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THE

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SKETCH OF HUXLEY.

BY W. A. MACLAREN, '96.

[Read before the Natural Science Association.]

As a boy, Huxley had a strong desire to become a mechanical engineer, but this youthful wish was not to be realized, notwithstanding the peculiar aptitude he showed for solving mechanical problems. Force of circumstances led him to the medical profession, where, for a time, he studied in an aimless, indefinite way. In his altogether too meagre autobiography he says that for some years his time and mind were occupied in desultory reading, and it was not till he came in personal contact with Wharton Jones at Charing Cross Hospital that he realized his own powers. He decided at that time to be a biologist—a physiologist, if possible. But the two foremost men in physiology of that time had studied that branch of science from sheer love of it, and were obliged to earn a bare living in opthalmic surgery.

So Huxley turned his mind to morphology for the present, and fortunately for the world of science that he did so. His contemporaries were good observers but rash speculators, and it fell to Huxley to eliminate speculation, in his endeavor to bring morphology in line with the advance of the other exact sciences.

With what success he did so, may be judged by the fact that had he never accomplished anything else he has left foundations enough to build for himself a substantial fame in that branch alone that would not be dimmed in comparison with the works of Newton, Farraday, or Darwin.

His book on the "Medusæ," worked out amid all the hardships and inconveniences of ship life, away from references of any kind, shows the efforts of a clear, decisive intellect, striving to see through the gloom of the unknown and holding fast to facts undeniably established. In subsequent memoirs on the Molluscs, Tunicates, Arthropods and Vertebrates he followed the same line of inquiry. However, it is not as a morphologist that he is popularly known, nor as a physiologist, in which he held a professoriate chair for years and in which subject he gained great distinction, but he *is* known as a hard-fighting, vigorous opponent in debate and an able exponent of Darwinism. It was left to three men to decide the fate of the "Origin of Species." These were Lyall, Hooker, and Huxley. Darwin said if he could but get these three persuaded to his thinking he cared not for the rest of the world. Writing to Darwin, Huxley says :—

"As for your doctrine, I am prepared to go to the stake, if requisite, in support of chapter ix. and most parts of chapters x., xi. and xii."

Anticipating the opposition the "Origin of Species" would arouse, he concludes : "I am sharpening my claws and beak in readiness." This is the key-note to much of Huxley's life. A keen debater and logical reasoner, readily foreseeing the future effects of present causes, he would have had few peers, if any, in the House of Commons had he turned to politics. But it was not from any vain glory that Huxley donned the armour of a warrior on Darwin's behalf. Little by little he relinquished his narrower studies and earlier joys in working out special problems, in order to give himself up to the larger pursuits of life.

It was these wider issues at stake which forced him to fight so gallantly for the sake of scientific truth. He hated dogmatism and bigotry, especially theological, and was most bitter when denouncing some unworthy idol of his adversaries. In his younger days he had realized the selfish joy of successful and

progressive inquiry into the confining realms of science. These he gave up, not without regret, to become the apostle of the scientific method of inquiry, which he had found to be the only means of solution to those great problems of the universe which lie all around us.

This philosophical turn of mind took possession of him in his later days, impelling him, by a deep altruistic sense of duty and citizenship of the world, not that he loved science the less, but that he loved man the more. His disciples to this newly founded school of inquiry were at first few, because even the men of science had to be taught, but in a few years his genius was working in the minds of many. Unlike his great contemporary Darwin, who kept himself a solitary worker, Huxley held out a welcoming hand to every zealous student whom he thought could profit by his aid.

As a debater, his powers were first generally recognized in his discussion with Bishop Wilberforce, at the British Association, where he fought his way and that of science single handed, encouraged by only a few earnest followers, till the whole house resounded in applause for him. He delighted to bewilder his audience by startling ideas. At the Metaphysical Society he once declared that, if a frog had a soul at all, it must have two souls, just as the spinal cord has a twin purposive action.

To all questions Huxley applied the same method of solution, unlike many men of science, who are governed by one code of rules for religious questions and by another set of laws for matters of science. He felt that the unreserved application of the scientific method was the best guide to man in *all* things. It is an undeniable fact that he felt great antagonism and bitterness towards theologians, who were in the habit of putting up trespass signs. For instance, it was, and to a lesser extent still is, their custom to block all inquiry into the history of the first chapters of Genesis by the metaphorical notice: "No Thoroughfare. By order, Moses." This was his most powerful enemy, and has always done much to prevent the spread of scientific truths.

Of the two conceptions of man, theological and scientific, he abhorred the former, and unreservedly gave himself up to the latter. But strong as was his conviction that the moral and

temporal welfare of man can best be secured through the scientific method, no less was it evident to him that science had its limits which must be recognized, and to this realm of the unknown, beyond the pales of science, Huxley gave his worship, which was, as he himself expressed it, mostly of the silent sort. He introduced to current use the word "agnostic," not that he uttered it with that light-heartedness and popular flippancy which is so common to-day, even among men of science. To him, it was, together with the positive teachings of science, the guiding star to higher and nobler things. He conceived it to be the only true sort of religion. It fostered and cherished the noblest of man's emotions. Sympathizing with the Athenians, who bowed to the "Unknown God," he himself knelt at the altar of the unknown and unknowable. No greater devotee to science could be found, but it was an elementary truth to him that science could never touch, even for one brief moment, that "dream with which our little life is rounded."

It did not follow, because of his loyal adherence to science, that he must believe, as did Haeckel, in materialism. He says: "The only freedom I care about is the freedom to do right; the freedom to do wrong, I am ready to part with on the cheapest terms. . . . But, when materialists stray beyond the borders of their path, about there being nothing else in the world but matter and forces and necessary laws, I decline to follow them."

Of all Huxley's works, perhaps that most widely read is his "Lay Sermons," and to me one of the most powerfully expressed thoughts in all these addresses is this :—

"Suppose it were perfectly certain that the life and fortune of every one of us would, one day, depend upon his winning or losing a game of chess. Don't you think that we should all consider it to be a primary duty to learn at least the names and the moves of the pieces, to have a notion of a gambit, and a keen eye for all the means of giving and getting out of check? . . . Yet it is a plain and elementary truth that the life, the fortune and the happiness of everyone of us . . . *do* depend upon our knowing something of the rules of a game infinitely more difficult and complicated than chess. It is a game which has been played for untold ages, every man or woman of us being one of the players in a game of his or her own. The chess board is the world, the pieces are the phenomena of the universe

and the rules of the game are what we call the laws of nature. The player on the other side is hidden from us. We know that his play is always fair and just and patient. But we also know, to our cost, that he never overlooks a mistake or makes the smallest allowance for our own ignorance. To the man who plays well, the highest stakes are paid . . . and he who plays ill, is checkmated—without haste, but without remorse. My metaphor will remind you of the famous picture in which Retzsch has depicted Satan playing with man for his soul. Substitute for the mocking fiend in that picture a calm, strong angel, who is playing for love, as we say, and would rather lose than win, and I accept it as an image of human life. Well, what I mean by education is learning the rules of this mighty game."

But, how does he know that the strong angel is always fair and just? He presumes what he would take another to task for saying. And is this not at variance with the rest of his life, where all he could say was, "I believe." Here he declares he "knows." But this is not so startling as the greater discord, when he says, in another place, that he thinks Jesus of Nazareth to be the "almost perfect realized ideal" of humanity. Did he forget that Christ, of all men, led us farthest from the worship of the unknown—Huxley's own agnosticism?

Further, he tells us that this hidden player is one who does not even give a word and a blow, but the blow without the word, and it is left to you to find out why your ears are boxed. Perhaps to Huxley, who was an adept at boxing others' ears, this seemed just and angelic, but it seems to me a little harsh that the unfortunate player must find out even the rules of the game, yet it was to this same hidden player that Huxley gave worship of the silent sort—a player without qualities or attributes—the great Unknown.

This is the most fatal link in the armour in which he so implicitly relied.

The great scope of the man's mind may be judged, however, when it is known that, listening to the debater, one forgot the zealous student and investigator, and, hearing him talk of pictures and music, it was the man of letters one saw. Yet this was the smallest part of his life; by far the greater was that which shaped his being—a heart full of love—clinging to the circle of his family and friends in true devotion—a love that spread over all

his fellowmen, in kindness and justice. This human side of him shows us how much the agnostic has in common with the man of faith.

On the northern heights of London, he now lies buried, with this inscription on his tombstone :—

> "And, if there be no meeting past the grave,
> If all is darkness, silence, yet 'tis rest.
> Be not afraid, ye waiting hearts that weep,
> For God 'still giveth his beloved sleep,'
> And if an endless sleep He wills—so best."

FINANCE IN THE UNITED STATES.

BY CHARLES G. PATERSON, '96.

[Read before the Political Science Association.]

THE United States to-day are at a most critical point in the history of their development. Whether or not they are to go forward and press upward to exalted rank among the great and historic nations of the earth will largely depend upon the legislation of the closing years of this century. Many vital issues confront the Government of the United States, and imperatively demand the immediate thoughtful attention of the electors of the land; but of all these there are three that stand out most prominently and most threateningly—viz., the tariff question, foreign policy, and the silver question; the greatest of which is, undoubtedly, the silver question. For every newspaper and for every magazine, for political speeches and for electoral addresses, for Republican and for Democrat alike this subject has formed, during the last five years, the basis of accusation and recrimination, campaign bitterness, and party toadyism. Yesterday it was the tariff, to-morrow it may be the foreign policy, but to-day it is the financial question.

Nor can the importance of this question be overestimated. Without a sound financial system, there can never be a sound Government; and whenever the Government is unstable, there is great danger. The people can accommodate themselves to a high tariff, to a low tariff, or to free trade; but never to a dishonest dollar. That the financial system of our American friends is not what it should be, and must be ere the wheels of their triumphal car can smoothly run, is painfully apparent to all men. With them, as with all self-governing nations, there are but two great political parties: the Republican and the Democrat. The

Prohibitionist party has had an existence like the flower of the field, while the Populists are not to be counted upon as a constant quantity; for, like the bat, they shun the genial warmth and light of national prosperity, and flourish and grow fat during the darksome days of distress and decline. They comprise the audible representatives of that angry and incoherent discontent with things in general, which is to be found in every state, especially every modern state.

To those two great parties, therefore, we must look for information on this subject, and for a declaration as to the stand taken and the views held by the great body of the people.

In a recent number of the *Century** appeared two interesting articles under the heading "The Issues of 1896"; one written from a Republican point of view by Hon. Theodore Roosevelt, the other from a Democrat standpoint by ex-Governor William E. Russell. In the first place, each writer tells us that, without doubt, the most important question now before the electorate of the United States, and the one on which the Presidential campaign of 1896 will be based, is the silver question. When we endeavor, however, to ascertain from these articles the position taken by each of the great parties on this all-important issue, we are completely non-plussed. The Republican tells us, confidentially, that it seems likely at present that the Democrats will make no open fight for free silver; but that, as their leading men occupy every conceivable position upon this as upon all other public questions, it is quite impossible to tell what any Democratic nomination really will mean. But on the other hand, and in marked opposition to such vacillation and hesitancy, he assures us that the attitude of the Republican party is absolutely clear. It does not depend in the least upon whether the crops are good or bad, upon whether the business community is or is not in a flourishing condition; the Republican party is, as it always has been, unflinchingly against the free coinage of silver.

Well! surely that is a plain enough statement of the case. There we have the past and the present attitude of both parties revealed to us in terms which cannot possibly be misunderstood, in language which can have but one meaning: the

* *The Century*, November, 1895, pp. 68-78.

Republicans will be firm and unflinching in their opposition to the free coinage of silver, while not even the Democrats themselves can predict what will be their final views and belief.

Of course there is no necessity to read the second article; but curiosity prevails, and we turn over the page to see what the Democratic contributor can possibly find to say for himself, and what excuse he will give for the undecided attitude of his party towards a question of so great importance as this.

It is truly somewhat startling to be told, confidentially by this writer also, that the Republican party, forsooth, is a party of compromise and expediency, and that, judged by its past, it will trim and evade to satisfy an aggressive minority deemed necessary for its success. "At the critical moment, the Republican party yields to financial heresy in its ranks, and the Democratic party conquers it. Through such weaknesses have come the many compromise measures as to paper money, inflation, and silver, which have been a constant menace to the stability of our finances. . . . The old Republican malady of timidity and compromise has paralyzed Republican speech; its ambitious leaders remain silent, useless, with their weather eye open only for any little favoring breeze which may drift them onward It is time for them to trim ship, and set a course." On the other hand, he hastens to assure his readers that it is by no means difficult to foresee the course his party will take, and predicts, with confidence refreshing to behold, that in 1896 the Democratic party, in its national platform and candidate, will stand for sound money, and will oppose to the end the free coinage of silver. Both principle and expediency suggest this course. It is in line with the traditions and past of the party; with its platforms and principles; with the whole record of its administration, for which it is responsible; with its own action in opposing and repealing the Sherman law, and so forth.

Thus it ever is, and always has been, and probably will be: the outs accuse the ins of leading the country along the high road to ruin, while the ins denounce the outs as weak, incapable, and dangerous. The Democrats claim that the Republicans have no definite policy concerning this question, on which their rank and file are united; the Republicans say the same of the Democrats, and probably both are to a great extent telling the truth.

From confusion twice confounded such as this, it is a relief to turn and contemplate the one solitary figure in American politics who, for eleven years, has always been the conspicuous and valiant champion of honest money and sound finance. The most recent sensation in political circles across the border is the declaration of the New York *Herald* a day or so ago (Nov. 22nd) in favor of Cleveland as the Democratic candidate for President in the approaching election. This fact is all the more significant when we remember that when General Grant signified his intention of standing for a third term, no paper was more loud and constant than the *Herald* in denouncing such "Cæsarism," and proclaiming the danger to the nation of allowing such vaulting ambition to be gratified. But circumstances alter cases, and it is far from improbable that this third-term superstition may soon be put to the test once for all. Already has Cleveland gallantly led his party in three campaigns; it may be he will lead them in a fourth. In that case he would certainly not poll a consolidated Democratic vote; but what would be lost in one quarter would be made up from another source. He would lose the support of the satellites of Gorman, Brice, Hill, and faithless leaders of that genus; but would gain a large portion of the Republican business men, who desire above all things else that there should be no doubt about the views of the next President on the financial question.

Leaving the present for a moment, let us take a glance back over the history of the financial policy in the United States, as revealed to us in the more important fiscal enactments that have at different periods occupied the attention of successive Governments.

The Constitution of the United States gives Congress the power "to coin money and regulate the value thereof," no mention of either gold or silver being made; so that either or both of these can be used.

By the law of April 2nd, 1792, any person could take gold or silver bullion to the mint to be coined, and could receive back coin of the same species of bullion, weight for weight of the pure metal contained therein. The standard for gold was 11 parts pure gold to 1 part alloy, and for silver 1,485 parts pure

silver to 179 parts alloy. The mint thus retained for the expense of alloying and coining one-twelfth of the pure gold, and a little more than one-ninth of pure silver. There was also a deduction of one-half per cent. in case of the immediate delivery of coin for bullion. Both gold and silver coins were to be legal tender for all payments whatever. This act also established a ratio between the metals of 15 to 1; that is, the silver in a silver dollar was to be just fifteen times as heavy as the gold in a gold dollar; or, in other words, the gold in a gold dollar was to be just one-fifteenth the weight of the silver in a silver dollar. This ratio was not chosen arbitrarily, but represented the existing relative commercial values of the two metals.

In the years 1795, 1800, 1828, and 1834, acts of importance were passed relating to the charges to be paid by depositors of bullion for the expenses of alloying, refining, and coining, when the bullion was above or below the standard. The law of 1837 declared that the standard gold and silver coin was to be nine-tenths pure metal and one-tenth alloy, and all such coins were to be legal tender of payment for all sums. The weight of the dollar was fixed at 412½ grains.

