If the accumulation of food or gas is great enough to stretch the stomach so that vomiting is possible, it

may be great enough to rupture this organ. But after the stomach ruptures, vomiting is impossible. This condition of the stomach is generally made known to us, as soon as food is thrown out through the nostrils. The death rate from this form of colic is higher than in the case of any other.

314. Obstruction Colic usually is known as impaction of the large intestines. It may be, however, the obstruction of the digestive tract by accumulations of partly digested food, by foreign bodies, by displacements, by paralysis, or by abnormal growths. It is generally induced by overfeeding, or the feeding of old dry hay, or stalks, superinduced by a deficiency of the secretions of the intestinal tracts. The last named condition may be brought about by lack of water, or the use of too much strong medicine. The only treatment in this form of colic that can be effective is to produce movement of the bowels, so as to prevent inflammation of the same from arising.

315. Flatulent, or Wind Colic, may be induced by anything that may produce indigestion. The chief symptoms of flatulent colic is the distention of the bowels with gas. The symptoms of this disease are not so suddenly developed nor so severe as those of cramp colic. At first the horse is noticed to be dull, pawsome, and the abdomen enlarges. The pains from the start are continuous. If not soon relieved the symptoms are aggravated, and in addition there are noticed difficult breathing, mucous membrane highly colored, profuse perspiration and trembling of the front legs. This form of colic is much more fatal than spasmodic colic. The treatment differs very materially from that of spasmodic colic. An injection, per rectum of two ounces turpentine in eight ounces of linseed oil may safely be given every thirty minutes to stimulate motion of the bowels and favor the escape of wind. The moval of the gas from the bowels is the essential thing. Under the direction of a veterinarian the bowels may be punctured with a small trocar or needle of a hypodermic syringe. This has often saved the life of a horse, and can be done with no danger if made with a clean instrument

316. Spasmodic, or Cramp Colic, is the result of contraction, or spasm of a portion of the small intestines. Spasmodic colic is more frequently met with in high bred, than in large draft horses. Like external cramps, spasmodic colic is caused by the unequal distribution of the nervous supply Drinking cold water while warm, or the sudden lowering of the temperature of the body are the most frequent causes. There shou'd be little trouble in diagnosing this form of colic from any other form, yet there frequently is. One should keep in mind that in spasmodic colic the attack is sudden; the pain violent, with intervals of ease, the temperature and pulse normal during the intervals of ease, and that frequent attempts to urinate are always made. The treatment should be something in the way of an antispas-

modic, since the pain is due to spasm or cramp. Given as a drench every half hour until relief is noticed, the following is the best formula I have ever tried: Laudanum one ounce, Sulphuric ether one-half ounce, Turpentine two ounces, raw linseed oil four ounces. Shake well before using. I give this only because in cases of this form of colic there is a great need of quick relief, and unless help is given the animal early in the disease, there is likely to be serious trouble.

317. Worm Colic is a symptom rather than a disease. In many cases of extreme worm infestation, there are colicky pains at times, such as switching of the tail, frequent passages of manure, and at times some slight straining. About every other man one meets has a "sure cure" for intestinal worms in horses, but if plenty of well cured alfalfa hay be given either horses or colts, no "cures" will be needed.

318. Inguinal Hernia is frequently mistaken for colic. Within a few minutes after an accident of this kind occurs, the horse will become restless. He will jerk up the hind legs, kick at the belly, and point with his nose to the side. The symptoms will increase in severity until the horse begins to sweat and roll as in some forms of colic. Inguinal hernia is but an incomplete scrotal hernia, and may exist and cause no signs of distress, or it may become strangulated and cause the death of the animal. Inguinal hernia is seen mostly in stallions, occasionally in geldings but rarely in mares.

Until about the ninth month of fetal life, the testicles of the male occupy a position in the abdominal cavity, similar to that occupied by the ovaries of the female. At about the ninth month the testicles begin to descend, and finally become lodged in the sac called the scrotum. In making this change a canal is formed called the inguinal canal, which connects the scrotum below and the intestinal cavity above. This canal is permanently occupied by cords, arteries and canals of the genital organs.

It will be seen then that there exists in the stallion and gelding an opening through which it is possible for the small intestines to pass into the scrotum. The passing of such intestines into or through this canal is inguinal hernia. If the intestines are crowded with sufficient force into this canal so that the circulation through the bowel is impeded, it is strangulated. Strangulated inguinal occurs much more frequently in the stallion than in gelding. It is very serious and often times a fatal accident.

It is easy for anyone with a slight knowledge of the anatomy of the parts, to understand that the position a stallion assumes during coition favors inguinal hernia. It will be observed that the testicle on the side of the hernia is kept tightly drawn upward in the inguinal region, and if the loop of the bowel has descended through the inguinal canal, it can be made out as quite an enlarge-

ment above the testicle. An examination made through the rectum is the only way to confirm the diagnosis, when any entrance of a gut into the canal can be felt from within.

The treatment lies in its prompt reduction. If recognized early, this can be accomplished by careful traction upon the hernial mass. Every care must be exercised lest laceration occur, and the longer the time of the hernia, the greater the care to be exercised. This is one of those conditions where the amateur is likely to do no harm, even though he does no good, and no effort should be spared in reducing the hernia in the shortest time possible. If the owner of a stallion does not succeed in a very short time, or if in the beginning of such an accident he feels himself unable for the task, a veterinarian should be secured as early as possible. In such cases one should remember that the hernia must be reduced or the stallion will die.

