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PREFACE

Public lectures, by members of the University faculties, have been held for three years, and the present volume contains the subjects discussed in the third year of the course. It is assumed, from the continued attendance on the part of the general public, that these efforts of the University in the direction of public service are appreciated; hence it is a genuine pleasure to place, in this permanent form, the products of the thought and endeavor of the men who are quietly advancing the borders of human knowledge within the halls of the University, that a still larger audience may come to know them.

THE ECONOMIC INDEPENDENCE OF THE UNITED STATES

By Edward Sherwood Mead
Professor of Finance

The European war, both in its immediate consequences and its remote results, must exert a profound influence upon the policies of the United States. It is now reasonably certain that our military and naval expenditures will increase not merely to the point of providing the means of national defense, but also to the provision of an equipment which shall enable us to protect our interests in whatever part of the world they may be threatened. To such a policy opposition is not likely to be effective. We are living in a world where responsible statesmen plot the ruin of weak and peaceable neighbors and carry out their plots to the conclusion of wholesale murder and national extermination; a world where it is no longer considered necessary to offer the specious excuses of diplomacy for acts of violence, where even declarations of war are dispensed with, where all the so-called laws of war are set at naught by the nations which originated them; a world in which nations offer themselves on the auction block, sell their so-called honor to the highest bidder, and will find, when too late, that the purchase price is paid in counterfeit money. In such a world it is folly to remain undefended by little else than the consciousness of virtue. To this conclusion, I think I am safe in saying, the public sentiment of the United States has arrived. Even our pacific President, who six months ago was too proud to fight but who is not too proud to learn, is pushing a program of naval and military expenditure which leaves his critics impotent and mute.

While we may be in general agreement with the policy of military preparedness, it is not so easy to agree with some

of the arguments by which this policy is justified, and the implications which it contains. We are told that the United States is now a world power, that a large part of our economic future lies over the sea, that we must have a huge merchant marine to carry our surplus products abroad, that our manufacturers must learn to adapt their wares to the diversified needs of the buyers of many nations; that we must enter the contest for international trade, and that we must win in that contest. Our foreign policy, it is urged, must, to a large extent, be molded by considerations of export trade.

For example, we were urged to strong protest against the recent aggressions of Japan upon her defenseless neighbor on the ground that the door into China should be kept open for American products and American financiers and investors. The retention of the Philippine Islands, an expensive and otherwise useless undertaking, is justified mainly by trade considerations. Our growing influence in Latin America, which has already taken the form of a virtual protectorate over Cuba, Hayti, San Domingo and Nicaragua, and which seems likely to develop into a protectorate over Mexico, is justified by consideration of export trade and its direct consequence, foreign investment. The recent loan to two of the belligerent powers was justified exclusively by the argument that if this credit was not given, our export trade would seriously decline. And when the representatives of the Allied Powers return in the spring, as they have said that they may return, for another loan of larger size, the same argument will be heard. If we may judge from the tone of newspapers of many shades of opinion on other matters, and from the utterances of public men of all parties, large export trade is of supreme importance in order to get rid of our surplus products, which, unless quickly disposed of, would decay in our midst, a decomposition attended by the gravest consequences to our national well being, certain to result in prolonged business depression with its attendant ills.

The Secretary of the Treasury, Mr. William C. McAdoo, in his recent Indianapolis address in advocacy of a government

owned merchant marine, has expressed this view as though it were an accepted axiom of economics. "I believe," said the Secretary, "that there can be no difference of opinion as to the desirability of increasing our foreign trade. I believe that we shall all agree that the prosperity of this country depends upon the maintenance and expansion of our foreign commerce," and in another place, "We are one of the greatest industrial and producing nations on earth. We must have foreign markets to absorb our surplus products. Without them we shall have stagnation and depression and want." These statements are supported by a reference to the prostration of American industry at the beginning of the war due to the sudden interruption of our export trade, and to the recovery due to large orders from foreign nations. I think that we are safe in saying that the administration believes that the future prosperity of the United States is closely bound up with a large foreign trade.