England, in the meantime, had demonetized silver in 1816, and her action in adopting a single standard of gold depreciated, to some extent, the value of silver; so that the mints of the United States* became closed to gold from the fact of its being under value in their coinage. In order to restore the coinage of gold, the Acts of 1834 and 1837 raised the ratio between the two metals to 16 to 1. Then came the great gold boom in California in 1849, with the consequent enormous increase in the rate of gold production. This circumstance, together with the fact that in European countries the ratio was only 15½ to 1, so affected silver in the United States that it almost ceased to circulate. There ensued a great struggle for silver. France made a bid for it; and since, owing to the different ratios in the two countries, silver in France was worth $1.03⅛ when exchanged with the States for gold, and as gold would there answer the same purpose for money as silver, the latter was rapidly withdrawn from that country. To prevent this, Congress passed a law in 1853

* Under the Coinage Act of 1873, by which the minting and assaying service of the United States was reorganized, the following mints are in operation :— Philadel-

making the fractional silver coins of light weight, in order to prevent their exportation from the country. The weight of the silver half-dollar was reduced from 206¼ to 192 grains, and the lesser silver coins in the same proportion. These were made legal tender only in payments of debts which did not exceed five dollars. No private deposits for coinage were to be received at the mint, the director of the mint being ordered to purchase bullion for such coinage, and to exchange such coins at par in sums not less than one hundred dollars. This is the last enactment of any great importance in connection with this question till the famous year 1873.

Previous to that date, then, there was gold money and there was silver money. Congress fixed the unit, *i.e.*, what should constitute one dollar, to consist of 371¼ grains of pure silver, and provided for a certain amount of alloy or baser metal to be mixed with it to give the necessary hardness and durability. By the law of 1837 it was enacted that the standard of both gold and silver coins should be such, that of 1,000 parts by weight 900 should be pure metal and 100 alloy. The alloy of silver coins was to be copper, and that of gold coins to be copper or silver, the latter not to exceed in any case one-tenth of the whole alloy. Thus 371¼ grains of pure silver constituted a dollar, the unit of value. All fractional coins, such as dimes, quarters, and half-dollars, were to be counted from this unit of a silver dollar. Gold was also made into money, but its value was likewise reckoned from these silver-dollar units. The ratio between silver and gold was first 15 to 1, and afterwards 16 to 1: so that in making gold coins, their relative weight was regulated by this ratio. When the ratio was changed, the silver-dollar unit was left the same, original size, and the gold dollar made smaller. This was enacted by the law of 1834 referred to above. From 1792 to 1873, or nearly a century, the unit of value was never once altered. During that long period, both gold and silver were legal tender in the payment of all debts, except with regard to

phia, San Francisco, Carson City, Denver; and the following assay offices :—New York, Charlotte, Boise City. The Bureau of the Mint of the United States is in charge of the Director of the Mint, who is under the general direction of the Secretary of the Treasury, and appointed by the President, by and with the consent of the Senate, for five years.

the lesser silver coins legislated upon by the law of 1854, and the mints were open to the coinage of all that came. During that period the United States currency system was on a silver basis with gold enjoying equal privileges, except that silver fixed the unit and the value of gold was regulated by that unchangeable unit. That was what is known as *bimetallism*.

The next era in the financial history of our American cousins opens with what has been called, in vigorous language, "the crime of 1873." On February 12th of that year, Congress passed an act for the revision of the coinage laws, which prohibited the coinage of the standard silver dollar. Since then all silver dollars have been coined on Government account; *i.e.*, the Government buys the bullion and coins it as prescribed by law. The unit clause in the statute of 1792 was repealed, and the gold dollar, at the standard weight of $25\frac{4}{5}$ grains, was made the unit of value which remains to this day. Silver was then deprived of its right to unrestricted free coinage, and was no longer valid as legal tender money in payment of debts exceeding five dollars in amount. While silver formed the unit of value, gold enjoyed free coinage, and was legal tender in the payment of all debts. Now gold is the unit, and silver is both denied free coinage and closely restricted in its capacity of legal tender.

The example of the United States was followed by Germany in July, 1873; and the mints of the Latin Union, comprising France, Italy, Greece, Belgium, and Switzerland, were also closed to the free coinage of silver in January, 1874. Then came the inevitable gradual decline in the commercial price of silver as measured in the new gold standard, until in 1893 silver had declined 35 per cent. In that year the mints of India were closed to silver, and the decline increased to 50 per cent.

Returning to the United States, with which alone we are dealing, we find that after the demonetization act of 1873 no standard dollars were coined till the passing of the act of February 28th, 1878, the first section of which reads as follows: "There shall be coined, at the several mints of the United States, silver dollars of the weight of $412\frac{1}{2}$ grains Troy of standard silver, as provided in the act of January 18th, 1837, on which shall be the devices and superscriptions provided by said act:

which coins, together with all silver dollars heretofore coined by the United States of like weight and fineness, shall be a legal tender at their nominal value for all debts and dues public and private, except where expressly stipulated in the contract; and the Secretary of the Treasury is authorized and directed to purchase from time to time silver bullion at the market price thereof, not less than two million dollars' worth per month nor more than four million dollars' worth per month, and cause the same to be coined monthly as fast as so purchased into such dollars." This act, known as the Bland-Alison Act, and the act of 1890, known as the Sherman Act, were both intended as compromises between the views of those in favour of the free coinage of silver and those opposed to it.

The Bland Act remained in operation for twelve years, and was then nullified by the famous Sherman Act, described by a prominent American as "the most absurd financial measure ever adopted by a civilized nation, the very absurdity of which furnishes a reason for believing that its repeal will soon be accomplished." This was written in the spring of 1893.

The Sherman Act was passed July 14th, 1890. The third section thereof is as follows: "The Secretary of the Treasury shall each month coin two million ounces of the silver bullion purchased under the provisions of this act into standard silver dollars, until the first day of July, 1891; and after that time he shall coin the silver bullion purchased under the provisions of this act, as much as may be necessary to provide for the redemption of the Treasury notes herein provided for. Any gain or seigniorage arising from such coinage shall be accounted for and paid into the Treasury." In another section of the act, it is enacted that the Government must purchase four and a half million ounces of silver every mouth, in payment for which it issues notes payable in either gold or silver coin. The statute, however, requires the Secretary of the Treasury to maintain the parity between gold and silver, which means that these notes must be redeemed in gold, or in an amount of silver equivalent to their face value in gold. Hence the silver purchased by the Government cannot be used in the redemption of these "coin-notes," and it remains idle in the Treasury like so much iron, cotton, or hay. While the law compels the Government to pur-

chase periodically this enormous amount of silver and issue paper notes for this purpose, it does not empower the Government to obtain any gold wherewith to redeem the paper. These notes being steadily forced into circulation must of necessity replace other forms of currency; and, as gold is the only money of international value, it is steadily withdrawn from the Treasury for export. The volume of notes increases, while the amount of gold by which they are to be redeemed steadily decreases. Holders of these notes become doubtful of their value, and take every advantage of the law which allows them to be used in discharge of debts due to the Government. The inevitable result follows. The revenues of the Government are paid in its own paper obligations, and the policy which renders it imperative for the Government to obtain an extraordinary supply of gold becomes the very means by which it is prevented from obtaining even the regular supply which, under ordinary conditions, would be derived from its revenues.

For reasons such as this, the act was but short-lived, being repealed in October, 1893, by the Wilson Bill. The only benefit derived from the former piece of legislation was to help out that portion of the community dependent on silver-mining for a living, while on the other hand it shook the faith of foreign nations in the stability and security of American investments at home and abroad. Some idea of the serious state of affairs brought about, not entirely, but mainly, through the operation of this act, may be derived from the language of the President when summoning in hot haste a special session of Congress for 1893, to discuss the financial problem then confronting the country. In his summons he uses the following words: "The distrust and apprehension concerning the financial situation which pervades all business circles have already caused great loss and damage to our people, and threaten to cripple our merchants, stop the wheels of manufactures, bring distress and privation to our farmers, and withhold from our working-men the wage of labour."

In the extraordinary session thus called, the purchase clause of the Sherman Act was repealed unconditionally by a vote of 239 to 110. The main feature of this Statute, known as the Wilson Bill, is found in these words therein contained: "Be it enacted that so much of the act approved July 14th, 1890 . .

as directs the Secretary of the Treasury to purchase from time to time silver bullion to the aggregate amount of four million and a half ounces, or so much thereof as may be offered in each month at the market price thereof . . . and to issue in payment for such purchases Treasury notes of the United States, be, and the same is hereby repealed; but this repeal shall not impair or in any manner affect the legal-tender quality of the standard silver dollars heretofore coined; and the faith and credit of the United States are hereby pledged to maintain the parity of the standard gold and silver coins of the United States at the present legal ratio, or such other ratio as may be established by law."

It was confidently predicted by the supporters of this bill, and no doubt fondly believed by the great majority of the people, that by this repeal confidence would be restored and the steady outflow of gold from the Treasury and the country would be effectively checked. It was hoped that with repeal would come stability and prosperity; the wheels of industry would once more begin to revolve, commerce would revive, and the country would bud and blossom as the rose. But alas for the uncertainty of all things here below! Since the repeal the country has, in the words of Hon. R. P. Bland,* "been in a state of financial depression; industries prostrated, low prices, hard times, labor strikes, riots, mobs, and unrest everywhere prevailing." The amount of gold, also, taken from the Treasury since the passing of the Wilson Bill has been greater than ever before, and some two hundred millions of five per cent. bonds have been sold; whereas the only great merit of the repeal bill was proclaimed to be that it would prevent gold drainage and bond sales.

Such is a superficial sketch of the history of United States financial legislation in the past, and such is the unenviable position in which they find themselves at present. Just a week ago to-day (Nov. 21st) news came from Washington that the President would probably once more deliver a message to the country in a few days, devoted to a single topic—finance; an appeal for decisive legislation on this all-important question that will not down; an appeal for the single gold standard and for the withdrawal of greenbacks from circulation. Mr. Cleveland feels that the financial conditions, in view of the recurring necessity for

* *North Am. Rev.* March, 1895, p. 345.

issuing bonds to maintain the parity of all currency, justify him in putting aside for the present all other questions. He feels that a clear-cut, easily understood financial policy should be made certain and plain, and that this can be accomplished only by making the financial question from henceforth the overshadowing issue.

The tendency in the United States at present is away from free silver and in favor of the gold standard, if the results of recent political conventions, especially in the Southern States, are any indication of public sentiment. The people are beginning to realize that since the depreciation of silver did not result from its demonetization by any one country, but by a general movement to a gold standard throughout the world, it is very unlikely that its restoration to free coinage by any one nation would be sufficient to counteract the effect of its demonetization by all other commercial communities. The dislocation of the parity between silver and gold was, in the judgment of many, a reckless and ill-devised experiment. For centuries these metals had remained at a parity. The legislation which caused their divergence may have been short-sighted and pernicious; but, while it may well be deferred, it cannot be remedied by the isolated action of a single community. The battle of the standards cannot be decided by mere legislation. Silver will be universally demonetized only when all the commercial nations are brought face to face with the consequences of its universal demonetization. The imperious, irresistible necessities of commerce alone will bring about a final solution of the coinage question.

The full-tender metallic money of the world consists in round numbers of about seven billion dollars, of which very nearly one half is silver. If silver were universally demonetized the metallic money of the world would therefore be reduced in amount by one half; and the problem to be solved by the commercial nations of the earth would then be, the possibility of carrying on the business of the world with one half of the existing stock of metallic money. If some three billion and a half of gold dollars would form a sufficient money basis on which to conduct the whole system of international exchange, then surely the demonetization of silver would be a beneficial and a salutary

measure. On the other hand, if experience should prove conclusively that this tremendous reduction in the stock of metallic money, tended inevitably to unsettle credit and paralyze enterprise, silver would of necessity be recalled by the unanimous demand of the commercial world.

Complicated as this question necessarily is, it is pre-eminently so in the United States. One system of finance following another in rapid succession; statutes enacted only to be repealed by other statutes; great political parties now advocating this, now that; the President at variance with the platform and all the traditions of his party; Congress and the Executive widely at variance; there is no agreement on the currency question, and no hope of immediate settlement one way or the other. But at the Presidential election of 1896, the question will come straight home to every elector: does he or does he not want the single gold standard? The answer then given at the polls throughout the country will settle this question once for all, if such a thing be possible; and the remaining years of the nineteenth century will be regarded in the days to come as one of the most momentous eras in the history of the great Republic.

GOETHE'S WORKS AS CONFESSIONS.

BY MAUD C. EDGAR, '96.

[Read before the Modern Language Club.]

GOETHE says himself that all his works are a fragmentary confession; but we must examine to what extent this statement is literally true. We cannot take a certain character out of each of his works, and say: "This is Goethe." The many biographical details we have of his life forbid this; but we can take his works as a whole, and find in each one the portrayal of a certain phase of his character, of the motives which influenced him, and of his internal moods and reflections. When swayed by any very strong emotion, he seems to have taken refuge in his pen; sometimes merely to find an outlet for his overwrought nature, but sometimes also to see the course of action to which he is inclined in all its bearings, and to follow certain tendencies to their logical conclusion. Thus, where he represents his own actions in those of certain of his characters, he frequently punishes their failings in a manner which satisfies the feeling of poetic justice, and serves, to a certain degree, as a penance for himself in cases where he feels that his punishment has been too light. His aim was to depict the real, not the imaginary; and, in describing the impulses which are common to human nature, he is guided by his own experience. Possessing not only a poetic temperament which felt very keenly every emotion, but also a reflective and critical mind, he analyzed all his inmost feelings, and thoroughly comprehended the motives which actuated him. These feelings he embodied in his different characters, whom he places often in positions very similar to those in which he himself had been placed. We may thus trace, in these outpourings of a gifted mind, the transition from a stormy, wayward, passionate youth to a manhood, calm, self-controlled, and beneficent.

Let us look, then, at his earliest important work, "Götz von Berlichingen," which appeared in 1773; that is, when the author was in his twenty-fourth year. In this the main characteristic is revolt against conventionality. In form, the play violates all the laws of the French drama, which had for years been the standard by which all German plays were judged. The subject is national, the hero a German baron of the Middle Ages. In this play, Goethe embodies that striving for liberty, and impatience of control, which was animating the minds of many German youths of that day. Ardent and impulsive, he also cried aloud for nature and reality, and scorned artificiality in any form. But there is in this play another confession of a more intimate character. He had begun to write the story shortly after leaving Strassburg and Frederika Brion; and, stung by remorse for his treatment of her, he pictured his own vacillation and faithlessness in the character of Weislingen, who is false to his betrothed, and is punished for his desertion by dying a most horrible death. In this we see that he did not think lightly of his own behaviour, but felt it so keenly that he desired an outward expression of his remorse. He even sent a copy of this confession to Frederika through a friend, saying: "Poor Frederika will be to some extent consoled when the unfaithful one is poisoned." In his poems of this period, he betrays another very attractive side of his nature. "Mailied," for instance, shows us a youth overflowing with love and keenly alive to every influence of external nature, exulting in the mere bliss of living, of seeing the sun on the meadows, and hearing the birds twittering in the bushes:—

"Wie herrlich leuchtet
Mir die Natur!
Wie glänzt die Sonne!
Wie lacht die Flur!

Es dringen Blüthen
Aus jedem Zweig
Und tausend Stimmen
Aus dem Gesträuch,

Und Freud und Wonne
Aus jeder Brust.

O Erd, o Sonne!
O Glück, o Lust!

O Lieb, o Liebe,
So golden schön
Wie Morgenwolken
Auf jenen Höh'n!

Du segnest herrlich
Das frische Feld,
Im Blüthendampfe
Die volle Welt."