Figure 84. Bacilli of anthrax. (1000 diameters.)

319. Orchitis is another disease with which stallions may become afflicted. When not by blows or bruises, orchitis is likely to be the result of congestion, produced by excessive copulation, exciting the sexual desire without gratification, or heavy grain feeding with little exercise. By removing the cause, reducing the grain ration, increasing the exercise, the giving of some laxative such as two ounces of Glauber's salts daily in the food, and the bathing of the affected organs daily with hot water will usually restore the testicles to a healthy condition.

320. Hemorrhage of the Penis is generally induced by blows, or the force used in entering small, constricted mares, coupled with too frequent service. The treatment may be rest from service for a few days, and the application of alum water to the end of the penis.

321. Maladie Du Coit is a germ disease, and is propagated by the act of copulation. It is not unlike syphilis in the human subject, and is highly contagious, affecting both stallions and mares. It has depopulated a few herds in the western states, and as there is no satisfactory treatment of the malady, it should be stamped out by castration or death.

322. Anthrax is a germ disease, and until within very recent years the horse had always been considered immune. In the valleys of the upper Missouri river and some of its tributaries, it has made the horse breeding industry unprofitable. The disease is never present in the high lands of the west so far as the horse is concerned. The virus of diseased animals is disseminated in the excrement, which is often mixed with blood, and therefore with the microbes. The anthrax bacillus is shown in figure 84.

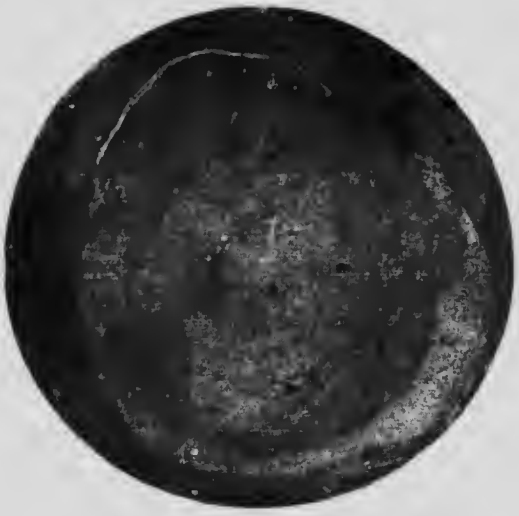


Figure 85. Bacilli of tetanus (lockjaw)

They are straight cylindrical rods, usually associated in twos and threes, but sometimes in chains. The formation of spores does not usually take place until after the death of the animal. They multiply most rapidly under mean temperatures, yet when dry the spores will resist boiling water for some time. The bacilli are taken into the system with the herbage.

The disease shows itself by a fever, with more or less stupor of the patient. The blood is much changed, sometimes visible hemorrhages occur. The intestinal lesions in the horse often give rise to more or less violent symptoms of colic. This complication, considered too exclusively, frequently interferes with the correct diagnosis of the essential disease. After death the blood is found to be de-oxygenated, viscid, the corpuscles altered, and the plasma colored red. The spleen is much enlarged. The

intestines are sometimes the seat of intense congestive hemorrhagic lesions, and in some cases the lymphatic glands of the different regions are in the same condition, and also enlarged to twice or three times their normal size. Similar lesions may also be found in the kidneys.

This is an unfortunate disease for the breeder, and it should be reported to the state veterinarian as soon as its presence is known.

323. Tetanus (Lockjaw) is a germ disease, bacilli being shown in figure 85. Breeders are likely to be troubled with tetanus to quite an extent, the infection following pricks of nails or abrasions of the skin. The bacillus does not multiply in air containing oxygen, because of which only deep punctures are likely to become infected. It is very resistant to heat, supporting the temperature of boiling water for some time. It is but little sensitive to the action of antiseptics. To be infectious the bacilli require the co-operation of other microbes.

The disease is characterized by spasms affecting the muscles of the face, neck, body and legs, and of all the muscles supplied by the cerebro-spinal nerves. The spasms or muscular contractions are rigid and persistent. The first symptoms which attract the attention of the owner, is difficulty in chewing or swallowing, of moving, and the protrusion over the inner part of the eye of the membrane commonly called the haw. The jaws are set or locked, wholly or in part, giving use to the name of lockjaw. If the attack is acute, the animal will die within a very few days If of a milder form he may be saved. Tetanus antitoxin injected beneath the skin with a hypodermic syringe, will afford a very high degree of protection The patient should be kept in a quiet place, away from all other animals and noises. The bowels should be kept active by the use of cathartics. Mares infected with tetanus poison, seldom breed after, even though a complete recovery is apparent.

324. Influenza is another disease of the horse, and a very common one, that is of interest to the breeder. It is of especial interest to the breeder because of its effect upon both stallions and brood mares. The latter if pregnant are very apt to abort. Young stallions are frequently made sterile by a severe attack of influenza. It occurs in several forms, such as equine typhoid fever, pink eye and others. When the visible mucous membranes are the principle seat of the disease it is termed pink eye.

It is a contagious and infectious fever, caused by a microbe shown in figure 86. Young horses and colts are more susceptible than mature horses, and one attack is generally self-protective. Very few horses contract the disease after their fifth year, and those kept in poorly ventilated stables experience a more severe attack than those accessible at all times to pure air. The disease is known by its alterations of the blood, great depression of the

vital forces, stupor and frequent complications of the lungs, intestines and brain. Occasionally an apparent recovery is followed by a severe relapse, sometimes proving fatal.