It is worth while to subject this theory to critical examination if for no other reason than that its acceptance is likely to lead us into trouble. It is one thing to prepare for war, but quite a different matter to adopt a policy which increases the chances of war. Where a nation oversteps its boundaries it steps into trouble. When it places its capital in foreign lands it assumes the responsibility of protecting that capital. Within its own boundaries it is safe from disturbance; without, however, are serious possibilities of danger. The consequences of foreign trade and the desire for more foreign trade, are among the most fruitful causes of international dissensions. Take the present conflict. In part it originated in a desire to accomplish union of severed nationalities, in part from plain fear of aggression, but its main motive is the trade conflict between Germany and Great Britain. From the peculiar limitations of the natural resources of these great powers, they have been forced into foreign trade. Germany was late in entering the contest, but she has far outdistanced her rival who had two hundred years the start of her. In the endeavor to challenge the sea power upon which the trade supremacy of England rests, and to gain

still further advantages, Germany embarked upon a program of naval construction. Immediately England took offense, made friends with her traditional enemies, Russia and France, drew Italy into the circle of her influence, and built up a wall of hostility around Germany. Germany refused to desist from naval preparations, her export trade continued to swell, her designs upon the Turkish Empire as a fruitful field for trade expansion prompted her, in co-operation with Austria, whose interests were in this respect identical, to intervene in the Balkans, and suddenly Europe was at war, a war which is primarily a trade war financed by England for business reasons to cripple, and, if possible, to ruin her most dangerous commercial rival, to insure for another century the world supremacy in trade which she won in the Napoleonic Wars. . . . Now that the United States has loaned England a half billion dollars to assist her in her difficult task of crushing Germany, may we not be permitted a quiet smile at the extraordinary pretense that England is engaged in a contest for civilization against the modern Attila, that she is spending or lending $25,000,000 per day for sentimental reasons, that her sympathy with Belgium is inspired by anything less substantial than a fear of Belgium in German hands, that she is holding her lines in France from motives more disinterested than a fear of the Channel ports in the possession of Germany or that, in all her doings, she is not working for the advancement of the permanent business interests of the British Empire. The American people have little sympathy for Germany, because of her policy in waging war. We shall not soon forget the Lusitania, nor the invasion of Belgium. We know who threw the match into the magazine, and we believe that the aggression of Germany was the immediate cause of the conflict. Our sympathies, for these reasons, incline, if not to England, at any rate away from Germany, but the indulgence of the pleasurable emotion of sympathy with ruined Belgium and hard pressed France, that love of justice which is, at bottom, the fear of suffering injustice, should not blind us to the fact that this war is a trade war, financed on

the side of the Allies by England for trade reasons, and continued by England as long as there shall be any prospect of permanent trade advantages commensurate with the expense.

We cannot predict the result of this war. It may cease from general exhaustion. Already some of the participants are on the brink of ruin. The chances of another year of war seem increasingly remote. We can be sure, however, that peace will not bring disarmament; that the preparation for the next war will begin the day that peace is declared, and that the struggle for markets, the warfare of tariffs, preferential trade agreements, discriminatory patent and corporation laws, will be waged with increasing energy. The United States has remained neutral in the warfare of killing. What shall be our policy in the warfare of commerce? Shall we take an active part in the contest for export trade? Shall we send our capital abroad to develop the resources of foreign countries, molding our national policy to conform to the necessities of trade and investment, or shall we continue, as in the past, to concentrate our energies on the development of our domestic resources?

A brief consideration of the objects and methods of foreign trade may furnish us with an answer to these questions. A nation in foreign trade should be looked upon as an individual. An individual spends his money for these purposes: first, to purchase commodities or services; second, to pay debts; third, to make investments. In international trade, exports to other nations and services performed for them correspond to the outlays of the individual. The United States has little shipping, insurance or financing business as yet, so our expenditures are represented by our exports of commodities. These exports pay for our imports, they pay our shipping and insurance bills, they pay the expenses of foreign trade, interest and dividends on foreign investments in the United States, maturing loans, and the cost of American securities resold to this country. Exports are not presents to foreigners, they are payments. They are not the objects of foreign trade, any more than individual expenditure is the object of individual effort; they are

the means by which the objects of international trade are achieved.