This leads us to another phase of his character, that of extravagant sentimentality, which he portrays so vividly in "Die Leiden des Jungen Werthers," which appeared in 1774. This story is founded on incidents in his own life at Wetzlar; but none of the characters are exact portraits of the originals which suggested them. In enthusiastic love of nature, in morbid sensitiveness, in violent outbursts of passion, Werther, no doubt, has a strong resemblance to the Goethe of that period; but there is one striking difference in their characters. Werther was tossed about on every wave of feeling, blown hither and thither by every gust of passion, and finally, like a rudderless ship, hopelessly wrecked. Goethe, through all the storms which beat upon him and drove him many times out of his course, was still guided by a powerful will, which finally overcame the stormy elements, and brought him into smooth waters. His mind was healthy, though his heart was wayward.

Werther was not written immediately after leaving Wetzlar. Goethe had had time to analyze his feelings thoroughly, and to graft on to them some of the despair which had caused his friend Jerusalem to commit suicide under very similar circumstances. He idealized Lotte in his thoughts, until his imaginary self was more fascinated by her than his real self had ever been. He then removed this imaginary self from the ordinary distractions of everyday life, with its varied duties and pleasures, and allowed it to brood over one idea. Goethe once said he could imagine he had committed every crime, and recognized in himself a capacity for all the vices, envy excepted. How easy for him, then, to imagine that he might have been too weak to tear himself away from

Lotte, or even to take the slightest interest in any of his old pursuits. There would then have been no possible end to his misery, excepting death.

The next work we shall examine marks a decided change in the author's character. "Iphigenie auf Tauris" was written in prose in 1779, and put into verse during the Italian journey in 1786. It contains no violent outbursts of passionate feeling, no stormy revolt against prescribed forms. Great care has been bestowed upon bringing to perfection every detail, and harmoniously blending all the parts into a perfect whole. The chief character is no longer a sturdy knight of the Middle Ages, striving for personal liberty at the expense of order and civilization; but a true and noble woman, whose struggle is a purely moral one between what she feels to be right and what seems to be expedient. The form and language of this play also show the author's change in sentiment. Instead of a rapid, vivid, sometimes disconnected style, such as that of "Götz von Berlichingen," the diction is calm, measured and dignified. We feel that the author is no longer a fiery, impetuous youth. The stormy elements of his nature have been brought under his control. The fire of genius is still visible, but it burns now with a steady glow instead of flaring up in brilliant flashes. Goethe has learnt that the truest freedom is that which comes from complete self-mastery. As in Iphigenie every detail is made subservient to the main idea of keeping a just proportion between the parts, so in his life Goethe was training each faculty and striving to overcome every weakness, so that all the forces of his nature might work in harmony towards a lofty goal.

In the character of Iphigenie, Goethe has expressed some of his own feelings towards the court at Weimar. As Iphigenie longed for her own country, Goethe was longing for Italy. But he was bound to the Duke of Weimar, Karl August, by love and gratitude even more strongly than Iphigenie was bound to Thoas.

This personal element adds to the pathos of Iphigenie's first soliloquy :—

> "Doch immer bin ich, wie im ersten, fremd.
> Denn ach ! mich trennt das Meer von den Geliebten
> Und an dem Ufer steh ich lange Tage,
> Das Land der Griechen mit der Seele suchend."

In these three works we have seen certain phases of the author's character represented. In Faust we see Goethe's life and character as a whole, and not only his life but the life of mankind in general. The plan of Faust was sketched probably in 1772, or in 1773, that is when the poet wasabout twenty-four years old. He had gone to Strassburg to study, as Faust did,

"Philosophie,
Juristerei und Medicin,"

but felt that all he had learnt and all his professors could teach him were but empty formulas. He wished to pierce to the heart of things and could not be satisfied with mere words. He had also become somewhat of a mystic under the influence of Fräulein von Klettenberg, during his illness at Frankfort, and had dabbled in alchemy. The Faust legend, then, full of mediæval superstition, and containing the story of a professor who bartered his soul to the devil in return for more knowledge, appealed to him strongly. He felt that he could make out of it a drama of life in a very broad sense. The supernatural machinery should be retained, but it must be made symbolical, at least in part, of real things. Of the characters, Faust and Mephistopheles may both be said to represent Goethe himself, that is to say, Faust represents all that Goethe could imagine himself to be. What in him was a vague longing for fuller knowledge, became in Faust an overwhelming desire for more than human knowledge.

All the love Goethe had felt for Frederika Brion, and the sorrow and remorse he had suffered for his unkindness to her, formed the root from which sprang the terribly pathetic story of Gretchen. The catechism scene contains the creed of Goethe as described by Kessner, Lotte's husband, in a letter to a friend. It may indeed be a poetical rendering of a conversation between Goethe, Lotte and Merck.

And the character of Mephistopheles grew also from Goethe's knowledge of his own nature. It represented, as it were, his second self—the spirit within him which denied, which ruthlessly destroyed every illusion, which analysed every emotion and robbed it of freshness and spontaneity. His outward attributes were drawn from different sources. Herder, whose cold, disinterested criticism had made a disagreeable

impression upon Goethe when he first met him at Strassburg, is supposed to have afforded some characteristics. Merck, whom Goethe met later, also served to increase Mephistopheles' attributes. This intermixture of real human qualities with imaginary ones, makes one frequently forget the cloven foot for a moment, but the utter absence of all human love and sympathy soon causes an inward shudder, as in the presence of some evil thing.

> Es steht ihn an der Stirn geschrieben
> Dasz er nicht mag eine Seele lieben.

We come now, in the Second Part of Faust, to the close of this great confession of a great mind. As Goethe grew older he developed a taste for mysticism and reflection, and lost much of the spontaneity of his youthful nature. Thus, instead of the stirring scenes from real, human life, animated by passion and possessing an overpowering interest in themselves, by means of which, in the first part of Faust, he symbolised man's life with all its hopes, its aspirations, its strivings after the good, and its many succumbings to the evil, the symbols are now shadowy and unreal, and gain their chief interest from the abstract ideas which they are intended to represent. The characters of Faust and Mephistopheles have both changed with the character of their creator. Mephisto is still the critic, but his cynicism is that of a refined and polished man of the world. If we look upon him as representing the cold, calculating part of Goethe's nature, we can quite understand how this change was inevitable. Goethe's wide experience of men and manners has expanded the nature of his constant companion.

And in the Faust of the Second Part, what key do we find to the author's nature? As Faust, in the beginning, represented his own aspirations after knowledge and longing for experience, so must the solution to the problem of life, which Faust found, be taken to represent, to some extent, the poet's idea of what was man's destiny, and in what he would find the truest happiness. Faust was not to be completely given over to the power of evil until he should be content to strive no more, until he should say to the passing moment, "Stay, thou art so fair." This moment never came. Ever restlessly striving for something higher, Faust finally realizes that the nearest approach to perfect

happiness is to be found in working for the good of others. He reclaims from the sea a large tract of land, in order that future generations may be benefited by it. This, then, is the creed which Goethe expounds. In life there is a continual struggle between good and evil, in which the evil often triumphs: but if the strife continues to the end, if man does not allow himself to sink into a deadly lethargy in which all aspirations are silenced, all ideals shattered, then must the good overcome and the evil finally disappear.

SOME PHASES OF ALTRURIA—II.

BY R. H. COATS, '96.

[Read before the Classical Association.]

"For all the law is fulfilled in one word, even in this: Thou shalt love thy neighbour as thyself."—*Gal. v. 14.*

THE latter half of the eighteenth century saw the development of the modern industrial life of England under conditions indeed that had existed in a more or less modified form ever since the Reformation. Improvement followed improvement in manufacturing as in agriculture with incredible rapidity. Watt, Brindley, Roebuck, Hargreaves, Arkwright, came on the scene opportunely. The coincident growth of political freedom allowed men boldly to seize advantage of the turn events had taken, and to embark in the most distant and hazardous undertakings—a privilege especially necessary when the markets of the New World became opened up to the commodities of the Old; and when, to use an Altrurian metaphor, "rivers and seas became the warp of commerce where the steam-sped shuttles carried the woof of enterprise to and fro with tireless activity." This industrial revolution was accompanied by a parallel revolution in ideas which found its memorable and terrible utterance in the French Revolution.

The main characteristics of the ensuing period may be briefly stated as follows: First, a system of free competition—a fair field for all and no favour. But the tendency of capital to accumulate in the hands of the few soon developed itself, and has ended in an alarming prevalence of monopolies and millionaire syndicates. Much subtle division of labour, whereby the man became a mere machine; the concentration of specialized industries in large centres; the growth of huge cities or hives of industry; all this accompanied by a daily increasing friction between the main factors of the system, capital and labour, make up some of the most striking features of our modern

social organization, which in the United States of to-day have become so exaggerated that four thousand millionaires control the available capital of a population of sixty millions.

Against this system and its abuses, socialism is the emphatic protest. It began in a most Utopian movement towards alleviating some of the worst evils of the factory system. Robert Owen, in England, and Saint-Simon and Fourier, in France, strove to give to its principles a concrete and tangible existence; but disillusionment followed their failure. Idealism gave way to realism, even to the materialism of Marx. The more moderate Socialists have ceased to formulate cut-and-dried schemes of reform, and are content to entrust their theories to the magic of evolution.

The literal acceptation of Darwinism by Marx and his followers has been thought to involve a grave inconsistency coming from the avowed opponents of the freedom of industry and enterprise. A grim struggle for existence and the survival of the fittest, is not this the very essence of the modern system of every man for himself and the devil take the hindmost? Since the recognition of the importance of altruism in evolution, the charge is not likely to be repeated. Socialism, too, with its growth, has shown a tendency towards becoming more altruistic in its ethics as well as more democratic in its politics. But this by the way.

The influence of socialism in the modern world is tremendous. It has invaded literature. One of the most popular of recent novels—Mrs. Ward's "Marcella"—owes its interest to the socialism of the heroine; and this but recalls "Yeast," "Alton Locke," and a score of others. Though its basis is economic, it implicates other changes of the greatest moment, and we may safely say that the triumph of socialistic principles would involve a revolution greater than history has recorded.

Modern socialism may be looked at in two ways: First, as a matter of agitation and propaganda; second, as a stage in sociological evolution destined to succeed capitalism, as capitalism has succeeded feudalism. The higher form of collectivism in which the common good takes precedence of individual caprice is to be evolved gradually, not constructed by revolutionary methods. This is the problem that the nineteenth century must solve. Society, it has been said, is dragging anchor, and in dan-

ger of going adrift. Is the set of the current toward the rocks or toward a deeper channel?

Such are some of the conditions with which the idealists of to-day are face to face. It is this last view of socialism as the economy of an era to be evolved out of the present that we have so vividly enunciated in Mr. Edward Bellamy's "Looking Backward," and in the latest contribution to the subject, Mr. W. D. Howells' "Traveller from Altruria."

To preserve chronological sequence, before examining the idealized socialism of Mr. Bellamy and others, which opens so new a field to dreamers of our century, let us first mention the "Coming Race" of Lord Lytton, perhaps the most astonishing result of the versatility of that prolific genius. We have already noted that the true Utopia is not primarily a scheme of practical reform; but, after reading Lord Lytton's book, we feel that it is possible for a dream to be too much of a dream. An Utopia need not be practical nor even possible, but it must at least possess the semblance of both. This the "Coming Race" does not. It is a debauch of the imagination. It is not a race of men that he describes, but of gods; and their institutions correspond. The hint that the human race may some day attain to such proportions, does not serve to reconcile us. The contingency is too distant even for our imaginations to accept for a moment. We may, however, glean a few practical ideals. Socialism was not to Lytton so great a force as it is to Bellamy, for he makes his government a benevolent autocracy. We well have occasion to mention other characteristics presently.

We will not here stop to notice the Utopian ideas of Mr. William Morris, the poet of socialism, preferring to examine those of a more recent date. His "Earthly Paradise" is a particularly attractive poem, being written with all the beauty of form, the melody and gracefulness of its author's best work.

Mr. Bellamy's and Mr. Howells' ideals (two of the latest of these types) are in all their essential features similar. The one pourtrays the American Republic of the year 2000; the other the commonwealth of Altruria of to-day, the exact geographical position of which is not clearly indicated, so that we have little hope

and less opportunity of verifying his extraordinary statements concerning it. The process of evolution is identical in both. The vortex of capitalistic accumulation (they say, from their imaginary standpoint) drew into itself the smaller capitalist, in spite of the desperate opposition of labour. Intolerable as the system was, for civilization to retrace its steps was felt to be impossible, even if desirable. For it could not be denied that consolidated capital imparted a prodigious efficiency to industry, and any lessening of that efficiency meant starvation for the masses. The situation reached its climax when monopoly completely silenced competition, and democracy itself became transformed into a tyrannous plutocracy.

Then the hideous nightmare was broken, and the true significance of the tendency toward monopoly was recognized as a process whose very progress was to open a golden future to humanity. The immunity and impunity of the accumulation was over, and by the final consolidation of the entire capital of the nation, the evolution from a civility in which the people lived *upon* each other to one in which they lived *for* each other was accomplished without a drop of bloodshed.

On the education and enlightenment of the modern democracy, socialism pins its faith. This is, perhaps, why Mr. Bellamy makes the United States the pioneer in the movement, and why Mr. Howells thinks the overturning of monarchy the first step towards the consummation of his ideal.

The institutions of Mr. Bellamy's "Looking Backward," then, as in Cabet's "Voyage en Icarie," are those contemplated by his socialist brethren of to-day. He owes more to Karl Marx and his school, perhaps, than to anyone else. He is first a socialist, and second an idealist. His work is an attempt to embody and solidify the doctrines of current socialism; Mr. Howells' is rather an attempt to solidify all those pretty soap-bubble worlds from Plato, through More, Bacon, and Campanella, down to Mazzini, Bellamy, and Morris.

In America of the twentieth century, says Mr. Bellamy, all occupations under the wise paternalism of the government, will possess equal attractions, and a man will be absolutely free to choose his walk in life. The principle of universal service applied to labour will have solved the insoluble problems of to-

day. The nation will be the sole distributor of goods, for buying and selling is an education in self-seeking at the expense of others, and no society whose citizens are trained in such a school can possibly rise above a very low grade of civilization. All will share the good things of life alike. Honour and duty not personal gain will be the motives for industry. Nay, the heaping up of wealth will be not only impossible but unprofitable. Ladies of the twentieth century are not to be vexed with the perversity of the modern domestic. The prices of things being regulated solely by the amount or arduousness of the work required to produce them, the monopoly and the practice of preying upon one's neighbour's necessities have become matter for the student of history. A huge clearing house will manage the world's international trade. When it rains in Boston they will put up one umbrella over all the heads, in place of the three hundred thousand umbrellas of to-day. The private umbrella has disappeared except as a figure to illustrate the old way when everybody lived for himself and his family. Lastly, "to end this strange eventful history" on the site of the old state prisons there will stand hospitals for the treatment of atavism, for the unfortunate criminal of the twentieth century but suffers from the recurrence of an ancestral trait.

As we have seen above, Mr. Howells' "Traveller from Altruria" is not socialistic in the complete sense that "Looking Backward" is. It will entertain the reader if it does not instruct him, and this perhaps is its principal *raison d'etre*. Unfortunately the Altrurian is in America not to teach but to learn, and he is provokingly evasive when questioned concerning his own country. But we gather incidentally that in Altruria a man can't do what he pleases with his own unless he pleases to do what is right; that in Altruria every man works with his hands and that from other incentives than the pinch of poverty; that in Altruria for some people to be richer than others is the worst incivism; "that in all Altruria there is not a furrow driven, nor a swarth mown, not a stone laid, nor a stitch taken, not a line written nor a sheet printed, not a temple raised nor an engine built—nothing whatever done without an eye to beauty as well as to use; that Mr. Howells' particular Altrurian never made any money in his life, never wanted to make money, and thinks

it absolutely *wrong* to make money." All this is very entertaining, but somewhat unsatisfactory. We would like to question the Altrurian directly, for we feel that in his country we should be like Rasselas in the happy valley.