Good nursing is the best treatment. The animal should have access to an abundance of pure air and sunshine but the wind should never be permitted to blow directly upon the patient. The patient may be allowed any nourishing food relished. The bowels should be made to perform their functions promptly and regularly. If inclined to be constipated, small does of Glauber's salts may be given. If the weather is very cold the patient may be kept warm by blanketing. In most cases no serious trouble will be experienced if the horse be handled so as not to take a cold.

Figure 86. Bacilli of influenza (1000 diameters.)

One of the most serious conditions resulting from influenza, of interest to the breeder, is that of its effect upon the mucous membrane of the uterus. Quite frequently young mares from three to six years of age after suffering with an attack of this disease will be found discharging pus or a glutinous substance from the vulva. This has been very frequently mistaken for the discharge common in cases of leucorrhea, but instead is the discharge from an abscess in the uterus. The mucous membranes throughout the animal are subject to abscess formations during an attack of influenza, and locally no part is so likely to suffer as the uterus.

No treatment will give better results for this particular condition of the disease, than irrigating the uterus with hot water at a temperature of 105 degrees. This should be done several times every day until relief is given.

325. Strangles is also an infectious disease of the horse, colts being more predisposed than mature horses. It is caused by infection by contact with an infected animal or the discharges of an infected animal. The germ or bacillus is shown in figure 87. It appears as a fever, lasting for some time, with formation of abscesses in various parts of the body, both near the surface and in the internal organs. It usually leaves the animal after convalescence in the best of condition. About the only treatment necessary is to keep the animal in dry quarters and feed a reasonable quantity of good wholesome food.

The swelling under the jaw should be watched and all blisters and irritating liniments should be kept away. These swellings may be bathed with hot water, and poultices may be applied. For such purposes no better poultices can be used than flax seed, with

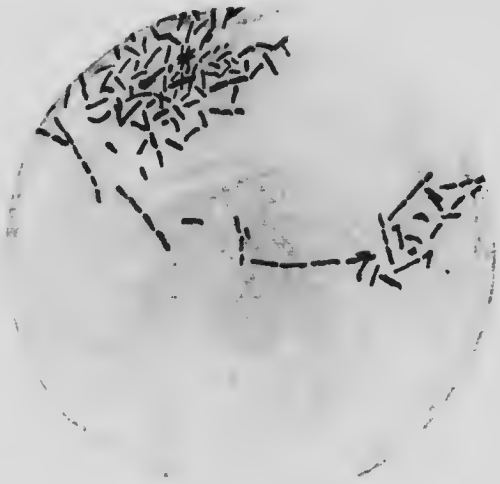


Figure 87.—Bacilli of strangles. (1000 diameters.)

a little charcoal and creolin added. As soon as there is any evidence of the formation of pus, the abscess should be opened.

326. Pneumonia is another disease of interest to breeders, and it is only in the case of very young foals that I shall make mention of it. A large number of foals coming early each spring, appear all right when foaled, but within two or three days are dead. These mostly die of pneumonia, usually contracted during the first hour of their life. In the early spring while the weather is chilly and the air damp, unless a blanket is thrown over a foal until it is dry, it is in serious danger of contracting a cold, which more likely than not will terminate in pneumonia. Lying upon cold or damp ground is also dangerous.

The first thing to attract attention in cases such as this, will be a dullness and weakness of the foal. If at this stage of the disease the membranes of the eye appear red, there is no help

for its life, for it is sure to go. If the ear is placed at the side of the foal just behind the elbow, a rasping or rattling sound will be heard. After death, the autopsy will disclose a thick, dark blood, and the blackened lungs. All that can be done with such cases is to try to prevent them. One thing that can be done is to have the foals come later. It has been shown that the loss of foals is confined largely to early ones. If one must have them come early, every means should be employed in an effort to keep them warm, and where no wind can strike them until they are well dried. Only think what it would mean if a man was to take a hot bath at a temperature of 100 degrees, and immediately step into a room without clothing where the temperature was as low as 50 degrees. That is what the young foal does in many instances, and results in the loss of many.

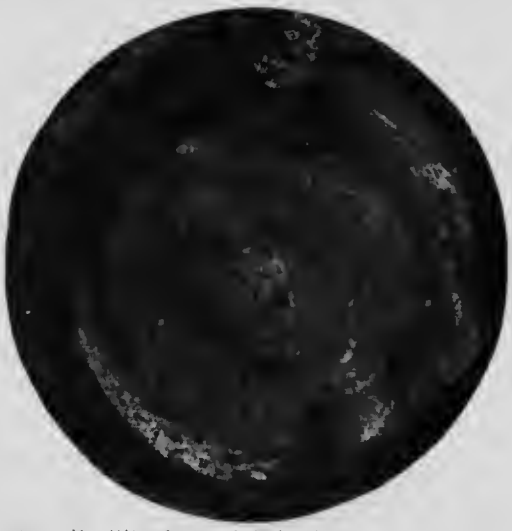


Figure 88.—Bacilli of navel infection. (1200 diameters.)

327. The Navel Infection of Foals is another disease resulting in much loss to breeders. This also, is a trouble of early foals. It is a true germ disease, the bacillus being shown in figure 88. This bacillus can not be propagated without oxygen, hence is always near the surface of the ground. Nor will it multiply at a high temperature, which accounts for its presence in the early spring. Wet situations are favorable to their development. Prevention is the best treatment, and consists of absolute cleanliness. Not only a clean stall should be given it in which to be born, but clean hands in handling it while wet, and the use of some good disinfectant two or three times daily upon the navel until it has dried and fallen off. Creolin, or any of the other coal-tar preparations are as good as any, and these can generally be found in every barn, and a five per cent. solution can be used for this purpose.