This fact is thoroughly understood abroad. European statesmen and business men are under no illusions on the subject of foreign commerce. They push the export trade because of the necessities of importation, or in order to find investments for their surplus capital. They are not guilty of the absurdity of supposing, as some Americans seem to suppose, that a nation can sell without buying.

The recent financial situation of the United States has furnished spectacular demonstration of the truth of a proposition which should be axiomatic. During the current year our export trade grew to gigantic size, while our imports dwindled. Under normal conditions debts due citizens of the United States are balanced by current obligations of residents of this country. The American exporter draws on his foreign buyer, and sells the bill to an American bank, to be sent abroad and the proceeds deposited to the bankers' credit. The American debtor at the same time buys from the banker who has purchased the exporter's right to receive money in England, the bankers' own check, drawn against the deposit in English banks of the proceeds of the exporter's bill, and sends it abroad to pay his, the American debtor's bills. Occasionally the debts owing one way exceed the payments coming from that direction. Americans, for example, owe more on current accounts than they have to receive. The demand for bankers' checks on English banks exceeds the supply of American bills drawn on English importers, by whose collection the deposits of the American bankers in the English bank, against which American bankers' checks are drawn. The American banker, in order to supply the demands of his customers for the means of foreign payment, negotiates a short loan known as a finance bill with his English correspondent and checks against the proceeds, repaying the loan when the supply of American bills again increases. Sometimes also, the American balances are kept up by gold exports to England. When the situation is reversed and bills offered

for sale here are in greater amount than the demand for bankers' checks, the American banker brings in gold to keep himself in funds on this side.

This normal balance and equation of foreign trade was violently disturbed at the outbreak of the war. At first England and France drew gold from this country by the expedient of refusing to pay their own debts and demanding the payment of ours. Since no money could be borrowed in the English market, American bankers were forced to send over gold.

At a later time, the movement was reversed. Europe bought heavily of American products, especially, at the outset, of food and raw materials, European exports to this country dwindled away. At once the ideal situation, from the standpoint of the extreme advocates of large exports and restricted imports, developed. We were selling them more than we bought. The road to unlimited prosperity stood open. The publications of the Bureau of Foreign Commerce fairly cackled with exultation. An enormous balance of trade, the crown and flower of successful commercial development, stood revealed. As Secretary McAdoo said, we entered "A period of gradual loosening up, of restoration, of confidence and credit, until now the orders from foreign nations have so stimulated our foreign trade that there is a demand for all our surplus products, particularly the products of the farms."

But difficulties arose. How was Europe to pay for these exports? The usual methods proved unavailing. American exchange on London fell from $4.86, the normal price of a pound sterling in New York, to $4.52. The price of things purchased from America advanced with the increase in the cost of realizing the proceeds of sales. Immense quantities of gold and securities were sent to America from England, but still exchange did not advance. A serious curtailment of exports seemed inevitable when the situation was met, as American bankers in happier days were accustomed to meet similar situations, by the negotiation of a loan in this country suf-

ficient in amount to make up the difference between the value of American exports and the money owing by Americans to Europe on current accounts. In short, we have agreed, up to $480,000,000, to accept the short term notes of France and England in payment for our exports.

Incidentally, we have loaned England and France $480,000,000 with which to carry on their own war and to finance Russia and Italy, and by this amount we have lessened the strain upon their own money markets. We have, directly and indirectly delivered to England and France one-half billion dollars worth of war munitions which will all be used to continue the struggle against Germany. If the credit is drawn upon by agents of the borrowing powers on this side, it will be directly used to pay for shells, powder, rifles, cannon, machine guns, submarines, uniforms, shoes, automobiles, barbed wire, material for bridges, and all the varied paraphernalia of destruction and death whose manufacture is spreading prosperity over the United States. In so far as the credit is used to furnish English importers with the means of payment in New York for commodities not intended for war use, the proceeds will be placed to the credit of the British Government to be paid out on the order of Kitchener and Lloyd George.