We may appropriately insert here, though it is somewhat beside our subject, the mention of an author who, unlike the two just mentioned, looks to the future with the eye of a pessimist. Edmund Boisgilbert, in "Cæsar's Column," traces the greed and selfism of civilization, not to a scene of peace and prosperity, but to one of universal and pitiless ruin. Under the brutality of monopoly, Socialism is perverted into anarchy—alike impatient of authority, whether proceeding from universal suffrage or from a single despot—and ends in nihilism, or satanism, as it has been called; a bitter duel to the death between ruler and ruled.

We have thus far regarded Socialism as a phenomenon peculiar to the nineteenth century. But there is a sense in which Socialism is as old as society itself—to which the modern industrial system is as a thing of yesterday—dating, in fact, from the primitive village community, wherein the tribe was the social unit, and property was common. In this respect, then, modern Socialism is but a return to simple and primitive conditions.

What, then, is the difference between ancient and modern Socialism, between the Socialism of Plato and the Socialism of Bellamy? If we define Socialism as in theory—for it has no actual existence on earth—a constitution for society, the legitimate offspring of the industrial revolution and the revolution in ideas that accompanied it, and as, when thus defined, a far wider and more imperious doctrine than communism (which is merely a system in which private property is abolished), and add that Bellamy and Morris are Socialists, while Plato, More, and Campanella are Communists, we have indicated the difference by a word. We must remember here that the sacredness of property is an idea rather modern than ancient, and that the evils of property-holding were much greater in Ancient Greece than they are to-day. Communistic schemes were to the Greeks nothing but an exaggerated Spartanism. Plato's advocacy of the community of property is bound up with his conception of

the State. The natural man, as Plato saw, was not disposed to place his individual advantages at the disposal of society. The good of the community being the sole reason for the State's existence, this disposition had to be turned to right account, and Plato thought he had accomplished this by abolishing *meum* and *tuum* even when applied to wife and child. Thus beneath his communism there lurks a subtle individualism, just as beneath the Aristotelian individualism, there is a latent communism. Individualism however subtle, or perhaps in proportion as it is subtle, is to Bellamy wicked as well as unprofitable—a pseudo-self-interest of selfishness.

If we examine likewise the altruism of the various ideals we have mentioned, we will find a corresponding difference, which we may also account for by the change of social conditions. The Greeks were essentially a selfish people, but selfishness under their conditions did not entail the misery that it does to-day. Thus Plato's altruism is confined to a single class, and it is moreover an altruism that, like a watch-dog, loves its friends and hates its enemies. But when we reach Sir Thomas More, we find the Utopians counting it great shame to conquer with bloodshed, although even here the principle is not world-wide in its application, and altruism as a virtue falls much short of patriotism. It was not, however, until the present century that the second great commandment was found not only to be a duty, but a necessity. In Mr. Bellamy's state a man's title to receive an equal share with his fellow-man, is his humanity. The basis of his claim is the fact that he is a man. The lame, the blind, the sick and the impotent, are as well off as the most efficient, and have the same income. "How did you come to be possessors of this knowledge and this machinery?" he says to the man of 1887. "You inherited it, did you not? And were not these others, these unfortunate and crippled brothers whom you cast out, joint inheritors, co-heirs with you? What did you do with their share? Did you not rob them when you put them off with crusts, who were entitled to sit with the heirs, and did you not add insult to robbery, when you called the crusts charity?" If we turn to Mr. Howells, we find the altruism of his guest manifesting itself in curious unconventionalities. Thus

he helps the porter with his trunk; he insists upon shaking hands with the head-waiter and relieving the overladen waitress of her heavy tray; he assists the hotel boot-black who has a sprained wrist, and he cannot be made to realize his behaviour in thus consorting with servants as a kind of scandal. However, both Mr. Bellamy and Mr. Howells are careful to make their altruism profitable.

Following the comparative method, let us now see how Plato's conception of the State compares with more recent ideals. Let us begin by noticing that, according to the prevailing Greek view, the State was an all but absolute power, which held the fortunes of its citizens in its hands. Plato, however, conceived it as arising primarily out of the necessities of mankind. The bond of union between the citizens is not external government, but man's natural desire for companionship, the simple fact that he is a gregarious animal. The barest notion of a State must include as many men as the efficiency of production gained by division of labour demands. It is an organic whole, and like a statute it must be judged as a whole. The chief end of the Platonic State is not the happiness of its citizens, but the well-being of the State itself. This is very unlike the mediæval idea that the State was a theocracy subject to the papacy, whose end was the morality and happiness of its citizens. This view naturally is very pronounced in Dante and Campanella, and appears, though not in as prominent a form, in More. We in modern times have ceased to regard the State as a self-contained community as Plato and More did. The ideal of Bellamy is a vast commercial Empire to the outside world, while to its citizens it is as a benevolent paterfamilias. It is interesting also to notice how Plato regards democracy as the sure forerunner of tyranny, while as we have seen Mr. Bellamy and Mr. Howells see in it a stepping-stone to higher things. Of course Athenian and American democracy are very dissimilar phenomena.

The Greeks were the first to develop a science of education distinct from the ecclesiastical training, which (if we omit the simple care of the family) was the first educational attempt that we find in history; and of the Greeks, Plato, following closely in the footsteps of the Sophists and more particularly of Socrates,

was the first to write a systematic treatise on education; the "Republic" being a work on "politics" in the true Greek sense of the term. As a work on pedagogics the Republic has a high value, but we are here considering Plato as an idealist. Judged from that standpoint his greatest error is in confining education to a single class. But on the other hand he educates his men and women alike, and his idea of making education comprehend the whole of life is still in the advance of philosophy, and is perhaps more than any of his ideas admitting of application to modern life.

The Utopians are all educated in childhood—chiefly by being made to keep quiet and to eat what was given them at meal-time. The more precocious are exempted from labour to enable them to pursue their studies through life, and to form a class of professional scholars. More provided for the education of middle and old age by a system of public lectures, which however no one is compelled to attend. Many of his ideas on education are borrowed from his great contemporary Erasmus.

In "Looking Backward" we have a very high ideal. All are to be educated alike, the coarsest and dullest with particular pains, so that the cultured man is no longer like one up to the neck in a nauseous bog solacing himself with a smelling bottle. Like Plato he gives great prominence to physical culture, but we find no provision for the education of later life. Mr. Bellamy attempts, in brief, without scientific details, to describe the educational system as it will be when the art has caught up to the science.

But if Plato's conception of the State, of education, of altruism are narrow and unsatisfactory to us, in what terms shall we mention his ideal of woman! It is not his mistaken morality that shocks us; but that he should have fallen from the highest idealism into the grossest animalism is perhaps one of the most unaccountable features in the Republic. We can only say in extenuation that he was misled by his admiration for everything Spartan, and by a natural wish to be independent. One of the most pleasing features of modern Utopias is that they make the home the heart of their system. The home was to Plato the natural enemy of the State. Yet the relation of the

sexes that he proposes is the reverse of licentious. Judged by the standard of contemporary ideas, Plato appears in a far more favourable light. The Greek woman occupied a very low position in actual life. "Hers is the greatest glory who has least renown among men," is the great historian's conception of female excellence. And Plato recognizes that woman is but lesser man, and he would educate her accordingly for the same pursuits in life.

Bacon does not mention women, Campanella's views are Platonic, and in More the lady has not risen above house-work.

When we come to our modern Utopias we find for the first time the introduction of a new element, which may be regarded as the peculiar production of nineteenth century ideas. The new woman, her genesis, her social potentialities and her costume, has become a subject for speculation, only since the march of civilization has almost revolutionized her position. We have opinions and ideals the most diverse and disparate promulgated on this subject, ranging from all conceivable altitudes to the depths of "The Woman Who Did."

In Mr. Bellamy's state we have an attempt to reconcile the opinions of thinkers so divergent in their views of women's rights as J. S. Mill and Goldwin Smith. The women of the year 2000 are to be organized as a distinct interest, whose "general" has a seat in the governmental cabinet. As the State has assumed the peculiar functions of women, they have little or nothing to do (for a husband is not a baby, that he should be cared for) except to cultivate those charms and graces, by which they more than repay their debt to society. Yet for the sake of their health and to satisfy a laudable feeling of independence they are given a very little of the least arduous work. False delicacy does not prevent them from proposing; and as these motiveless creatures select their husbands as they do their horses, the ill-favoured and the laggards among men must become celibates perforce, and thus spontaneously will the race be purified, without resorting to the unnatural expedients of Plato and Campanella.

Lord Lytton, though he sketches a similar condition, is careful to make the women of his supernatural state the superiors of the men in physical strength and in stature. Thus the

criticism that Mr. Smith would apply to Mr. Bellamy's treatment of women that authority must be passed on power will not be applicable to Lytton's. However, the men are treated with great forbearance—even with indulgence—which is meant perhaps to point a lesson to mortal men. "But there is one privilege which the ladies carefully retain, and the desire for which perhaps forms the secret motive of most lady asserters of woman's rights above ground. They claim the privilege here usurped by men of proclaiming their love and urging their suit; in other words, of being the wooing party rather than the wooed. Such a phenomenon as an old maid does not exist among them." After this it is quite in the nature of things to read that their males are entirely beardless, while the females sometimes in old age develop a small mustache.

Plato's conceptions of Deity, his faith in good and immortality are almost Christian. Modern idealists have surpassed him only in their Christianity. More's pure deism does not attract us. Mr. Bellamy's sermon of the twentieth century is singularly like many of the popular addresses of our own day. One great improvement, however, it has: "the preaching is by telephone, and you can shut it off."

The question of the value of ideals is a much debated one. "It is strange," says Herbert Spencer, "that a notion so abstract as that of perfection, or a certain ideal completeness of nature should ever have been thought one from which a system of guidance can be evolved; as it was in a general way by Plato, and more distinctly by Jonathan Edwards. Perfection is synonymous with goodness in the highest degree; and hence to define good conduct in terms of perfection, is indirectly to define good conduct in terms of itself. Naturally, therefore, it happens that the notion of goodness can be framed only in relation to ends." In other words, he would say that perfection and goodness differing only in degree, it is useless to seek to promote the good, which is a means, by pourtraying the perfect, also a means, instead of the ultimate end—the happiness (utilitarian), the blessedness (Christian) or whatever that end is held to be. Yet surely the various means to an end react on one another; and if perfection is the superlative of goodness, it is surely a more efficient

means, even if only a means. The value of ideals, however, does not lie in their practicability. Utopianism is not akin to science. Practicability has nothing to do with truth. It is the merest platitude to criticise an Utopia seriously. It is a vision of a "world unrealized," "built on the baseless fabric of a dream." Plato failed to regenerate Syracuse, and his Book of Laws is a veiled admission of the impracticability of the "Republic." Platinus found that "Platonopolis" was impossible. More recently Robert Owen and Etienne Cabet have experienced a like difficulty when they sought to realize their ideals. Yet who would hesitate to pronounce the Republic one of the most valuable of books. If the answers of idealists are often full of a dreamer's extravagance, if they but stimulate us to answer for ourselves, we have learned half the lesson they would teach.

Intimately connected with this subject is the question of the relative value of idealists and reformers. Whether does a Demosthenes or a Plato confer the more lasting benefit on his race? Without attempting to draw this delicate distinction, let us merely point out, that as all men of strong moral sensibilities and a high ideal of the ends aimed at in life must apply themselves in some manner to the correction of the abuses of their age, so if they are of a practical spirit and have any hope of success they will become reformers; but if they are of another sort they will construct Utopias.

Utopias have another value besides that we have mentioned, as Mr. Goldwin Smith, himself a severe critic of Utopianism, allows. "As the rainbow in the spray of Niagara marks a cataract in the river, the appearances of Utopias has marked cataracts in the stream of history." That of More marked the fall of the stream from the Middle Ages into modern times. Plato's republic marked the catastrophy of Greek republicanism. Visions of reform heralded the outbreak of Lollardism in England. The fancies of Rousseau heralded the French Revolution. Reading history thus, what mighty changes do the Utopias of to-day portend? Is a social cataclysm at hand? Of good augury, let us count it, that they, like Israel's prophets thundering against iniquity, announce a good time coming.

MATHEMATICS IN EARLY ARABIA.

BY C. E. RACE, '97.

[Read before the Mathematical and Physical Society.]

THE history of Arabian mathematics seems to resolve itself naturally under three heads—the sources of the Arabs' earliest knowledge of the science ; the development it received at their hands ; and their introduction of it into Europe.

We find that there were two distinct sources from which the Arabs received their first ideas of mathematics, namely, Greece and India, and in order to understand clearly the extent of the knowledge thus gained, we shall consider these separately. In the paper read at the last meeting of this Society, we have already followed the progress of Greek mathematics up to the time of Euclid. It is now left for us to look briefly at the work of this universally known mathematician, and at that of two of his illustrious countrymen, Archimedes and Apollonius. We shall endeavor merely to outline the character of their work, leaving many interesting details for some future paper.

Euclid flourished about 300 B.C. He was the author of several works, but his reputation has rested mainly upon his "Elements." It is not claimed that he devised all the propositions contained in this treatise ; for, indeed, only a very few proofs can be directly ascribed to him. Many more, no doubt, are partly his, but his chief merit lies in the selection and arrangement of the propositions. As is implied by selection, some matter was omitted, and it is known that much which was not in itself generally useful, or which followed easily from inserted propositions, was discarded. There was a definite end in view in this rejection of available material, Euclid's design being the synthetic treatment of all geometry, exclusive of conics and higher curves. To him must also be attributed that orderly

method of proof, consisting of enunciation, statement, construction, proof and conclusion, and the design of the whole book, proceeding from a few definitions and axioms, by sure and regular steps, to the furthest limit of the subject, is certainly Euclid's. With this short summary, we shall now turn to Archimedes, the greatest mathematician of antiquity.

He lived in Syracuse, where he had ample opportunity for displaying his extraordinary mechanical ingenuity during the siege of the city by the Romans under Marcellus. He is said to have inflicted great loss on the besiegers by his many remarkable contrivances, but the city was ultimately taken, and Archimedes perished in the indiscriminate slaughter which followed.

It is much more difficult to give a concise account of the work of Archimedes than it was in the case of Euclid. The latter treated each branch of his work according to a regularly defined plan, which made his work useful and comprehensible to the ordinary student who had reached a certain standard. But Archimedes wrote disconnected treatises on nearly all the mathematical subjects then known, many of his works being in the form of essays addressed to some of the more prominent mathematicians of his day. His principal achievements were in mechanics and mechanical inventions, the investigation of the law of floating bodies, his plane geometry dealing with the area of the circle, parabola and the spiral, and his geometry of three dimensions, in which are found some masterly propositions on the surface and volume of the pyramid, cone, sphere and cylinder.

His writings show a thorough acquaintance with all the work previously done in mathematics. In his own time he was looked upon as the prince of mathematicians, an "Archimedean problem" being a name for a difficulty insoluble to the ordinary intellect, and an "Archimedean proof" was the type of incontrovertible certainty. And not only was he so regarded in his own time, but mathematicians familiar with the highest modern methods do not hesitate to rank him with Newton in the very fore-front of the champions of science.

Contemporary with Archimedes, though much younger, was Apollonius of Perga. His crowning achievement was the publi-

cation of the first text-book, of any note, on Conic Sections. This work consists of eight books. Apollonius did not pretend that the first three books were entirely new, but only that they were improvements on his predecessors. The other five books, however, are almost entirely original. He first gave the names Parabola, Ellipse and Hyperbola to these three conic sections, and showed that all three could be obtained from the one cone by varying the intersecting plane. These new ideas led to a new method of treatment, in which the logical arrangement and reasoning are unexceptional, and his work is not unfitly described when termed "the crown of Greek geometry."

The century which produced Euclid, Apollonius and Archimedes was undoubtedly the time at which Greek mathematical genius attained its highest development. We have now seen geometry, physics and conic sections, established on reliable foundations, and very appreciably cultivated. It will be interesting to see how these works found their way into Arabia, and to notice the influence they wielded over Arabian mathematics.