Should the foal become infected, place him in the hands of a veterinarian as early as possible. There is but one satisfactory treatment, and it consists of a serum treatment, which should be used by a veterinarian only. The symptoms are lameness from swollen joints, and the lameness will pass from one extremity to another in quite rapid succession. Foals dropped upon grass which is daily exposed to the sun are always immune.

328. Leucorrhea is a disease very discouraging to a breeder. There are but two primary causes, a want of proper nourishment, and congestion of the genital tract. The latter is often found in a catarrhal condition of the mare, a condition where some inflammation of all mucous membranes is present. There is more of less discharge, and of a nature all the way from a thin whitish

Figure 80.—Microbes frequently found in barren mares. (1200 diameters.)

and slimy to a thick yellowish substance. The hair on the under side of the tail is somewhat glued together. Mares in this condition should never be bred, as the disease is likely to be infectious, and nothing should be done to spread the infection. Only two or three per cent. of such mares will breed, and only when the semen is introduced directly into the uterus.

There are thousands of mares in the country that do not show the usual discharge by which leucorrhea is diagnosed, and yet do show a catarrhal condition, and they will not breed. These mares develop leucorrhea later if not given treatment before they reach that stage. In the treatment of this disease I wish to call the attention of veterinarians to the fact, that while the disease itself may yield as quickly to the permanganate of potash treatment as any other, yet the fact remains that mares do not breed, as a rule, after that treatment. I have been confronted with the prob-

lem of barren mares, where the condition of barrenness was the result of leucorrhea in some of its many forms for more than thirty years. It was not because of any desire to do it, but success in breeding made the solution of this problem an actual necessity. Mares with this disease, but of breeding age, are now giving me very little trouble. It takes much labor and some money to put such mares in condition but practically every one of breeding age can be made a breeder.

In many instances of leucorrhea the uterus will be found in a normal condition, while in others the uterus will be found the source of all the trouble. It is well to use the thermometer in the diagnosis of all suspected cases. If the uterus is normal it will show a temperature the same as that of the body. If the uterus is the source of the trouble a high temperature will dis-

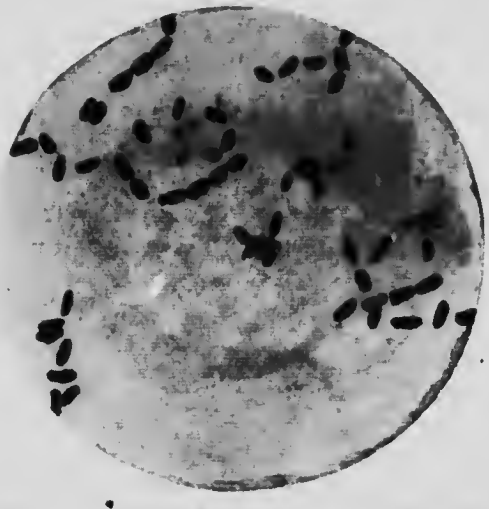


Figure 90.—Bacilli of contagious abortion in mares. (1000 diameters.)

close the fact. When the mucous membrane of the vagina, only, is inflamed, the local treatment need extend no further, but if the uterus is the source of the inflammation, then the local treatment will have to extend to this organ.

It will be noticed that most mares in this condition, and I will include all mares of a catarrhal nature, are more or less debilitated. I look well to this first, and usually give a tonic twice daily in the feed, of ten grains of sulphate quinine, ten grains sulphate of iron. For local treatment I have found nothing better than irrigating vagina, or uterus when necessary, with a gallon of hot water at a temperature of 105 degrees into which has been added a half teaspoonful of sulphate of zinc. As soon as the tonic has put the mare in good condition, and this may be two weeks or it may be two months, instead of the tonic give twice daily in water, from one to two drams of fluid extract of Mitchella

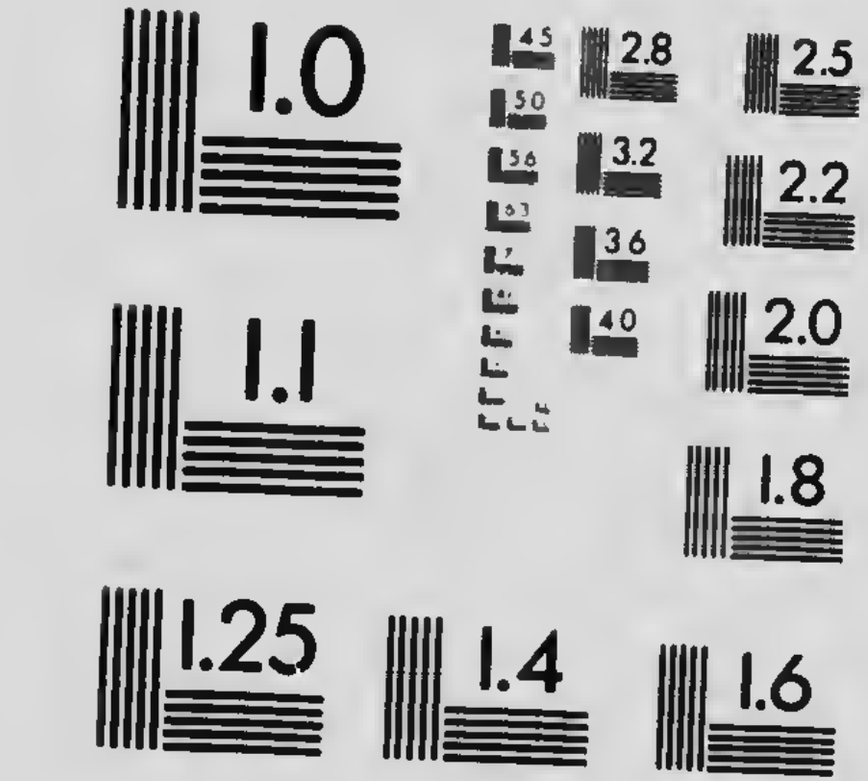
Repens. I have been using this specific for barren mares, and those troubled with catarrh and leucorrhea for 11 years with uniformly good results. The sulphate of zinc is one of the best stimulants for mucous membranes we have. It is used by oculists in almost every preparation known for granulation or inflammation of the eye. Mares breed readily after this, if there be no trouble other than that indicated. The fluid extract of Mitchella Repens I have never known to be used in treating mares until used by myself. With good hygiene, good nursing, and treatment as directed, I have made producers of many mares given up as barren by others. The Mitchella Repens (squaw vine) will stimulate the action of the ovaries as will nothing else.