Let us now return to the main highway of our discussion. Foreign trade, we see, is an exchange whose purpose is to export in order to purchase, to pay, and to invest. Is the situation of the United States such that it is to the national interest to encourage a large export trade? Does the future of the United States, like the future of Germany and England, lie upon that great domain which the midshipmen of England in one of their sea songs, for a hundred years and never more truthfully than today, describe as the King's highway.

Observing our export trade from the three standpoints, purchasing, paying and investing, we can arrive immediately at certain obvious conclusions concerning the future policy of the United States in reference to the encouragement of export trade. First, if large exports are desired, the present tariff

duties which represent a considerable decline from previous schedules, must either be continued or preferably still further reduced. Second, the United States must use her large exports to repurchase American securities now held abroad, or, third, we must make large investments in foreign countries.

To continue and still further develop the policy of a low tariff, looking at the question solely from its bearing upon export trade, must either result in large importations, in part at the expense of American industries producing similar articles, or, if American manufacturers are able to maintain themselves, a low tariff policy will be ineffective in obtaining an adequate return for our large exports. Imports into the United States are broadly divided into two classes: manufactured articles which are sold in competition with the products of American factories and raw materials. The latter consist mainly of the products of the tropics, sugar, rubber, coffee, fibres, together with certain raw materials such as iron ore, nitrate of soda, etc., articles which we do not produce or which can be imported at lower cost than they can be delivered from domestic sources. The former cover throughout the entire range of production. In the last fiscal year, under normal conditions, that ending June 30, 1914, the division between these two classes was as follows (in millions):

1,199.9 raw materials and half-finished products.
694.0 manufactured products.

Materials used in furthering production or imported food stuffs represents nearly twice the value of manufactured commodities other than food. The manufactured imports are sold in competition with American manufactures—cotton, woolen and silk goods, drugs, chemicals and dye stuffs, iron and steel manufactures, crockery and glass ware, knit goods, rugs and carpets, and a thousand other commodities all duplicating the results of American industry.

It is impossible to greatly accelerate the importation of raw materials and food stuffs. That must keep pace with the

growing requirements of our population and industry. A continuation of a low tariff policy may, however, largely increase the importation of manufactured articles which can either be produced more cheaply abroad or which represent the surplus output of foreign mills sold in this market at any price, above cost, which can be obtained.

I use the words, may increase, in reference to the effect of a low tariff policy upon imports of manufactures, because of a desire to avoid a controversy. The Secretary of Commerce and Labor, Mr. Redfield, for example, does not agree with the view that foreign manufacturers can undersell Americans. He attributes any success they have achieved in this regard to what he described as the lax and careless business methods of American producers and to the failure to improve their machinery and processes. Without taking sides on this question, we can, however, safely conclude, that if a low tariff policy does not increase imports, it will be impossible, without a resort to some other expedient, to maintain exports at their present level, since the foreign buyer of American goods would, in that event, just as he is today, be unable to pay for his purchases without borrowing.

I may be permitted, also, to say a word upon an aspect of the tariff questions which transcends the ordinary considerations of comparative international costs. It may be that, in a world of peaceful competitors, the United States should rely upon the processes of international exchange to supply her needs. For example, dye stuffs, potash, salts, and carbolic acid, can probably for many years be purchased more cheaply from Germany than they can be manufactured in the United States. But recent experience has shown that in time of war, national self-sufficiency is of supreme importance. The contrast between Germany and England is illuminating. At the most, it is true, the United States could never suffer more than trivial inconvenience from the interruption of its foreign trade. This country will naturally grow more economically independent. The consideration is, however, of sufficient impor-

tance to set against the argument that a nation should always buy in the cheapest market.