It is said that the Arabian conquerors, after giving up their wandering life and settling in the towns, became subject to various disorders which their native physicians were unable to cure, and many Greek physicians, at the invitation of the Caliphs, settled in Arabia. The Arabs soon saw the value these men attached to their scientific works, and the Caliph Al Mamun (813-833) obtained, through his ambassadors, copies of the Greek MSS. He established in Bagdad a college of Syrian Christians who were nominally his physicians, but who were chiefly engaged in translating the Greek works into Arabic. In this way the works of Euclid, Archimedes, Apollonius, and other Greeks became known to the Arabs before the close of the ninth century.

But these stirring people were not contented with assimilating Greek science alone. Their commerce with India had long before this brought to their knowledge the two great original Hindoo treatises on mathematics, although it was not until we near the time of which we are speaking that these works received much attention. Since it was along the line of these treatises that Arabian mathematics were most highly developed, it might be well for us to examine the character of Hindoo investigations.

The evolution of science in India was quite different from what it had been in Greece. The Greek geometers, carried away by the beauty and real usefulness of their researches, made the grave mistake of endeavoring to carry on their projects by the means which they already possessed, without taking the time to perfect those means. Doubtless our admiration is aroused in seeing Archimedes, with the aid of a logical instrument so imperfect, overcome the most difficult geometrical problems and establish the foundation of infinitesimal analysis ; but had this wonderful man devoted some of his time to algebraical theories, if he had only conceived algebra as a science in itself, he might have spared us a retrogression of fifteen centuries. During all that period Greek algebra consisted only in the process of resolution of numerical equations. In all else algebra remained subservient to geometry.

The Hindoos, on the other hand, applied themselves with perseverence and success, to speculations in algebra and trigonometry, obtaining some splendid results, but they paid little attention to geometry, and generally, when an attempt was made at it, false theorems were deduced.

The first great Hindoo writer was Arya-Bhatta, who lived in the early part of the sixth century. His principal work is one written in verse, which contains problems and theorems in arithmetic, algebra, plane and spherical trigonometry, and astronomy. In algebra he gives the sum of the first, second, and third powers of the first n natural numbers, solutions of special indeterminate equations of the first degree, and a general solution of the quadratic. In trigonometry he gives a table of the natural sines of the angles in the first quadrant, defining the sine as half the chord of double the angle.

The next Hindoo writer of any note is Brahmagupta, who lived nearly a century later than Arya-Bhatta. He also has left us a work in verse called the "Siddhanti" or "system" of Brahma. The arithmetical portion contains many problems on interest, and the Rule of Three ; the algebra embraces some fundamental propositions connected with arithmetical progression, a solution of the quadratic, giving the positive root only, and also solutions in integers for several indeterminate equations of the first degree. In geometry, Brahmagupta proved the well-known property of the right angled triangle given in Euclid I, 47.

He also found expressions for the area of a triangle, and a quadrilateral inscribed in a circle. He showed, too, that the area of a circle was equal to the rectangle under the radius and the semi-perimeter, but in finding the perimeter he takes the $\sqrt{10}$ as the value of π. We have no direct evidence that Arya-Bhatta was acquainted with the decimal system of numerals, but it is almost certain that Brahmagupta was familiar with it. At all events, it was known in India during his lifetime, and probably for some time before. None of the Hindoo writers lay claim to its invention, but they constantly assign to it a supernatural origin. It was probably introduced by Aryan invaders about the second or third century A.D. However that may be, we are sure that it had come into common use among Hindoo merchants very early in the eighth century, and by them was introduced into Arabia.

The works of the Hindoos which have come to us contain, as for arithmetic, only the rules for calculation, for geometry, only the enunciations of theorems, and for algebra, only the results. So, then, it is difficult to know what method they followed to arrive at their several discoveries. We do not know, for example, by what means they arrived at the solution of the general equation of the second degree. They were only fair geometers, and we have reason to believe that they knew nothing of Euclid's Elements. We must think, then, that they did not have the idea of obtaining this formula from the construction which furnishes two sides of a rectangle, when the area and semi-perimeter are given. And thus we are led to believe that they knew how to eliminate one of the unknowns from the two equations $\left.\begin{matrix} x+y=p \\ xy=q^2 \end{matrix}\right\}$. We have, also, other evidence of their ability to solve these equations, and it is thought their method was to render the first member of the equation a perfect square. From the Hindoos this method was learned by the great Arabian mathematician, Mohammed ben Musa, thence transmitted to Europe, and, with insignificant variations, we to-day pursue the same process.

We have now an idea of the foundations upon which the Arabs were to build their science. From India, before the end of the eighth century, they became possessed of a good numerical notation, and of the original Hindoo works on algebra, arithmetic and trigonometry, while before the end of the ninth

century they had become acquainted with the work of the Greek masters in geometry and mechanics. We shall now try to follow the development of these sciences in the hands of the Arabs.

The first, as well as the most notable of Arabian mathematicians, was Mohammed ben Musa, or Alkarismi, as he is sometimes called, from his native town. About the first we know of him is that he was librarian to the Caliph Al Mamun, who, as has been seen, was so zealous in the cause of science. Alkarismi's most important work was an algebra, which holds a distinguished place in the history of mathematics, for upon it were founded all the subsequent Arabian and many of the early mediæval works on algebra. He begins by giving rules for solving the quadratic, of which he makes six divisions in form, and here we find an advancing step in that he seems to have been the first to recognize the existence of two roots. His proofs are nearly all based on geometry, and he shows how equations may be solved by the use of geometrical figures. He goes quite deeply into the subject of square root and the manipulation of expressions involving the radical sign, ending his treatise by a selection of problems depending on the solution of simple and quadratic equations.

The work thus begun by Mohammed ben Musa was carried on by Tabit ibn Korra, a brilliant and accomplished Arab scholar, who produced several original works. Of special note is his discussion of cubic equations, which he solved geometrically, as Cardan did independently many years later. Korra also issued translations of the chief works of the Greek masters. The clerks at Bagdad had known very little mathematics, and many blunders had crept into their translations. Thus the work of revision done by this competent mathematician was highly valuable, and his editions became the standard in the Arabian schools.

From this period, algebra seems to have made rapid progress, although it still remained rhetorical in form, and so did not so readily admit of the establishment of general theorems as does the syncopated form of modern times. However, we find a prominent algebraist, Alkarki, about 1000 A.D., giving a good general solution of the cubic. Some minor improvements in notation were introduced, such as the writing

of a fraction with a line to separate numerator from denominator, and from this the sign for division, which is a line between two symbols.

In all of these early writings it will be seen that no distinction was made between algebra and arithmetic. Algebra had its origin in arithmetic, and later, was usually designated as "universal arithmetic." We now, of course, draw a marked distinction between the two, but in earlier times this was not recognized. In the one book we find the solution of the quadratic equation side by side with rules for the multiplication and division of numbers. Although the Arabs made use of the decimal system of numerals, they had very cumbersome methods of accomplishing the four fundamental processes of arithmetic. In addition and subtraction the work proceeded from left to right. In multiplication several systems were in use, all quite laborious, and none the less so because multiplication tables were unknown. It was considered quite an accomplishment to multiply by three or four digits correctly, and an ingenious Arab invented a test of accuracy, still sometimes used and known as "casting out the nines." But, if multiplication was difficult, division was more so, and was considered a feat which only a skilled mathematician could perform. The process followed was known as the "scratch system," so called from the scratching out of figures during the operation.

Very little was accomplished by the Arabs in astronomy, for they seemed to rest satisfied with assimilating the ideas obtained from the Greeks. On the other hand, they made great advances in trigonometry which was very little used except in connection with astronomy. They introduced the trigonometrical ratios and other functions now current, and constructed tables of tangents and cotangents. In the tenth century it might be said that they had reached the limits of spherical trigonometry and had left their foreign masters far behind. Optics and hydrostatics were also investigated by the Bagdad professors, but no great discoveries are recorded. However, their practical application of hydraulics does them great credit, and ample traces of their skill in the construction of waterworks, reservoirs, canals and the like, may still be found in Spain, North Africa, Egypt, and other eastern lands.

From this rapid sketch of their work it will be seen that the Arabs were eager to gain knowledge from whatever source it came, and, having assimilated it, possessed mechanical genius in putting it to practical use. Their work in the advancement of science, especially in the realm of algebra, arithmetic and trigonometry, was of a high order of excellence.

To the Arabs, algebra owes its name. It is derived from a very similar Arabic word, "Al-jebr," which signifies "restitution." This idea arose from their mode of handling an equation containing negative terms in one member, viz.: they added these terms, with a positive sign, to each side of the equation until all the terms became positive, which, of course, is the same as our operation of taking a negative term to the other side of the equation and changing its sign.

We have now to see how Arabian mathematics were introduced into Europe and became an influence in modern mathematical development. The city of Bagdad has appeared to us as the centre of learning and scientific progress in Arabia, and we might have supposed that it would be from there that Europe should feel the influence of this advancement in science. But science did not come to Europe from Bagdad. Some fifty years before the establishment of the college of translators in that city, wandering Arabs had penetrated Spain and taken possession of the city of Cordova. Although not on very friendly terms with their kinsman at home, they possessed the same intellectual tastes and were as enthusiastic in their pursuance of knowledge. By some unknown means, probably through Jewish book-pedlars, they became acquainted with the translations and original works of their eastern brethren, and thus new light was gradually diffused throughout western Europe. At this time learning in that part of Europe was at its lowest ebb; of arithmetic scarcely anything was known, and as to geometry, "we find in the whole literature of that time hardly the slightest sign that anyone had gone further in this department than the definitions of the triangle, square and circle, or possibly the pyramid and cone."

Among other things which the Arabs introduced, and perhaps a forerunner of their science, was the decimal system of numerals. Its great superiority over the earlier modes of numerical expression became at once apparent to both merchants

and scholars, and thus the system has come into almost universal use among civilized nations.

Such is the unique position which the Arabs hold in the development and diffusion of mathematics, a science "which alone," in the words of one of its earlier illustrious advocates, "can purge the intellect and fit the student for the acquirement of all knowledge."

THOUGHTS ON PHILOSOPHY.

ALBERT H. ABBOTT, B.A.

[Read before the Philosophical Society.]

WHAT is philosophy? is a question often asked, doubtless much oftener thought, but seldom answered with perfect satisfaction to the earnest questioner, and when we venture to suggest some thoughts which have been helpful to us in attempting to answer the question, we do it, not in the expectation that they will prove efficacious in the removal of all the difficulties which students of the subject meet, but rather in the hope that they may be suggestive to those who seek to ascertain what the problem and method of philosophy are or should be, and in what relation the various departments of study known under the general head of philosophy stand to each other and to the general problem.

We cannot more than refer to the rise of the problem of philosophy; to trace it with any degree of accuracy and detail would be impossible in a short paper.

From Thales, the first philosopher treated in the History of Philosophy, to the time of the Sophists and Socrates the problem of philosophy was confined to what would now be called "the external world." It would be quite incorrect, however, to state that their problem could be so expressed, for they thought only of *the world*; external and internal aspects of it were not distinguished. Man was part of the world. No distinction was made between the perception and the object perceived. Their problem, accordingly, was to find the underlying reality, the origin of all things. This problem has become in modern philosophy, as intimated above, the cosmological problem of the external world, the world of things.

This point of view remained practically unchanged until the time of the Sophists and Socrates, who turned the attention of thinkers on this subject to the Self. The influence of the Sophists

in this transition was almost entirely negative; but this was preparatory for the positive statement of Socrates—γνῶδς σέαυτον —*know thyself*. The problem of philosophy then became centred in the self. Out of the midst of the Sophistic scepticism Socrates arose with the firm conviction that if the Self, the man, were fully known, truth would be placed on a sure foundation. Thus the self was set over against the not-self, the knower opposed to the thing known, the internal world distinguished from the external world, and the problem became widened so that it included the psychological as well as the cosmological problem of modern metaphysics.

The problem of Socrates was fundamentally an ethical one, for though he sought first of all to reach clear conceptions, he did it with an ethical end in view, viz., to attain virtue. The vital connection between knowing and doing in his mind is brought into clear light in his statement, "Virtue is knowledge." The man who really *knows* truth is for that very reason a good man. We see, therefore, how naturally Plato, following his great teacher, is led to place the Idea of the Good above all other ideas. Thus from the problem of the Self arose the problem of the Divine Being. It is, indeed, in some dispute as to whether Plato himself conceived the Idea of the Good as synonymous with God, and for our purpose we need not attempt any discussion of the question; but whether he did or did not so conceive it, the problem of "The Good" in his philosophy became the problem of God, the supreme power or person.

Thus we have three problems arising; and under these heads we see the great problem of all modern philosophizing: (1) The external world—nature, as it is sometimes called; (2) The self —man, as a thinking being; (3) God, as the Absolute. These three aspects cover all the elements in our field of knowledge, and constitute for us the universe. Whether, indeed, they will always do so is not in question. If a time ever comes when these three aspects do not include every element of knowledge, the problem of philosophy will have to be widened to include a fourth, or even more if necessary.

These three elements of the universe having been distinguished, we have a new problem resulting from the contradictory character of the conceptions held of the three. Had the

conceptions of God, self and the external world been in perfect harmony with each other, philosophy would not have before it the problem which has been, and is still, awaiting complete solution. That problem may be stated thus: How must these three elements be conceived so that they will together constitute a non-contradictory totality. This totality or unity we call the universe.* It will not be an adequate solution if these elements be conceived as absolutely independent each of the others, for then we should have three universes (if the contradiction in the term may be allowed). They must stand in some relation to each other; in some sense they must be *inter*-dependent. Philosophy, having critically examined the three components, attempts to conceive this relation, and to determine in what sense they are inter-dependent. The problem of philosophy may then be stated as an attempt to conceive a universe in which at least three elements are supposed.

It will thus be seen that philosophy does not attempt in any way to do more than give a consistent meaning to that which is conceived to be real. Sometimes those who have not entered the temple of "divine philosophy," but who stand listening in the courtyard, seem to think that, because philosophers seek to give new meaning, and indeed find it necessary so to do, to the external world, to Self or to God, they are attempting to overthrow these and make them unreal. Far from this being the case, philosophers would never have had their problem were it not that the conviction that these are real in some sense yet to be determined, had laid hold of them.

The conception of the unity of all things is not one which philosophers have deliberately manufactured. It is implicit alike in the earliest thoughts of the child and of the race; and philosophy has only brought to clear consciousness what is everywhere implicit and involved in the thoughts of rational beings. No judgment of truth or error, no distinction between that which is conceived to be real and that which is relatively unreal, no system either of science or philosophy can be made

*Care must be taken to distinguish the universe in this sense, as including the Self and God, from what is frequently called "the material universe." While there is a certain sense in which the latter may be justified, it seems to the writer better to keep the term "universe" for the unity of all things, including the three elements above referred to.

without implying the unity of all things, the conception of a universe; and, in attempting to conceive this explicitly, philosophy is only attempting to rationalize the thought of all men.

The problem is none the less easy, however, because it is inevitable. A glance at the history of philosophy will indicate to us at once how varied are the standpoints from which men have attempted to solve the problem, and consequently, how various and contradictory are the solutions offered. They range all the way from the conception given by the philosopher who is sure he has succeeded in answering the question, to the sceptical conclusion of the one who is only sure of one thing, and that, that the problem cannot be solved. There is, indeed, a third standpoint possible other than these two extremes and the various degrees between them, viz., that the problem as so stated is not a legitimate problem; but we know of no philosopher to the present who has definitely taken this stand, and therefore we need not discuss it here.