329. Abortion in mares is the last disease to be mentioned in this chapter. This disease, so costly to breeders, can be divided into those that are contagious or infectious and those that are accidental. Abortion is the expulsion of the impregnated ovum at any period from the date of fertilization until the foal can survive out of the uterus. Accidental abortion may be brought about by reason of anything that very profoundly disturbs the system. Violent inflammations of any important internal organ, acute indigestion, diarrhoea, the presence of stone in the bladder, uterus or kidneys, may so disorder the uterus as to induce abortion. Service by the stallion, blows on the abdomen, rapid driving or riding, over pulling on heavy loads, backing loads, rough handling or the use of the whip, slipping, jumping, slipping, falls, working in deep mud or snow are all well known causes of abortion. It will be noticed, however, that most abortions occur just after cold rains and sudden changes of weather from warm to cold about eightly per cent. of all abortions occur at such times. Irritant medicines, the ergot of rye or other grasses, the smut of corn and other grain, and various fungi in musty hay are other causes. Frosted food, indigestible food, green food in a frozen state, and filthy, stagnant water are all dangerous to use for pregnant mares. In addition to all these one must not lose sight of the diseased condition of the fetus, or its membranes, entailed by a sire of low vitality, whether caused by two frequent service, or a want of proper exercise.

The symptoms vary according as abortion is early or late in pregnancy. During the first two months, and by the way the largest number of abortions occur at this time, the mare may abort without observable symptoms, and the fact is made known only by her again coming in heat. If closely observed a small clot of blood may be found, in which the embryo will be revealed. If the occurrence is later in gestation, there is likely to be some general disturbance, when the small body of the fetus will be expelled, enveloped in its membranes. Abortions during the last stages of pregnancy are attended with greater constitutional disturbance; the process closely resembling normal parturition. There is the swelling of the vulva, with mucous or even bloody

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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discharges, the abdomen droops, the flanks fall in, the udder fills, and the first pains of parturition begin. Abortion may be followed by the same accidents as normal parturition, such as malpresentations, flooding and retention of the placenta.

Treatment should be preventitive as much as possible, to the extent of avoiding all causes of constipation, diarrhoea, indigestion, unnecessary medicines, painful operations, and abuses of all kinds. When abortion is threatened, the mare should be placed by herself and given one-half ounce of fluid extract of black haw, three times daily. The best veterinarians now regard this as the most active preventive of abortion known. Carbolic acid may be given in small quantities with good results. About 20 drops given with the fluid extract of black haw twice daily would probably be better than either of them without the other. If the mare strains, leading her around for a time will sometimes stop it, but if does not, this should be checked by some sedative. One ounce of laudanum in two ounces of water may be given every three hours until straining has ceased.

If all measures fail and abortion proceeds, all that can be done is to see that both fetus and membranes are removed. After abortion, good care should be given the mare in the way of exercise, pure air and wholesome food. No mare should be bred sooner than three months after an abortion, and some mares never conceive after one abortion. If a mare is bred and conceives, she should be treated for abortion before the next abortion is imminent. This can be done best by giving the black haw and carbolic acid as suggested, about one month earlier in the gestation than at which she aborted the preceding year.

330. Contagious Abortion is not likely to be present in mares as in other domestic animals. It is only in low, undrained localities that I have found trouble of this nature among mares. It never occurs in high altitudes, and very rarely in high land localities of lower levels. No disease is more difficult of diagnosis, since we find mares in the same herd manifesting many symptoms. In most cases the mare appears sluggish, listless, even stupid. Occasionally the opposite is indicated, the mare acting restless and nervous. A temperature or one or two degrees above normal is the rule for a day or so before the fetus is expelled. The cause of the disease is a germ or bacillus shown in figure 90.

These bacilli were present in all of seventeen cases of abortion in one herd. Not a mare in this herd escaped. The microbes were found in the excrement of geldings and young mares running in this herd, yet all animals incapable of producing foals were normal in every way. They were found in the excrement and blood of all mares aborting. Every fetus expelled was found to contain them in all parts.

Blood serum cultures were injected into pregnant sows and cats with no evil results, but a five year old pregnant mare in-

noculated with pure cultures aborted 11 days later. I found that the cultures multiplied most rapidly at a temperature of 40 to 50 degrees F. This will account for the prevalence of the disease late in the autumn.