We come, now, to the aspect of the problem of large exports which is of dominating present importance. A large balance of trade in favor of the United States can be obtained by an increase of importations at the expense of American industries producing the goods imported through the international security market. Exports demand corresponding imports, but the imports need not be of material things. We can repurchase, as we have recently been doing, and will continue to do, the securities of American corporations which represent the investments of European capital in this country and whose amount has been estimated at as high a figure as $5,000,000,000. This process will, however, have the ultimate effect of reducing that part of our export trade which now goes to the payment of interest and dividends on these securities. Assume, for example, that the United States owes $250,000,000 a year to foreign investors. This annually accruing debt is paid by exports of wheat, cotton, lumber, meat products and manufactures. To that extent, at least, our exports would exceed our imports. Suppose, now, so long as these American securities are held abroad, that within ten years, as a result of the forcing of our export trade, with conditions of international exchange, resulting in higher security prices in the United States, this $5,000,000,000 of American stocks and bonds is repurchased. Evidently the $250,000,000 of American products which formerly went to Europe to increase the working capital and income of foreigners, would then remain at home to be saved and spent in this country. During the period while the securities are being returned, exports would exceed imports. When the process was completed, the balance of exports would be reduced, not merely by the $5,000,000,000 assumed as the annual repurchase, but by the $250,000,000 of interest and dividends.

We are left, therefore, if we refuse to countenance the replacing of American made goods by foreign importation and if we concede that the repurchase of American securities is merely

a temporary expedient, with one resource to attain the desired object of that large export trade which we have been so often and so vehemently assured is necessary to keep our economic system from being clogged with waste products, and to avoid the baneful results of auto-intoxication. That resource is foreign investment. Shall the United States rival England and Germany as world powers in finance? Shall American capital be sent abroad by the billions of dollars to refund the war debts and rebuild the ruined industries of Europe? Beyond this, shall American capital be sent abroad to go into the development of new countries, China, Asia Minor, Russia and, as it has gone in the past, but in increasing volume, into the Latin-American states?

To answer this question intelligently demands a brief preliminary statement of the nature of foreign investment which has, it is true, been suggested throughout this discussion. Capital is of two kinds, fixed and fluid. A railroad is fixed capital. The commodities consumed in the running of the railroad, including not only the operating supplies, the coal, oil and lumber which are used up in the operation of the property, but also the food, clothing, etc., consumed by the employees, represent the fluid capital. A large part of the fluid or working capital of the country is utilized in operating its industries. A smaller portion is employed in extending old enterprises and developing new ones. Continuing our railroad illustration, Mr. James J. Hill, who has just been instrumental in sending $480,000,000 of American capital, that is, American commodities, abroad, has frequently stated that at least $1,000,000,000 a year should be invested for years to come in new railroad construction. This means that $1,000,000,000 a year of wheat, cotton, lumber, meat and iron and steel, and the manufactures thereof, should be placed at the disposal of railway companies for new construction. To the extent that these commodities are sent abroad to be used either in slaughtering and devastating now, or in rebuilding and developing later, to that extent, these commodities will not be available for the development of American resources.

We have, therefore, still continuing our examination of the desirability of a large export trade, to choose between foreign investment and domestic investment, between keeping our capital, that is our products, at home, to give employment to our own people in developing the resources of our own country, or of sending this capital abroad to employ foreign labor and to develop the resources of foreign lands. If this policy is adopted and vigorously pushed we can, for many years to come, sell more goods than we buy, taking our pay for exported commodities in the stocks and bonds of foreign companies and governments, and either investing our interest in further foreign loans or drawing it back, as England has done, in imported goods. Opinions differ as to the expediency of one policy or another. There are men in this country who are in a position to make large profits from the exploitation of foreign resources for sale to the American public in the form of securities of foreign companies. These men, and the considerable body of public opinion which they influence, are outspoken in their advocacy of a vigorous foreign policy as a means of opening new channels for export trade, new opportunities for American investment. They wish the United States to assume larger control over Latin-America, and here their views meet, but little opposition, to assert ourselves in China, in a general way, to take a prominent place in the great world which lies without our boundaries. It is fair to presume that they will urge, then, participation in foreign loans at the conclusion of peace.