Definitions of philosophy are not rare, though here as elsewhere good, all-comprehensive definitions are. The one found most satisfactory to the writer is given by Prof. Hume of our own University. It is as follows: "Philosophy is a reflective inquiry into the meaning and acquisitions of the thinking self." It is a search to ascertain what is true and what false in the opinions held, or differently expressed; it is an attempt to bring the conceptions of consciousness into harmony with each other. This definition calls attention to a fact frequently overlooked, viz., that the self is a broader term than the universe; for while from one point of view the universe certainly includes the self, from another, which is equally true, the self includes the universe*; for the philosopher as well as the scientist can only deal with a universe *as conceived*, and if this be not the real universe, we must write forever over the word: "The Unknown and Unknowable." The problem of philosophy, this conclusion having been reached, will then be gone as a living issue at least, and philosophers and scientists will have to content themselves by playing with something which they are certain is not *the real*, but which, nevertheless, offers food for thought. However, such

* For a full discussion of this and the following point, see Chap. I., in "Descartes and his School" by Kuno Fischer.

a conclusion is not yet proven, nor is it at all likely to be, on rational grounds; for as long as the only material with which reason can work is a conceived universe, it is not by any means probable that sufficient grounds can be found for holding the existence of one of which the only differentia is that it is not conceived, and is indeed inconceivable.

This definition also indicates another point which has not always received the attention it merits, viz., the possibility, or even necessity for thoroughness, of a historical treatment of the problem of Philosophy in its various subdivisions. When the full meaning of the definition is grasped it will be seen that the History of Philosophy is the most comprehensive study of Philosophy both as to the subject matter and method. From this historical study we learn more than what men have thought at various times; we get most important suggestions, both with regard to the real problem and true method of Philosophy, as we discover the errors made by previous thinkers, and ascertain through a critical examination of their systems why they made these errors. It is only through a most critical historical study that we may hope to get a clear grasp of the problem with which Philosophy deals, and of the method by means of which we may expect to solve this problem.

These considerations bring us to the discussion of method. How must we go about it if the question is to be solved, and upon what grounds do we assert that it is soluble at all?

We conceive it to be an irrational procedure to begin by *assuming* either of the divisions of our problem in any definite sense. It might seem unnecessary to state that we ought not to begin where we hope to conclude, for the definite conception of one and of all the elements in our problem must logically be left till the last stage in our philosophizing, since the whole problem is to form a consistent conception of each, but such errors have been made and we must guard against any repetition of these. The philosophy of John Locke, "the father of English philosophy," is founded, implicitly at least, on a definite conception of mind and matter. Matter, or, as he calls it, substance, is an unknown, independent somewhat, the substratum in which the qualities of external objects subsist, and mind is a "spiritual substance," the unknown background in which "thinking, knowing, doubt-

ing, and a power of moving, etc., do subsist,"* a passive somewhat waiting to be impressed by movements originated by matter. In this general conception of matter at least, he has been followed by all materialistic philosophers and scientists since his time. Altogether apart from the conclusions of those who so begin their philosophy, we object to their method. It seems to us irrational to establish a whole system of philosophy upon an assumption which is, at the beginning at least, entirely gratuitous and might quite as well be conceived the very opposite. We should equally object to basing our philosophy, as did Spinoza, on a conception of God. This conception also can only rationally be reached at the end of the process, and hence philosophy can never follow a purely deductive method, taking as its starting-point either a conception of God or any other such idea.

Where, then, must we begin? As it seems to us, at least, we must begin with an unavoidable fact,† one which it would be nonsense to deny, one which could not be evaded by anyone who was really inquiring. This Descartes found, following his method of doubting everything of which he had not absolute surety, in the fact of doubt itself. Surely here he found such a fact as we seek! We, however, do not begin with the method of doubt and so do not follow him in this, correct as his method thus far may have been. We choose rather to accept as our starting-point the occurrences in consciousness as such.‡ To deny

* Essay on the Human Understanding. Bk. II., Ch. XXIII. § 5.

† Concerning facts, the writer agrees with Dr. Kirschmann of our own University, who defines a fact in his lectures on metaphysics, as follows: "That of which I am absolutely certain and to deny which would have no meaning whatever." There are two kinds of facts.

(1) The immediately given states of consciousness—(sensations, emotions, and volitional states).

(2) The axioms of mathematics and their necessary derivatives.

The first class have absolute, but only *assertive* certainty, *i.e.*, they *are* so, but it could be otherwise. These form the constituting elements of "the world."

The second class possess *apodictic* certainty, or necessity, *i.e.*, I could not possibly think them otherwise. These form the regulative elements of "the world."

Every proposition which asserts something which is neither an assertive or apodictic fact itself, nor derived from such by means of apodictic relations, expresses not absolute knowledge, but contains elements of belief. (In this we say nothing as to the relative value of Knowledge and Belief.)

‡ Concerning the fact upon which we insist as the starting-point of our theory it may not be altogether superfluous to add a few words more. This fact is not the meaning or interpretation of any state of consciousness, for, as we ordinarily

that one has such states as are actually in consciousness at any time would only be nonsense. The method, then, is to reflectively examine these states and note what is involved in them being the states they are.

It is to be noted that as our problem is to harmonize the facts of consciousness, our method is to begin with the simplest facts in consciousness and to reach out at last to the most complex, and so form the facts of consciousness into a systematized whole. This may demand that some *opinions* which have long been held be given up, but it must not do violence to a single essential *fact*.

It will easily be seen that beginning thus and following our method out, carefully guarding every possible avenue of error, accepting only as facts those which it would be absurd to deny, and carefully analyzing these to discover, if possible, what they imply and involve, that at last we must reach a conception of the universe as consistent as our logic has been, and the facts of consciousness will admit. Thus, on the face of it, our problem would seem to be a soluble one if we follow such a method.

But it may be asked: "Is there not also a presupposition in this method?" We frankly admit that there is, and further, that it is the only presupposition philosophy may be allowed to make. The presupposition is this, that Reason is rational, or, in other words, that Reason can be trusted, and the reason we allow it is that it cannot possibly be avoided. It proves itself in the act of denying it, and is therefore a necessary presupposition, one which is made equally by all schools of Philosophy and Science.

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understand the term, this may or may not be a fact, (*i.e.*, a truth), and in any case this would have to be determined from previous facts, but it is the state of consciousness itself as such, the occurrence; *e.g.*, it may be the sensation Red, or the feeling of gratitude to God or any other occurrence in consciousness. If we have such a state of consciousness it is simply nonsense to deny that we have this state, while the meaning or interpretation of the state may or may not be deniable. The most absurd picture the imagination can construct is equally a "fact" in the sense in which we use the term here, with the most devout feeling or the most rational conception. Having ascertained any fact in consciousness we endeavor to analyze it to see what is involved in it being the fact it is, altogether irrespective of the truth or falsehood of the meaning given to this state. It may further be noted that in order to get back as fundamentally as possible we ought to begin with a simple rather than a complex state of consciousness, not indeed that this is any more a *fact*, but it seems likely that we should be able to ascertain the implications of a simple state with much greater surety than those of a highly complex one.

For, suppose we assert that Reason is not to be trusted, we must be prepared to answer *why* we have come to this conclusion; in other words, we must be ready to give the reasons upon which we base our assertion. In thus determining that the reasons against the rationality or trustworthiness of Reason are more *reasonable*, and hence stronger, than those for it, we are simply trusting Reason to prove that Reason is not to be trusted, and this is sufficient to prove the rationality of Reason, for we cannot possibly avoid assuming it either explicitly or implicitly. This fact is sufficient to keep us from a thorough-going scepticism, for no matter what we doubt, we can never consistently doubt this. Hence our system of philosophy cannot be agnosticism,* but must be gnosticism in some form or other. Indeed, Reason never doubts of her ability to solve this problem, nor is she indifferent to it, until, as in the case of David Hume, she reaches a reasoned doubt and a corresponding reasoned indifference; but even this kind of indifference is not rational,† for Reason can never, consistent with herself, admit defeat. The trustworthiness of Reason must again be the spur which arouses us and forces us on to the discovery of new truth. We may thus conclude that to rest in scepticism or agnosticism is not rational or consistent with the essential facts of our nature. Indeed, it was the very scepticism of Hume which awoke the great Kant from his "dogmatic slumber," as he himself has told us. In this we see the implicit power of this great truth, for though Kant had to admit the logical correctness of Hume's conclusions, starting from his foundation, he could not admit the rationality of them, and, therefore, went back to see perchance if his starting-point were not weak or even entirely wrong. It has been fundamentally the influence of this necessary presupposition which has led men into philosophic thought in past ages, and it is owing to its influence to-day that we, looking back over the systems which have been advanced and critically noting their weaknesses, are able still to be confident, that, though the last word has not yet been said, and though our problem has not yet been fully solved, it is a soluble one, and the very Reason

* For an able discussion of this subject see an article by President J. G. Schurmann in "The Philosophical Review," May, 1895.

† Cf. Kant's "Critique of Pure Reason." Preface to the first edition.

which brands all previous systems as imperfect, confident of her own powers, believes that, learning from the errors of the past and building only on unavoidable facts with mathematical exactness, the problem may yet be solved in the future.

It is further to be noticed that this solution must be all-comprehensive. We must take into account every fact of science, every so-called law of nature, every fact of the moral and religious life, every necessary presupposition of science, morality and religion, in short, it must comprehend every principle of consciousness, and it must form these into a system in which there are no contradictions, and in which every part is related to every other part, so that all may go together to form a unity—the universe.

One needs no argument to be convinced that the problem which Reason thus sets for herself is a stupendous one, and from the fact that it includes every element of consciousness, it is little wonder that it is found necessary in the philosphic inquiry, for convenient and exhaustive treatment, to divide the work into various departments. Thus we have—Logic, Psychology, Theory of Knowledge, Ethics, Metaphysics, and Philosophy of Religion.

It will be noticed in these subjects that there are two general departments, viz., Logic and Psychology, and then two lines of thought, generally distinguished as the Theoretical or Speculative, and the Practical. The former including Theory of Knowledge and Metaphysics, and, in so far as it reaches to the Divine Being, Philosophy of Religion; the latter including Ethics or Moral Philosophy, and, in so far as the Ideal of Conduct demands it, Philosophy of Religion. The naturalness of this division is evident, for, while in their reality they can never be separated, we can in abstraction at once think of man from two standpoints:—First, as *Knowing*, that is, as endeavouring to incorporate a world into himself. Second, as *Doing*, that is, as endeavoring to put himself out into the world, and thus to make it a world which he conceives *ought to be* in distinction from what *is*.* Following the terminology of Prof. Ladd of Yale University, the Speculative branches of Philosophy deal with "The Real," that is, what *is*, and the Practical branches deal with "The Ideal," that is, what *ought to be*.

We shall then briefly discuss these divisions of the problem,

* Cf. Green's Prolegomena to Ethics., § 85.

taking up, *first*, the general divisions, *second*, the speculative divisions, *third*, the practical divisions.

Though *Logic* cannot well come first in reality, it seems proper to discuss it first in order, because it seems to underlie all the other divisions equally. It is a search after the fundamental laws of thought. Its problem may be stated thus, "according to what principles must man reason if he is to reason correctly." Logic seeks to tell us *from the side of the principles of thought* how we may distinguish truth from error. Following Dr. Tracy of our own University, we may define it as: "The science of the *method* of knowledge as distinguished from other sciences which have to do with the *matter* or *content* of knowledge." Wherever we are called upon to estimate the reasonableness or unreasonableness of any consideration or argument, and surely this is at every step in our process, the results of the logical inquiry must be applied. Thus Logic is the underlying, most fundamental department, as regards the rational procedure of all other departments.

Psychology is the other general subdivision. It is "The Science of the Facts or Phenomena of Self."* It endeavours to ascertain and classify these phenomena and to determine the laws of their rise and of their combination with each other. It need not, and in fact does not, say anything regarding the external world, and deals with the self as little as possible. Some hold that Psychology, being a purely natural science, has properly nothing whatever to do with the self, but must confine itself wholly to phenomena, while others hold, in opposition to this view, that it cannot be a pure natural science since they find it impossible to advance one step in the study without a reference to the self for whom the phenomena exist. There is, however, a third view, represented in our own University, by Drs. Kirschmann and Tracy, to the effect that all natural sciences must have reference to the self since all deal with the facts of consciousness,† and that Psychology must not be excluded

* Cf. "Psychology" by Prof. Dewey, Chap. I.

† The general statement of this theory may be taken as follows: "All sciences must base their method and conclusions on *facts*. and there are no facts which are not in relation to the self." The theory further denies the original distinction between external and internal worlds, and holds that that which is immediately given is, before any process of abstraction has taken place, at once external object

from the rank of the natural sciences on this account. The only difference between it and other sciences is, that it has to do with all phenomena purely as phenomena of consciousness, while the others select only a certain class of these phenomena, and treat their relation, etc., in a special way. Thus Psychology has to deal with the fundamental phenomena of all sciences, and hence must classify, etc., on a broader and different basis than any of the other sciences (*e.g.*, Biology, Physics, Chemistry, etc.), since these only take into account part of these phenomena. This third view seems to the writer the most thorough-going and rational, however it does not at all change the fact that phenomena are the essential objects of the study, and its reference to the noumenon for which these are phenomena ought to be as slight as possible, in so far as it remains at the purely psychological standpoint.

It will be seen that in Logic and Psychology we are dealing with questions equally necessary and fundamental for every branch of our philosophic study. Having briefly discussed these, we now take up the two special lines of thought referred to above, (1) The Speculative. (2) The Practical.

In Psychology the phenomena of consciousness are treated in a scientific way, but no question is raised as to their validity as knowledge. Having ascertained and analyzed the facts of consciousness, and having examined their actual and necessary relations, the work of Psychology is done, and it remains for the next branch of our study, in generally accepted classifications, *Theory of Knowledge*, to ask the question as to the validity of these as knowledge. Theory of Knowledge asks the question: Can man *know* reality? Do these ideas tell us anything of the real? Is our knowledge *real* knowledge? Thus we have Locke giving us as his problem: "To inquire into the original, certainty, and extent of human knowledge, together with the grounds and degrees of belief, opinion, and assent *," he wishes to "set

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and internal presentation. Wundt accordingly calls this immediately given fact "the presentation-object."

Dr. Tracy's statement of the case is, indeed, somewhat different, but as regards the relation of psychology to the natural sciences will amount to the same thing. His statement is to this effect, that all sciences must make metaphysical presuppositions, and psychology is no more or no less a science than any others on this account.

*Essay on the Human Understanding, Bk.I., Ch. I, § 2.

down measures of the certainty of our knowledge." These considerations are purely along the line of the Theory of Knowledge. It will be noticed, however, that in this discussion we must either presuppose a theory of the real, or else make it as we proceed in the treatment of the above problem.

Here, then, *Metaphysics* begins its work in attempting to answer the question: What do we mean by *reality?* What is it *really to be?* It will be seen that in raising the problem of the correspondence of perceptions with the real we are also raising the problem of the real itself. Does this perception represent anything real? That depends on what the real is, and here every branch of knowledge must await the answer of Philosophy, for on our conception of the real depends the validity of all our so-called knowledge. The ultimate worth of Science depends on the answer to this question quite as much as the worth of Philosophy itself. If the real is "The Unknowable," Science as well as Philosophy may content itself with a far-reaching agnosticism, and we shall have to admit that while both as mental exercises may be very good, they are only of worth to this extent, for neither can give us knowledge of what really *is*. And just here it may not be out of place to note the acuteness of Locke over many of those who have followed him in an empirical or sensational theory of knowledge. He tells us frankly, and in this we must agree with him if we accept his metaphysics of mind and matter, that no science of bodies is possible.* What astonishes us is that materialists and empiricists since Locke have not seen with equal clearness the far-reaching effects of their system.

The problem of Metaphysics, then, is a most vital one, since the answer to it must logically influence every branch of human inquiry. The problem, as stated above, is the general ontological discussion of being, and this divides itself naturally into two branches—(1) Cosmology or Philosophy of Nature, which asks the question, "What is the real being of the system of things?" (2) Rational Psychology or Philosophy of Mind, which asks the question, "What is the real nature, and relations in reality to the world, to its fellows, and to God, of the human mind?"†

It will, of course, be quite obvious that these various divisions of the general philosophic problem cannot be separated in any

* Ibid, Book IV, Ch. III, §26. † Ladd's "Introduction to Philosophy," p. 255.

absolute way. Psychology passes over insensibly into Theory of Knowledge, and Theory of Knowledge is so related to Metaphysics that the two must go hand in hand. It will also be clear that in the Metaphysics of Mind especially we do not hold too strictly to the Speculative side of our inquiry, but the results of the Practical side must come in also, though of course the problem is not one of conduct, and hence the Practical is subordinate in this division.