Since these germs are found only in low lands, it can not well be said they are associated with filthy conditions and surroundings. Mares running in low pastures but having access to yards of any kind, or to filthy places are as likely to contract the trouble, as those having access to filthy yards and stables.

The disease is highly infectious, as is evidenced by every mare in a herd aborting, and the stallion is quite likely to be the source of infection. No stallion should ever be mated with a mare known to have aborted. Such mares should be bred by the capsule method. Mares will carry the infection from year to year and for many years. Because of this mares aborting from this cause should be thoroughly disinfected before being rebred. Every fetus of this character should be destroyed by burning, and mares aborting should be removed from all other pregnant mares.

CHAPTER XXII.

BARNS AND BARN BUILDING.

331. General Plans. It would require a full volume to do justice to this subject. Success in breeding depends so much upon the manner in which mares are housed, that a brief mention of the subject is made necessary in this work. Only the general principles of barn building will be discussed, however, and these but briefly.

332. Ventilation. One of the essential things in housing horses which are to be used for breeding purposes, is that of ventilation. Too much fresh air can not be provided for them, and this can be supplied best by having high ceilings and admitting the air near the ceiling. This will make it impossble for direct draughts to fall upon the horses. Bad or vitiated air can be best disposed of by air shafts running from the roof to near the floor. If the poisonous gases are thus drawn off, and the ceiling high above the horses, the general health of the animals will be good. Colds are seldom known in barns where fresh air is supplied in abundance.

333. Sunlight. Of equal importance for the health of the horse is plenty of sunlight. It is not only the best and cheapest germicide known, but the eyes of horses kept in barns well lighted are always better than those housed in dark and poorly lighted places. An abundance of light can be given a barn, and with very little expense by the use of windows wherever a space can be found for one. If small windows are used placed well up to the ceiling, they can also be the source of fresh air, and these are the two essentials, if health be desired in a breeding barn.

334. Drainage. In the building of a barn good drainage should also be secured. If the barn is located in a city having a sewer system already established it can be easily drained and kept in a sanitary condition by connecting the drainage with the sewer. If the barn is to be built in the country or in a small town, it should be built on an elevation admitting of good drainage. Unless good drainage is provided one need never expect his horses to remain in a thrifty and healthful condition.

335. Floors. In barn building, never make a floor of wood in any part of the barn to be occupied by horses. A wooden floor can not be kept in a strictly sanitary condition by any known means. If any floor other than earth is to be made, let it be of concrete. No floor ever built under a horse has so many good qualities as concrete or cement. Such a floor can be built that

will last for 50 years, and at all times is easily kept in a sanitary condition. It is not expensive, either, costing but little more than a good plank floor. For heavy stallions I make the floor eight inches thick, and six inches for the other horses. The

Figure 91. Front elevation of a breeding barn

bottom is made with one part cement with three parts gravel, finished on top with cement and gravel, equal parts, and two inches thick. It should be left in the rough, no trowel being used. To get the surface level or to an specified grade, a straight 2x6 board can be used. It will be noticed that I use no sand. In

foundation work sand is seldom used by one, and I use gravel on top instead, that I may have a rough surface. Even a horse without shoes will never slip on such a floor. So long as the general level or grade is secured, it matters not how rough the surface may be. The rougher it is the better it will be for horses from every viewpoint.

336. Cement. I am often asked if the cement is not a bad thing for the horse to stand upon. Instead, it is the best thing

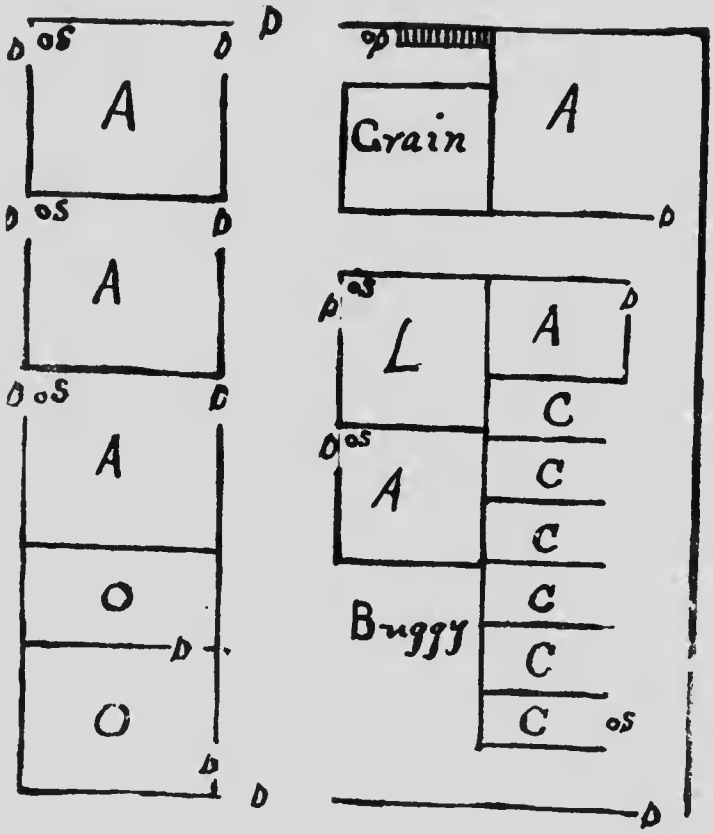

Figure 92.- Ground floor plan of barn shown in figure 91. A—box stalls; C— open stalls; O— office; L—breeding room; S—sewer.

a horse can have under him. If men would do a little thinking for themselves, most of these questions would answer themselves. All horses grown near the sea coast and at low altitudes have a broad foot, with a thin, weak wall, while horses grown at high altitudes and in dry territory always have feet, high rather than broad, with thick, strong walls. The goat offers a good illustration. In his native habitat we find him living upon the rocks, and his foot is more flinty, of finer and better texture than any

of which we know. The horse is no exception to this rule. I have been keeping both stallions and mares upon cement floors for many years, and with a noticeable improvement of their feet When I sold Nicolas 21007 (43394), August 10th, 1910, the quality of his feet was the cause of much comment. He was in his fifteenth year, and yet his feet were much better than when he came from the old country nearly 12 years prior to this time He had been kept upon cement floors for many years. Horses standing upon cement or any other kind of floors should be well bedded at all times.

