new colony, the division is generally due to the appearance of a new queen.

The queen bee, usually quite contented with her lot, watching over her progeny, active and patient in the care of her eggs, becomes furious if a rival arises in the hive. She pounces upon her, and they sometimes fight to the death. So well is this understood in the hive that the workers take care to prevent such conflicts by holding back the new queen, just ready to be hatched from her royal cell, till the bees have swarmed. At such a time the workers will stand by the cell, out of which a queen is to be born, ascertain how far her transformation is completed, and, should there be a disposition of the young queen shortly to creep out, they increase the deposit of wax upon the lid which shuts the cell, thus preventing the egress of the royal prisoner. If she tries to break through or attempts to gnaw her way out, the workers crowd around the opening or accumulate such an amount of wax upon it as to frustrate all her efforts. When the old queen has peacefully departed, the new one is set free. What makes this fact more extraordinary is, that usually the workers have never seen the birth of a queen or perfect female before; their hive has known but one queen, and yet they anticipate and guard against all the dangers likely to arise from a second. Can it be that these creatures do the right thing at the right time consciously, by means of any faculty similar to our reason?

The warm, having escaped, chooses a place for the new colony—a cavity in the rocks, perhaps, or a sheltered notch among branches of trees. The swarm having alighted near a favourable spot, a single working bee—one out of twenty thousand, perhaps—starts from the crowd and lays, not the first stone, but the first piece of wax which is to be the foundation of a new comb. Before swarming, they have provided themselves with an ample supply of wax and food, and are prepared to build their new home.

The construction of a honeycomb, with a double row of cells on opposite sides, dovetailed into each other, and with larger cells for the drones and the special cells for queens, is so well known that I need not dwell upon what every encyclopædia will give. The first cells, being raised upon an uneven surface, are often irregular and may be uninhabitable on that account, but they then make the foundation for perfect cells, whose regularity and precision of form and relation have been the wonder of all ages. The irregularity of the first cells, adapted to the unevenness of the surface, seems only another evidence that these animals work deliberately, not like machines. Dr. Wyman has published a most interesting paper upon the irregularities of the cells in a honeycomb; I dwell upon the fact that the first cells present every possible variety of shape modified to suit the situation, because it is not generally understood.

The first bee having made the first cell, a second bee comes and stands opposite her, head to head, then another at her side, so that the two stand side by side, and the rest follow in definite position, each building a cell around itself until gradually a good sized comb is built, it may be a foot in length and six or seven inches in depth, the width being uniformly that of a double row of cells. All this work is done by the imperfect females or so-called workers. Neither drones nor queen take any part in it. The working bees, on the contrary, are ever active, bringing in supplies for the community, swarming out daily to collect honey, filling the cells as fast as they are completed with food, and then closing them to prevent escape, thus securing a large store of honey. The drones meanwhile look lazily on. Sluggish and inactive, they seem to have different temperaments from the working bees.

The Distinctive Character of the Cells.

The honeycomb being sufficiently advanced, the queen now begins to lay her eggs in the cells. Here comes in another marvellous evidence of that power we call instinct. We have seen that a certain numerical proportion is essential to the well-being of a hive. There must be but one queen and at the most two or three queens' eggs, and even then trouble is sure to arise when these are hatched; there must be several hundred drones, and there must be many thousand workers. In preparation for this, the workers have laid out the cells as systematically as if they had been guided by a superior intelligence; special cells adapted for the eggs out of which the thousand of imperfect females or workers are to be produced; others somewhat larger, intended for the development of the less numerous drones, and a very few so-called royal cells, still larger than those of the drones, many times larger than those of the workers, and of a very peculiar form, out of which perfect females or queens are to grow (Fig 5).

The queen cells stand out from the rest of the comb, and have a large opening. Two or three such cells, will usually be formed in one comb. In old colonies, it often happens that no provision is made for the advent of a new queen, and in that case no royal cells are built; but in a new community several such cells may often be seen upon one comb. Still more perplexing than the impulse, or instinct, or unconscious perception, by which the workers are guided in the preparation of these cells, is the intelligent selection shown by the queen in distributing her eggs among the various kinds of cells. She finds thousands and thousands of small cells, and in these she deposits fecundated eggs out of which nothing but workers grow. In the royal cells, or, as is the case in many hives, in one royal cell, she lays an egg, also fecundated, out of which is sure to grow a perfect female, or, in other words, a queen. The eggs of the perfect and imperfect females do not differ originally; the ultimate difference is brought about by a special mode of nursing and feeding the royal egg, the workers supplying the royal cells, in advance with pollen from the stamens of flowers and honey; so that when the little grub comes out of the egg, it finds itself in the midst of the nourishment necessary for its development into a queen bee. How do these careful nurses know the amount and quality of food needed by the eggs they have in charge? To this question there is no answer. But there is no doubt of the fact, and they perform their work with surprising economy and accuracy. In the drone cells the queen lays only unfecundated eggs, and these always produce males and males alone. The faculty by which all these acts are performed without teaching, without preceding experience, without any antecedent knowledge of the conditions necessary to the life and growth of the eggs, that faculty we call instinct, in contradistinction to those mental processes involving argument, rational consideration, combination and adaptation, by which acts are performed under full consciousness of all contingent conditions.

The Eggs: What they Bring Forth, and How they are Fecundated.

It may be asked how it has been known that certain eggs were fertilised while other remained unfecundated. The facts have been gradually made out by very careful and connected observations. It is known that with bees, as with most birds, the act of copulation takes place outside of the hive in the air during flight. It happens sometimes that a queen bee, from injury or from malformation, defective wings, for instance, is unable to fly and cannot leave the hive. Under these circumstances she is incapable of fecundation and yet has been seen to lay eggs, and those eggs invariably produce males or drones. This fact gave the clew, and successive observations proved beyond a doubt that the workers were always born from fecundated eggs. It remained a mystery how, in the same ovary, a certain number of eggs could come under the fertilising influence while the rest remained untouched.

Siebold ascertained by a skillful anatomical investigation, that the special organ of the queen bee, in which spermatic particles are received, has a muscular apparatus which enables her to close or open it at will. This organ, known as *receptaculum seminis*, is placed just at a point of the oviduct or canal through which the eggs are passed when they are dropped from the ovary, half way between the ovary and the outlet of the oviduct. The queen stands on the edge of the cell in which either fecundated or unfecundated eggs are to be deposited. If the former, she has the power to open this receptacle, the organ in which the spermatic particles have already been received, and to allow one or two such particles to come into contact with the egg; if not, she can close the organ and allow the egg to pass out unfecundated. Siebold has shown that eggs cut out above the opening of the *receptaculum seminis* into the oviduct, at which these organs connect, are always unfecundated.

Siebold has investigated a similar set of facts in the history of an ther species of Hymenoptera, a kind of wasp of the genus *Tolistes*. In this case, the queens, which are fecundated in the autumn, begin to lay their eggs early in the spring; out of these egg are born a variety of individuals, workers and males, as in the bee community. By a careful de-truction of all the males, which was accomplished without injury to the comb,