Deeper than this, however, there is a vital connection between the Speculative and the Practical, for when we think of it closely we see that the Speculative side, in fact knowledge in general, is sought primarily that it may help us to live truly. We seek the laws of nature so that, knowing them, we may be the better able to live in harmony with them. Hence our Speculative inquiry must inevitably lead to the Practical. But again, looking back on our procedure, we see that man has been a *doer* in *knowing*. Our first statement of the question was not complete. Man is equally a *doer* in seeking to *know* a world which is, as in seeking to put himself out into the world and make it what he conceives it *ought to be*. Thus the ethical inquiry is deeper than any of those already discussed, and in it ultimately we must see the highest point to which Philosophy can reach.

As already intimated, Prof. Ladd treats what we have called the Speculative divisions of our subject as "The Philosophy of the Real," and what we have called the Practical as "The Philosophy of the Ideal;" he then very suggestively calls the Philosophy of Religion "The Philosophy of the Ideal-Real." These titles seem to bring out the essential points in each division and will suggest to us the relation between the Speculative part of our inquiry and the Philosophy of Religion, as also between the Practical and this department.

Accepting, then, Prof. Ladd's title for *Moral Philosophy*, viz., "The Philosophy of the Ideal," we note at once that the end of this inquiry is to establish an ideal of conduct. It must begin, as must "The Philosophy of the Real," with an unavoidable fact, and endeavour to discover what is implied and involved in this fact being the fact it is. Prof. Green finds such a fact in the consciousness of wants and the consciousness of wanted objects.*

* Prolegomena to Ethics. Book II, Chap. I, § 85.

Working out from these we seek to analyze the content of the moral life, so as to discover, if possible, what man is *in essentia*, and, if there be freedom, what he *ought to be*. Thus we seek an Ideal of Conduct; we endeavour to determine the true nature of man, his relation to his fellows and to God.

Under the name of Moral Philosophy will arise the discussion of the ethical side of the various social and religious problems which come before us as we advance in our system. It will be seen at once how closely Philosophy touches many of the problems of Political Economy and how essentially it is related to Political Philosophy and Law at this point. The relation of Philosophy and Theology we reserve for discussion later; * however, enough has been said to indicate that the connection is a very vital one. In dealing with the Ideal of Conduct, Moral Philosophy must approach very close to the whole question of religion, and thus we are led very naturally into the last step of the strictly philosophic inquiry, "The Philosophy of the Ideal-Real," or the *Philosophy of Religion*. The suggestion is that, having discussed the Real on one side, and the Ideal on the other, we ought to find them united in God, and see the Ideal no longer a mere Ideal but as a realized Ideal, that is, the Real.

Thus from both the Speculative and Practical sides of our discussion, we approach one point from which the Real gets its Reality and the Ideal its validity.

Under these various subdivisions does Philosophy attempt to conceive a universe. Beginning with the simplest facts, and noting their implications, it approaches more and more the more complex, freeing from contradictions, as it advances, the conceptions with which it deals, until, in a stage yet to be reached, it conceives the universe as a great harmony in which no element stands out of relation to every other element, but where each gets its meaning and reality from this relation; where, therefore, there can be no independent "matter" or "substance" unrelated to the knowing mind, and where the knowing mind or cognizing subject is no longer a "spiritual substance" unrelated to anything else, but where each is what it is because of its relation to the other.

* We regret that lack of space prevents the more detailed discussion of this point in this paper.

We can only hope to reach this conclusion, as it seems to the writer, by following some such method as that suggested in this paper. Beginning with an unavoidable fact, and proceeding with mathematical exactness step by step, never "jumping" at conclusions, but rationally reaching them, gradually freeing our opinions from falsehood and error and reaching that which is necessarily true, we may at length hope to attain the end we seek—a consistent conception of the universe with all its multiform details.

It must not be forgotten that the conception thus reached must be all-inclusive; it must embrace every element of the known world, the principles according to which it is known and the active spiritual sources of such principles. We judge the special work of Science to be the determination of the details of the world in accordance with the principles of knowing, while the special work of Philosophy is the examination of these principles, their meaning, validity and source in the spiritual activity of the self-conscious, thinking and idealizing principle. If this opinion be correct, it will be seen at once that Science and Philosophy can be in no sense opposed to each other, but must together co-operate to give us knowledge, and each has its part to play in reaching the final conclusion—the conception of the non-contradictory totality—for which we strive.

EMPIRICISM AND METAPHYSICS.

BY A. W. CRAWFORD, '95.

[Presented to the Philosophical Society.]

EMPIRICAL philosophy sets out with the assumption that all our knowledge comes to us from experience. It consequently endeavors to derive all the elements of our most advanced knowledge from sensations, which are the only data furnished by experience. It is likewise materialistic, and so regards external phenomena as the entire content of experience, thus closing off entirely anything which may be supposed to be contributed by the mind. Accordingly, it can have no data but individual phenomena and what it may be able to make out of these, though it can never go beyond these as bare facts to what is involved in them. So that, should we find in the course of our investigation that phenomena as such can never be known at all apart from rational presuppositions and implications, then we shall be safe in concluding that Empiricism is incapable of giving us a philosophy of existence, and that it falls short of any metaphysics whatsoever.

Metaphysics may be said to be, first of all, the Science of Knowledge; and then, through and by means of this, the Science of Being. It is the science of all that is involved in knowledge or experience, the science of all existing things in their ultimate principles and nature. It is the science of the real or the actual, and has to do with that which has real existence. As Lotze says, it has to do with "things that are, events that happen, and relations that exist."

Our question then is: Can Empiricism reach and explain these ultimate principles, which are the problems of knowledge and of being? Is Empiricism able to raise these questions, and can it give a satisfactory answer?

It will not do to say that none of these metaphysical problems exist, and that a philosophy may be quite adequate, and

yet not have these problems to solve. For the fact remains that men *do* raise these enquiries, which we call metaphysical, and they *do* strive to answer them. Men *do* ask about the ultimate nature of all existing things, and about the principles which underlie all experience, and its possibility. Moreover, even if these should be seen to be improper questions, a complete philosophy will, at any rate, be able to account for their existence as enquiries. But can Empiricism measure up to these requirements?

We will test it first as to its ability to give us a Science or Knowledge of physical nature—*i. e.*, of external phenomena; and if we should find it to be unable to do this satisfactorily, we shall then be warranted in concluding it to be much less able to give us a science of what is involved in, or implied in, these phenomena, which constitutes the true problems of metaphysics.

A science or a knowledge of nature implies three things: Description, Explanation, and Prediction. We shall take each of these aspects in turn, and see whether Empiricism can meet these requirements, which must be met by any adequate theory.

Can the bare experience of phenomena ever give us Description? This involves an orderly progression from one characteristic, or one phenomenon of an object to another, and this constitutes the phenomena in relations to one another. But "relation," as Hume has shown, can never be given as a phenomenon, and the Empiricist would be very bold who would in these days assert that it can. There is, then, no other source for it but the mind, and so we have already got beyond the bare phenomena to that which the mind contributes. Furthermore, Description involves a holding together of all the phenomena or characteristics belonging to an object as pertaining to one and the same object, and as constituting the one thing. But there is no power in phenomena to thus co-ordinate themselves, and for this they are dependent on what is not a phenomenon. Thus there must be a contribution from the mind itself, in order to any description whatsoever.

We shall now proceed to enquire whether Empiricism can give us any Explanation. What does Explanation involve? In order to give Empiricism perfect fairness, we shall take our answer to this question from the leading Empiricist of to-day, Mr. Herbert Spencer. According to him, all our knowledge, or

Science, is the putting of this or that fact under a more general notion, which shall comprehend it, and all others similar to it, or in referring this or that fact to some other as being similar, thus making a classification, and then forming our notions from their common characteristics, and in bringing these again under still higher and more general notions, with the hope of finally reducing them all to one conception, which shall be ultimate. Then explanation will consist merely in showing the relation of any fact to this most general notion, through all the less general ones. We shall quote from "First Principles," section 23: "The particular phenomena with which we set out have been merged in larger and larger groups of phenomena, and as they have been so merged, we have arrived at solutions that we consider profound in proportion as this process has been carried far. Still deeper explanations are simply further steps in the same directions."

But we wish here to ask: Can Experience alone do all this? Is there not more in this process than mere experience can furnish? By asking whether experience alone would ever lead us to look for any common characteristics, *i. e.*, any common mode of behaviour among objects, we may see the way to an answer. Experience alone would never suggest to us that there might be such a thing as a common mode of behaviour in different things, or a uniform mode of behaviour in the same thing. For, as a matter of fact, the Science of the world has made its progress by refusing to believe what common experience has given, that the world is an arbitrary group of phenomena, which occur with no regularity and consistency. Unenlightened people generally, and all whose minds are objective, and occupied with only what their senses bring to them, never suppose for a moment that there is any regularity among natural phenomena. Even the educated Greeks and Romans, whose minds were essentially objective, thought each separate object was presided over by some special divinity, whose conduct was perfectly arbitrary. Even in this nineteenth century there has not yet been found any regularity in certain groups of phenomena, and this is made sufficiently evident by the fact that Science has not yet attained to anything like completeness.

The fact seems to be, then, that men think of regularity or

"law" among natural phenomena only when they have become somewhat subjective in their modes of thought, and when they begin to read into phenomena what the mind, when interrogated, indicates ought to be there. Then all the search for "law" in Science rests finally on the presupposition furnished by the mind as its contribution to knowledge, that regularity and consistency are in all phenomena, and that if we only come to thoroughly understand the phenomena, we shall then find the regularity or the LAW. If, then, these presuppositions underlie all attempts at explanation, we may accordingly conclude that Empiricism is forever incapable of giving any explanation, without which there can be no knowledge.

We might almost conclude now that neither can Empiricism Predict, but we shall proceed to examine it on this point also. Experience of the past can never give us any indication of the future, unless we are certain beforehand that the course of the world will be like it has been. But experience can never assure us of this, for it is plainly a mental presupposition. Even if experience has found a long course of events with some uniformity, it will not obviate the supposition. For these again rest on supposition, for, as Lotze has said, supposition is the foundation of every attempt to get knowledge from experience, and "whoever doubts supposition takes away the only hope of prediction, and also robs himself of every reason for expecting one event rather than another." Some philosophers have seen this and so have tried to banish all suppositions and have left only pure mathematics, holding a science of nature impossible. This, however, would be a "reductio ad absurdum" of their theory, and they have not been able to carry it out in practical life. That suppositions are recognized in all science is shown by the fact that Natural Scientists persist in searching phenomena for LAW, when, as yet, experience has given only the negation of it. Thus we may conclude that presuppositions are necessary, and that moreover they are the mind's contribution to the knowledge of phenomena. Such are found to be the categories which Kant brought to light.

But as Hume long ago saw, these are not given in phenomena, and if they exist at all they must *underlie* phenomena. Since, however, he rejected everything not given as phenomena, he consequently

rejected these, and proved himself a consistent Empiricist, though he could not thereby prevent his philosophy from committing suicide. Herbert Spencer, however, tries to give these a place, because he sees they are necessary for science, though he is forced into the awkward position of declaring them Unknowable, being the essence of phenomena. Yet, as Lotze points out, this implies two things, firstly, that there is an essence, and, secondly, that it is unknowable, which latter shows the relation in which the human spirit stands to the essence. But if it is "unknowable," it cannot even be known to exist; hence even the knowledge of its existence cannot be obtained from experience. This, however, is one of the tacit assumptions of experience, which it is the business of metaphysics to examine. Accordingly Spencer, to be consistent, should do as Hume did, deny the problem altogether. But on either alternative his Empiricism is "self-convicted of inadequacy" to solve metaphysical problems, for on the first he is forced to foreclose inquiry, and on the second he can give no answer.

We may now ask, how do all such metaphysical enquiries arise in the first place? If we are to take Lotze's answer, it is that experience has conflicted with our expectations. Hence the enquiry for its solution. But Empiricism is again found wanting, for having nothing to appeal to, but the bare experience, it cannot even make these enquiries. For the conflict is not of experience with experience, but of experience with presuppositions or expectations. Thus, then, our metaphysical enquiries arise not within the bare experience itself, but between expectations and experience, and Empiricism being confined to phenomena of experience alone, can never have any occasion for such enquiries and can therefore have no proper metaphysics at all.

But some one may ask, may not metaphysical enquiries arise within experience itself? or may there not arise conflicts within experience itself which will lead to metaphysics? Our answer must be given in the negative, if we find that Empiricism can furnish us no knowledge whatever, for if there can be no knowledge within experience alone there certainly can be no conflict. Now we have already seen that in order to any knowledge of phenomena we must get beyond the phenomena themselves, for in these occuring successively or co-existently, there

can be no knowledge. There must be a grouping, a comparing, and such like processes in order to any knowledge, *i.e.*, there must be "relations." But whence comes the suggestion of grouping or comparing? It is clear it cannot be itself a phenomenon, but it is a mental product. Consequently Empiricism is forever shut up to a long succession of phenomena which have no connection with one another, not even can they be known in succession and co-existence, for succession and co-existence can never themselves be phenomena. Accordingly there can be no conflict of one experience with another, for there being no knowledge, there is no conscious experience. So that Empiricism is of itself not only incapable of answering our metaphysical enquiries, but it is likewise incapable of asking them. Even if knowledge were possible within experience itself, yet Empiricism can never go beyond the given, to what the given implies, and since its method must always thus be analytic, and never synthetic, it remains forever incapable of any proper metaphysics.

We cannot do better than add the line of argument in sections 5 and 6 of the Introduction to Lotze's "Metaphysics:" "But they say the science of Nature is only an arbitrary assumption of law, only a guess, and that this is only done as an experiment, as an hypothesis. But this gives only a generalization of the past, and can never touch the future. But to go back, what gives rise to the wish to find law and to the placing of hypotheses? It all rests on a conviction that nothing can happen which has not its ground in a connected universe of things. For every explanation is at last "a reduction of a mere coincidence between two facts, to an inner relation of mutual dependence according to a universal law." "If once we drop this primary conviction nothing any longer requires explanation, and nothing admits of it, for that natural dependence would no longer exist, which the explanation consists in pointing out." If we did not have this conviction, then uniformity or variety might either occur, in which case the uniformity would not prove law, for it would be an arbitrary or accidental uniformity. So a universal principle of connection of facts is necessary to make it possible for us to distinguish a probable from an improbable. The supposition is that on the strength of which we affirm general uniformity, for experience can never give it nor prove it. This is what scientists

actually do, for when experience gives variety they still insist on finding uniformity in spite of it, but if there were no supposition or no conviction they would then give up."

"This conviction, then, that there is a relation of mutual dependence between things according to law, is not given in experience. But science takes this supposition with more exclusiveness than philosophy can do off-hand. What these laws are it deems it a matter of experience to find out. But experience, as we have seen, cannot even do this. Neither does metaphysics attempt it, for it is not its business to demonstrate special laws of nature. But it will only be able to unfold certain ideal forms to which the relations between the elements of everything real must conform. So that when science gives results which contradict these, they must be treated as fictions or unexplained facts. Consequently experience not being able to arrive at the special laws will be much less able to arrive at the ideal forms which it is the business of metaphysics to unfold."

Thus Empiricism is convicted of inadequacy either to ask or answer any Metaphysical questions whatsoever.

CORALS OF THE CORNIFEROUS FORMATION OF WESTERN ONTARIO.

BY A. COSENS, '96.

[Read before the Natural Science Association, Nov. 27th, 1895.]