337. Earth Floors. The second best floor for horses is one rightly made of earth. If a good tight wall is placed under a

Figure 93. Horse barn.

barn and the inside filled with 15 to 18 inches of the right kind of material, one has a very good floor. Before filling, tile should be laid thickly throughout the building, sloping downward from the center to the outside if the barn is built upon level ground, and from the higher to the low r side if built upon sloping ground or a side hill. Upon these one can begin to fill with clay or other soil that can be firmed down, or even with broken stone, brick or very coarse gravel. For the surface nothing will be found better than clay and coal cinders, equal parts of each. Such a floor well pounded down before using is far better than any plank floor. The plank floor is to be condemned because of absorbing filth and microbes, besides making an ideal breeding place for rats and mice. In addition to these objections, is that of the space below the floor being filled with poisonous gases.

338. Barn Plans. Figure 91 gives the front and side elevation of one of my barns, this one being used exclusively as a stallion or breeding barn. It has a floor space of 56x64 feet, and two sheds in the rear, not shown in the photo, 20x60 feet each. The ground floor plan is shown in figure 92, where it can be seen that a driveway 10 feet wide runs through the barn. There is highly satisfactory. This barn is 36x80 feet, with eight box stalls 14.8x16 feet each; three smaller box stalls; an oats bin; a bran bin; pump and stairway; and a breeding laboratory where all tools and stove for heating water are kept. There is also six open stalls for mares during the breeding season, the sheds in the rear being used for the same purpose. Every stall is connected with a sewer system owned by myself. The floor above affords room for 60 tons of hay. This barn complete was built for $3,300.

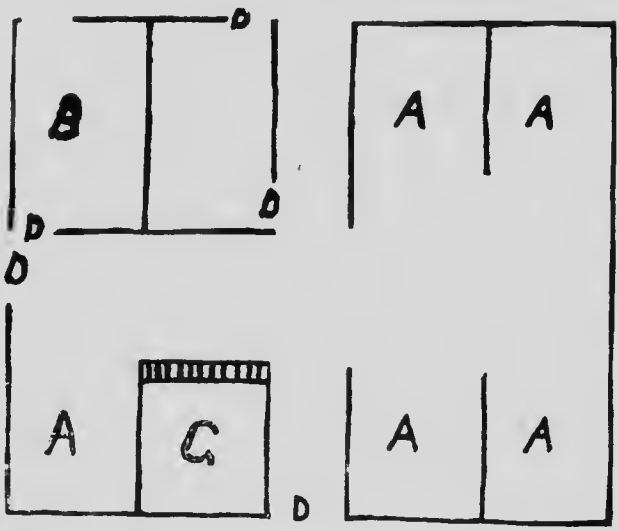

Figure 94.—Ground floor plan of barn shown in figure 93. A good farm barn. A—open stalls; B—box stalls; G—grain.

Figure 93 is that of a barn on the farm of Wm. J. Knebel, three miles south of Norfolk. This barn was built to be used for horses only, and is 36x48 feet, with much space above for hay and grain. Figure 94 is a ground floor plan of this barn, which has cement floor throughout.

Figure 95 is that of a brood mare barn which has given results highly satisfactory. This barn is3 6x80 feet, with eight box stalls upon one side, and nine open single stalls five feet wide; two double stalls each 10 feet wide; a tool and harness room 5x12 feet; and a grain bin 10x12 feet on the other side. There is a driveway of 10 feet through the barn. The box st lls open with sliding doors from the driveway, and there is a window 16x30 inches in each stall near the ceiling, which is ten feet from the

floor. The floor is cemented throughout. There is space for 100 tons or more of hay. The cost complete was $1,925.

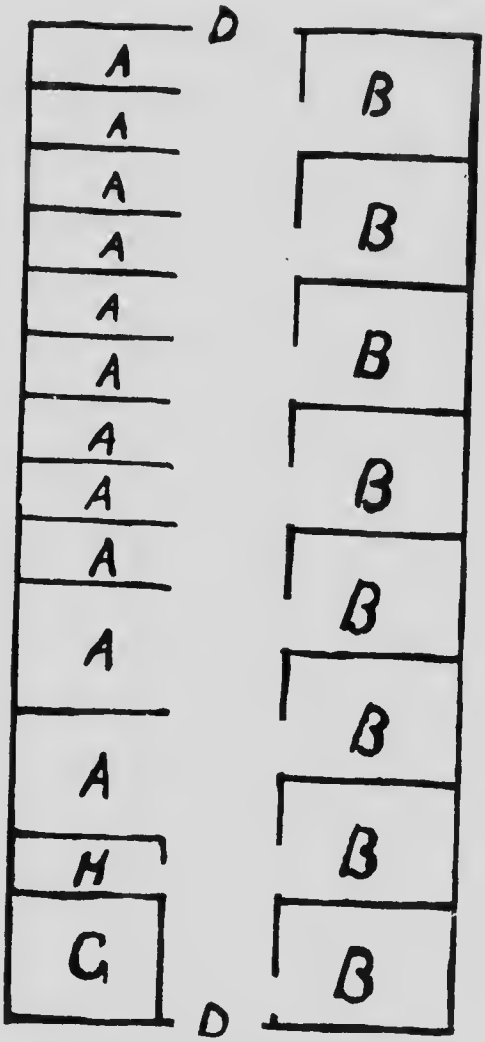

Figure 95.—Ground floor plan of a barn for brood mares. A—open stalls; B—box stalls; G—grain; H—tools.