On the other hand, are those who believe in the doctrine of America first, not merely first in patriotic song and speech, but first in practical interest as well; those who place before their minds the great problems of American internal development, the highways and the railroads which must be improved and newly constructed, the great projects of canalization, river improvement and water power development, the tasks of irrigation and drainage, the work of soil improvement, upon whose undertaking depends so directly the reduction of the cost of living, the problem of housing in our large cities, and its corre-

lated problem, improved transportation, the full development of the partially utilized resources of the United States. Those who place these considerations first believe that, for many years, the development of America will require all the savings of the American people, especially since foreign accumulations will no longer be so available as in the past. They believe that our national policy should be one of internal development rather than of the encouragement of export trade and foreign investment. Our normal trade relations are with the countries immediately adjoining. They supply the raw materials which we cannot produce for ourselves. They will purchase what we have for sale. Our interests and theirs are closely united in opposition to the interests of Europe. We are drawing them each year more closely into our circle of political influence. Beyond the development of these countries, the West Indies, Mexico and Central America, which for economic purposes are practically a part of the United States, our economic interests do not extend and our foreign policies should not attempt to go.

We come now to the final conclusion of the argument and I shall base this upon the assumption that our foreign policy should be based upon the imperative needs of American industry for new capital. These needs are great. The supply is limited to the surplus over the cost of supplying the current necessities of an extravagant expenditure. Already, and indeed for several years, sound corporations have had great difficulty in financing their requirements. Other causes, such as an unsettled policy of regulation, may have contributed to this result, but the underlying cause has been a scarcity of capital. We have just depleted our slender store by the enormous loan to England and France. This loan, let it be remembered, is not made in money, but in materials, in food and clothing as well as in the more lethal munitions of war. The proceeds of this loan could have been used in a variety of ways for the development of our domestic resources. At $50,000 per mile, for example, they would have built and equipped 10,000 miles of railroad, the most productive of all forms of expenditure,

an expenditure which permanently returns to the nation several times the interest on its cost. As it is, in place of financing 10,000 miles of railroad we have financed twenty days of war. In place of enriching America we have assisted to destroy Europe.

The current loan is over. It was floated with great difficulty and only because it offered an escape from a desperate situation. It may not be repeated.

War loans, however, are exceptional and small. It is the loans when peace is declared that should engage our earnest attention. I have already suggested that the bonds of these loans, looked at from the standpoint of the individual, will be very desirable investments. They will be offered in this market on most attractive terms. Should the American people be encouraged to accept them?

It is at this time that the real crisis arising out of the war will confront the American people. If these attractive offers by European governments and corporations are accepted, and American capital for the next decade turned into foreign loans, it is difficult to overstate the extent of the damage which will be inflicted upon the interests of this country. Some apprehensions have been expressed in administrative circles and elsewhere over the probable consequences of a flood of European imports. It is feared that the prosperity of the textile industry, for example, may be seriously affected, and, very properly, measures are being considered by which the danger may be averted.

Far more serious, however, is the danger which will threaten American industries by the "flood" of European government bonds which will be pushed into this market. America needs every dollar of capital which can be accumulated for the development of her own industries. She must depend on her own savings: Europe will be a borrower, not a lender. Any money invested in European loans is that much subtracted from our supply. We shall be faced with the necessity of repurchasing a portion of our own securities. These repurchases, at best, will place a heavy strain upon our resources, and by

this I mean that the prices of American securities may be seriously depressed by the increased supply from abroad. But if, to these offerings, which cannot be kept out, are added the unlimited supplies of European bonds, sold at bargain prices, the probable effect upon American values and American industries can be described by no milder words than disastrous.

It is unreasonable to expect that the government will interfere in a matter of this kind. Political interest in corporation matters is limited to schemes for reducing corporation profits by taxation and regulation.