THE Corniferous formation overlies nearly one-third of Western Ontario. Its base or lower border runs north-eastward from near Goderich on Lake Huron to the township of Greenock, then taking a turn it maintains a southward course to the township of Burford, then strikes eastward to the township of Bertie. The shore of Lake Erie, from the outlet of the Niagara River to Port Rowan, lies upon this formation; in that locality, however, it is so covered with superficial deposits that its exact boundaries are uncertain. Besides this large extent of territory, it occupies, in the region south-west of James Bay, an area greater than all the western peninsula of Ontario. The thickness of this formation is uncertain, as it is very difficult, either on lithological or palæontological grounds, to separate it from the underlying Onondago formation. Borings in different parts of south-western Ontario have given the following results: Port Lambton, 320 ft.; Petrolia, 378 ft.; Belle River, 209 ft.

It is made up essentially of bituminous limestones, containing, in many places, nodular masses of hornstone, from which, indeed, the formation receives its name; but in Western Ontario it consists almost entirely of grey limestone, usually containing large numbers of fossil corals, some of which form masses of considerable size. In many places these ancient corals may be found forming regular reefs, since the limestone of the corallum has been replaced by siliceous or flinty matter in such a way that when the surrounding limestone weathers away, the corals are left in relief, presenting much the appearance they did when inhabited by the zoophytes of Devonian times. It may be mentioned here that this natural process of weathering may often be assisted and the coral separated from the matrix by immersing in dilute acid.

Since the Corniferous comprises a time midway in the Devonian period, we must expect to find in it the culmination of the Palæozoic corals. The numerous and formidable fishes of that period, the probable exterminators of the Trilobites could have no object in attacking them, and consequently they were able to eat, drink and be merry, so long as the conditions of the sea were suited to their existence.

Since none of the soft parts of these fossil corals are preserved, it becomes a matter of extreme difficulty to classify them satisfactorily. After examining several methods, I have finally decided to adopt that of Nicholson as being the clearest and most comprehensive, and a skeleton of his classification is given in order to make clear the positions occupied by the Corniferous genera.

ORDER (I) ZOANTHARIA (MESENTERIES NEVER EIGHT IN NUMBER).

FFO { Sub. Order (1) *Actiniaria* (Corallum absent).
" (2) *Antipatharia* (Horny Sclerobase may be present).
" (3) *Madreporaria* (Well developed Sclerodermic Corallum, with a symmetry varying with the mesenteries).

Madreporaria—

Section (1) *Aporosa* (Symmetry may be completely radial or bilateral, arrangement of septa typically hexameral or may be tetrameral, pentameral or otherwise abnormal).
" (2) *Rugosa* (Tetracorolla). Symmetry of Corallum always obviously bilateral, since a well marked septal fossula is usually present. The septa, which are typically developed after a tetrameral symmetry are alternately long and short.
" (3) *Fungida* (No Palæozoic forms).
" (4) *Perforata* (Calcareous tissue of Corallum, more or less porous: thus the chambers of the corallites in compound forms are placed in communication. Septa usually somewhat porous.

Madreporaria Rugosa—

Section (1) *Cyathophylloidea* (Peripheral region of visceral chamber occupied by vesicular tissue, central region occupied by tabulæ. Symmetry conspicuously bilateral.
Genus (1) *Diphyphyllum.*
" (2) *Eridophyllum.*
" (3) *Heliophyllum.*

Genus (4) *Blothriophyllum.*
" (5) *Phillipsastræa.*
" (6) *Clisiophyllum.*

Section (2) *Zaphrentoidea* (Visceral chamber never sheathed with a zone of visculart issue, and consequently the tabulæ are more extensively developed).
Genus (1) *Zaphrentis.*
" (2) *Amplexus.*

" (3) *Cystiphylloidea* (Septa and tabulæ absent or merely rudimentary vesicular tissue extensively developed).
Genus *Cystiphyllum.*

Madreporaria Aporosa—
Genus *Petraia.*

Madreporaria Perforata—
(1) *Favositidæ.* Genus (1) *Favosites.*
" (2) *Alveolites.*
" (3) *Michelinia.*
(2) *Syringoporidæ.* Genus *Syringopora.*

ORDER (II) ALCYONARIA (MESENTERIES EIGHT IN NUMBER).

Auloporidæ. Genus *Aulopora.*

As an introduction to the corals proper, it will not be out of place to give a short description of the Stromatopora which is so characteristic of the Corniferous formation. This interesting fossil has been classified differently by various authors, it having been placed with the Sponges, the Bryozoons, the Formaminifera, the Corals, etc. Consequently, in its classification, a great deal of latitude is allowed. It has, however, certain affinities with the Palæozoic Corals that will admit of it being described with them.

It forms amorphous masses or sheets composed of delicate calcareous laminæ, arranged in successive layers one above another. These are separated by minute pillars which have much the appearance of cell tubes. These rods are directed usually at right angles to the laminæ, and consequently they divide the spaces between the latter into minute compartments. The laminæ in some cases are disposed around a centre of foreign matter, the particular specimen of which I have made a study being arranged concentrically around a coral of doubtful genus.

Nicholson reports five species of Stromatopora from the

Corniferous limestone of Ontario, but one of these, S. concentrica, he regards as doubtful.

Genus PETRAIA.—Corallum simple, turbinate, more or less curved, total length from $\frac{3}{4}$ to 1 in., diameter of the cup varying from $\frac{1}{2}$ to $\frac{3}{4}$ in., calyx oblique so that the greatest length of the coral is along its convex side. The septa are 26 or 28 in number a little above the base, but increase to 60 or more as we approach the cup; the increase in number is due to the bifurcation of each primary septum and to the intercalation of new septa along both sides of a line running along the dorsal or convex side of the coral from top to bottom. This line is marked on the exterior by a prominent ridge. The septa are unequally developed, the larger ones being somewhat bent and twisted in the centre, but a true columella is never present; tabulæ are also entirely absent. The septa show a somewhat crenulate appearance, and are connected by delicate transverse dissepiments. P. logani principal species in the Corniferous.

Genus HELIOPHYLLUM resembles Petraia in external appearance and size, also in the distribution of the septa, although the number of these appears to be somewhat greater in this genus. It differs, however, from the former genus in the possession of well-marked tabulæ, and in having its dissepiments less strongly developed; in no case do they reach the contiguous septum. Also the septal ridges on the exterior of Petrai are somewhat more pronounced than in this genus. Several species have been reported, of which the following are the principal: H. Canadense; H. Cobornense; H. Colligatum.

Genus CLISIOPHYLLUM resembles the former genus in the possession of an outer vesicular zone and well-marked tabulæ. It, however, has a false columella composed partly of vesicular tabulæ and partly of twisted plates, which have in general a radial direction. This pseudo-columella forms a rounded prominence in the calyx of the coral. The septa are long and short alternately, and a well-marked septal fossula is present, giving a distinct bilateral arrangement to the distribution of the septa. The septa are thickened by lateral deposits of stereoplasma, but are never carinate. The species of this genus represented are not well distinguished.

Genus BLOTHRIOPHYLLUM.—In this genus the conical pro-

tuberance of the form just described is absent, and also it is further distinguished from that genus by an external zone of arched tabulæ and imperfect septa. The forms I have examined have all been cylindrical, but it also furnishes turbinate examples.

A very common form of the Corniferous is B. decorticatum. This species is often 2 ft. in length, and from 2 to 3 in. in diameter. The epitheca of this species as betokened by the name is rarely preserved, thus giving it a very characteristic appearance, since the arched tabulæ with the imperfect septa are fully exposed to view. When the epitheca is present it is strongly marked with folds of growth and longitudinal furrows.

Genus DIPHYPHYLLUM.—Corallum simple, associated into large aggregations of long, slender, cylindrical corallites. The interior is occupied solely by tabulæ and as a general thing this region is not encroached upon by the septa, which occupy an exterior vesicular zone. Columella absent, some authorities however think this may be due to the process of fossilization but there do not appear to be any grounds for this belief. The species of this genus, viz: *D. Stramineum, D. Gracile,* are among the most conspicuous fossils of the the corniferous formation.

Genus EERIDOPHYLLUM differs from the former only in having its corallites united at greater or less distances by horizontal connecting processes and even this distinction does not always appear to be constant.

Genus PHILLIPSASTRAEA resembles essentially in internal structure Heliophyllum. A cell wall is however always absent, and the union of the outer ends of the septa connect the contiguous cells. These septa are alternately long and short and have carinæ developed on them. A distinct fossula is usually present and thus a clear bilateral symmetry is produced. The appearance of this genus is thus exceedingly striking and when once seen can never be mistaken. Hugh Miller has immortalized it by showing the similarity it bears, with its stars and confluent rays, to a calico pattern once very dear to the female h eart. From this circumstance he argues that the æsthetic qualities of the Supreme Being and man must necessarily be similar. The species represented most commonly in this formation is *P. Gigas.*

Genus ZAPHRENTIS.—Corallum simple, turbinatte or cylindrical cup deep with a single strongly developed fossula, this structure

may be on the convex side of the corallum, on the concave side or even lateral. The septum included in it is very short and may be entirely obsolete. The wide inner end of the fossular groove is partly enclosed by the septa bending around it and coalescing in that position. The septa are arranged bilaterally and are alternately long and short, the latter being sometimes partly rudimentary. Dissepiments are sparingly developed in the outer zone of the corallum, while tabulæ are largely developed and pass from side to side of the visceral chamber. The two species that have come under my notice are, *Z. gigantea*, *Z. prolifica.* The former varies from a few inches in length to 2 ft. or more and from $1\frac{1}{2}$ to 3 in. in diameter. It is thus a rather difficult matter to distinguish it's smaller examples from the larger ones of the following genus, viz : *Z. prolifica.* Billings reports a columella in this latter species but the specimens of which I have made sections gave no appearance of it.

Genus AMPLEXUS is closely related to the preceding genus but the simple corallum is usually cylindrical in form while the septa are much less perfectly developed, being confined to the margin of the corallum, the centre of which is occupied by nearly horizontal tabulæ. This genus is not at all common in the corniferous, and consequently does not require detailed description.

Genus CYSTIPHYLLUM.—Corallum usually simple, cylindrical, straight or variously curved, epitheca thin, calyx deep, sometimes tuberculated with ridges representing the septa. This coral often presents the appearance of several hollow cones thrust one inside the other. Each of these cups represents a periodic calyx and is produced by budding from the original polyp. Cross sections of this coral show the visceral chamber to be entirely filled with vesicular tissue, consisting of obliquely disposed lenticular cells. Longitudinal sections often show the funnel shaped arrangement of the layers mentioned above. Four species are reported by Nicholson from the corniferous, viz : *C. Sulcatum, C. Grande, C. Senecaense, C. Americanum.*

Genus FAVOSITES is important as presenting affinities to the Poritidæ, a coral which is building reefs at the present day. It comprises branched or massive corals composed of numerous more or less polygonal corallites, which are divided internally by tabulæ, which in some cases extend nearly across the tube, while

in other cases they are quite rudimentary. The septa are absent or minute, being at most represented by short spines.

In cross sections the individual corallites are seen to have distinct walls. Thus the partition which separates contiguous tubes, is usually represented by a central dark or light line, bounded on each side by stereoplasma. These corallites, however,are placed in communication with each other by the so-called "mural pores," which are usually arranged in longitudinal series. These pores are situated on minute eminences and are placed in a regular order. They are sometimes however incomplete, owing to the primordial wall which separates contiguous tubes not having been actually perforated. As distinguished from the preceding genus Cystiphyllum, the tabulæ of this form never anastomose to form vesicular tissue. The species are distinguished by the distribution of the mural pores and the degree of completeness of the tabulæ. A large number of species are reported from the Corniferous, those that I have found most commonly represented are *F. Hemispherica, F. Basaltica, F. Gothlandica, F. Turbinata.*

Nicholson describes one species to which he has given the name, F. Chapmani. It appears to be in some respects a connection between Favosites and the next genus Alveolites.

Genus ALVEOLITES.—In this form the corallum is massive or encrusting, composed of short cylindrical, or prismatic corals, which have inseparably united walls. These corallites are usually more or less compressed so that they appear triangular or semilunar in cross section. Their openings are always oblique to the surface, the lower lip being the more prominent. The tabulæ are complete, but the septa are represented only by tooth-like ridges. The mural pores are few in number. It thus differs from Favosites in the greater shortness of the corallites, the incompleteness of the septa and the oblique calyx. Several species are reported from the corniferous, one especially *A. Labiosa* being found abundantly everywhere in that formation in Western Ontario.

Genus MICHELINIA.—Corallum composite, forming hemispherical masses, depressed or pyriform. The corallites are subcylindrical or prismatic and have their walls perforated by mural pores. The corals of this genus approximate closely in their

general characteristics to those belonging to *Favosites*, but they are distinguished by the larger size of their corallites, by the septa being represented only as striæ and by the tabulæ inosculating so as to give rise to a tissue of arched vesicles. One species may be mentioned as occurring very commonly in the corniferous limestone, viz., *M. convexa.*

Genus SYRINGOPORA.—Corallum aggregate, at first creeping, then sending up numerous vertical, cylindrical corallites, which are usually flexuous and sub-parallel and are connected together by numerous transverse connecting processes. Septa rudimentary, tabulæ well developed, usually funnel-shaped, but they may be simply curved, while in one cross-section I examined they were almost or quite horizontal.

The affinities of the group of the Syringoporidæ are disputed, it having usually been placed among the Alcyonaria, but it seems to be very closely connected in several points with the Favositidæ. The hollow connecting processes shown in the genus Syringopora are morphologically nothing more than mural pores, and there appears to be a tendency even in Favosites towards the production of these processes, since the mural pores in that genus are almost invariably situated upon minute papillæ. It is also worthy of note that where the corallites come into direct contact typical mural pores are produced. The septa are also both in Favosites and Syringopora in the form of vertical rows of calcareous spines.

The species most commonly represented in the Corniferous Limestone are *S. Hisingeri*, with very slender corallites closely aggregated and presenting a rugged or knotty appearance.

S. Maclurei, consisting of long only slightly flexuous corallites.

S. Perelegans, distinguished from the preceding by the diameter of the corallites being less and by them presenting a less flexuous appearance.

Genus AULOPORA.—Corallum creeping, corallites pyriform, trumpet-shaped or cylindrical, the cavity of each communicating with that of the one from which it springs. Septa absent or represented in a rudimentary fashion by rows of minute spines.

Although placed in a separate order the corals of this genus often bear a close resemblance to young colonies of Syringopora before the latter have commenced to send up vertical corallites.

This genus is often found attached to foreign bodies as shells or even other corals.

Three species at least are represented in the corniferous, viz., *A. tubæformis*, *A. umbelliferæ*, *A. cornuta.*

When studying the numerous corals of this period, we naturally ask ourselves questions concerning the physical conditions that must have existed to produce this form of life so abundantly.

The similarity in structure between the modern corals and their Palæozoic ancestors is so pronounced that we are quite safe in concluding that the conditions necessary for one would be required by the other. We find our modern corals unable to exist in a sea whose mean temperature is below 68° F., nor can they flourish at depths greater than 15 or 20 fathoms. Coral growth in the seas of modern times is prevented where fresh or muddy water is present, but is much accelerated when the medium in which they are growing is disturbed by currents, this disturbance appearing necessary as a means of transporting food to the polyps.

We have thus data from which we are able to draw a map of the western part of Ontario during the time when the corniferous limestone was being laid down. To my mind, at least, it appears that this map must present many of the insular and oceanic peculiarities of the Southern Pacific at the present day.

List of the principal genera of corals found in the corniferous formation of Western Ontario :—

Diphyphyllum, *Eridophyllum*, *Heliophyllum*, *Blothriophyllum*, *Phillipsastræa*, *Clisiophyllum*, *Zaphrentis*, *Amplexus*, *Cystiphyllum*, *Petraia*, *Favosites*, *Alveolites*, *Michelinia*, *Syringopora*, *Aulopora.*

NOTE.—The descriptions of the microscopic peculiarities of the different genera were made in almost every case from sections of corals, ground in the Mineralogical Laboratory of the University.