339. Open Sheds. It is not necessary to build expensive barns to be successful in breeding. An open shed to run under in times of bad weather will give as good results as the most expensive barns. I have been handling mares in this manner for several years, and with very good results. This is also a very good way to winter young colts. Barns are only necessary with

mares that have to be in harness at any time. It will not do to work mares during cold weather and turn them out in the cold at night. If they have been warmed in the least they should have good housing at night.

340. Cost of Barns. It is wholly a matter of one's own finances as to what a barn should cost. A barn such as shown in figure 95, and which cost $1,925, can be built for around $800. It is all in the manner of building and finish, as to what the cost will be. The cheaper one will look cheaper and last a shorter time, but will be quite as likely to serve its purpose as the more costly one. Even the open shed which costs so little does quite as well if the foals are dropped after June first. The most noticeable difference will be the saving of hay and grain when using the better barns.

CHAPTER XXIII

BREEDING FACTS WORTH REMEMBERING

341. Salt. Breeding animals should have all the salt they will consume. They are prolific, or otherwise, in proportion to the salt contents of the body fluids.

342. Evidence of Virility. A stallion's desire, or readiness to copulate, is no evidence of his virility. Some of the most virile stallions are very slow servers.

343. Fat. Excessive fat in breeding animals is a potent factor in the cause of sterility, impotency and degeneracy.

344. Death of Foals. Most of the young foals dying are those coming early, rather than those coming later in the season.

345. Evidence of Pregnancy. The only satisfactory way of knowing whether or not a mare is pregnant is by examination via the rectum. After the third month this can be done with certainty, but with sensitive mares may induce abortion.

346. Frequency of Service. A draft stallion will sire more live foals by making one service per day, than he will by making two or more services daily. Excessive service is a frequent cause of sterility, besides producing many weakly foals.

347. Barrenness. If your mare will not breed, ask yourself why. Nature made every female a producer of her kind.

348. Cost of Maintaining Barren Mares. Barren mares are costing the breeders of the United States more than $200,000,000 annually. This is a tax upon the breeder and the country which should no longer be tolerated.

349. The Brood Mare. Give the brood mare a chance. Her foal will sell for more money than her labor.

350. The Capsule Service. Where the work is properly done, capsule service will result in 30 per cent more foals than natural service.

351. The Care of Foals. To mature a foal into a good horse, requires good feeding as well as good breeding. If five pounds of oats per day will make a good foal, ten pounds will make a better one.

352. The Education of the Foal. An hour spent in the early education of a foal, is worth more than a week spent later in breaking.

353. Pure Air. No tonic ever sold over a drug counter is worth so much to breeding stock as pure air.

354. Pure Water. To do their best, horses require pure water quite as much as yourself.

355. Exercise. No foal will mature into a good horse, nor will a stallion sire the best foals possible, without an abundance of exercise.

356. Kindness. Many vicious horses can be made valuable by the use of kindness, and many good horses have been spoiled by the want of it.

357. Working Pregnant Mares. There is no reason why pregnant mares can not be worked and produce good foals, yet taken as a whole they never have been. This should serve as a lesson in teaching us to work them carefully, and with good judgment.

358. Grass. There is no food so good for the brood mare and her foal as good grass, and the more so when fed in connection with good oats.

359. The Value of Good Hocks. Look well to the hocks of the stallion used upon your mares. No part of the horse is of such vital importance.

360. Cleanliness. In all things pertaining to the care of the horse, cleanliness should be regarded as of the greatest necessity for successful breeding.

361. Breeds. Be satisfied with nothing below the best, whatever your favorite breed. A good horse is always a member of a good breed.

362. Feeds. If you are feeding for the fat stock show, or the market, corn will help in making your ration, but if you are feeding for foals, let the corn be no part of your ration.

363. The True Draft Horse. If you desire to produce the real draft gelding, so much in demand, you will have to use real draft sires.

364. The Intermediate Type. Labor as much as we may to produce large horses, yet the law of reversion will always give us an abundance of the smaller or inermediate types.

365. Temperature in Breeding. The real producers among mares are those with low temperatures, while mares with temperatures indicating 101 degrees or higher seldom breed.

366. Spermatozoa. The best success in capsule breeding will be had by keeping the semen at a temperature of 98 to 100 degrees.

367. A Tainted Press. In patronizing the live stock press of the country, the breeder should know positively that he is patronizing a publication representing his industry, rather than a tainted press which stands for a class as against the real producer of horses.

368. Showing Horses. As our shows are now conducted, mares can not be used for both the show ring and breeding. It is for you to decide which use to make of them.

369. Advertising. If you are going to advertise your horses, as a means to selling them, patronize journals read by actual breeders. Breeding good horses only, is the best advertisement.