The protection of American interests, in a matter of such vital importance, must be left to the good sense and intelligence of the American bankers. They went into the recent war loan flotation with great and evident reluctance. Is it too much to anticipate at the conclusion of peace they will shut the doors of America to any foreign securities not now listed on our exchanges; that they will refuse to lend upon such securities; that they will discriminate in every possible way against their sale in this country? If this course is followed by American bankers, this country may be spared the worst consequences of the European war.

PAST ACHIEVEMENTS AND FUTURE PROMISE IN ASTRONOMY OF POSITION

By Eric Doolittle
Professor of Astronomy

The science of astronomy is,—or at least seems to be to those who devote their lives to it,—one of the broadest and most uplifting of all the sciences. As with our modern instruments we penetrate and examine ever more deeply the great cloud of stars which surrounds us, we are led on and on, where we are confronted with new regions of such utterly inconceivable vastness that it seems to our finite little minds as if we are approaching the antechambers of infinity itself.

Beginning with our very little earth, it is by astronomy that its exact form, size, and density are determined. From this, the next step is to ascertain the distances, sizes and weights of our sun and the seven other worlds which, like our own, revolve about this, our nearest star. And lastly, there comes the exploration and study of the whole universe of suns of which our own sun is one; of their natures and their motions, of their origin and future destiny, of the shape and extent of this vast cloud of suns, in which, beside the bright stars themselves, there are found dark suns and nebulas and meteoric matter, all of which have their testimony to give, if we can only read it, upon the true structure and development of our universe.

It is clear that a science dealing with so wide a field must be divided and sub-divided into many parts, and that, as with the other natural sciences, no man in the short space of life allotted to him here can become a master of all the parts at once. We might first separate the study into the two great divisions of Observational and Theoretical Astronomy, the latter utilizing all the resources of higher mathematics, and even demanding a higher development of that science than is yet forthcoming. But this division is in many respects an unsatisfactory one.

It is only when the innumerable observations at the telescope have been analyzed by and placed upon the solid basis of mathematics that we can hope to extract from them their whole value and to discover what they have the power to reveal to us. On the other hand, it is only by prolonged and accurate telescopic measurement that we can secure the material for mathematical investigation. And it is the observer himself, especially if he is devoted to the Older or Fundamental astronomy, who after making his measures subjects them later to a prolonged mathematical computation.

A perhaps more natural division of the entire science is into the two parts now usually known as Astrophysics and the Astronomy of Position. Astrophysics includes the study of the physical conditions of the heavenly bodies; their luminosities, temperatures, constitutions, and in general everything which may be revealed by a study of the lines in the spectra formed by their light. Astronomy of Position, as might be inferred from its name, has to do with a very exact determination of the positions which the heavenly bodies occupy at various times upon the great Celestial Sphere. Both branches make full use of the very recent wonderful developments of astronomical photography, but while in the former the photographs are often objects of great beauty which may tell their story at a glance, in the latter the plates only give up their secrets as they are accurately measured under the microscope.

As the spectroscope did not come into use until about 1860, the former department of astronomy is a very new one; it is, in fact called by many of its votaries "The New Astronomy," whereas, on the contrary, Astronomy of Position may be considered to have begun with the first rude drawing or other location of the relative positions of any of the stars in the heavens. Fifty years ago the science of astrophysics was just beginning to exist. It had its way all to win. The late Professor Langley in the introduction to his delightful little book, "The New Astronomy," which is largely a plea for the recognition of this new science, wrote as follows:

"We are all glad to know that Urania, who in the beginning was but a poor Chaldean shepherdess, has long since become well-to-do, and dwells now in state. It is far less known than it should be that she has a younger sister now among us, bearing every mark of her celestial birth, but all unendowed and portionless."

But this was written thirty years ago. Astrophysics has now won, and rests in, a highly honored place, and the danger today is rather that the fundamental value and interest of the older astronomy may fail to be justly recognized. From the great astrophysical observatory at Potsdam to the enormous Solar Observatory founded by Carnegie, on Mount Wilson, there are many astrophysical stations whose endowments aggregate many millions of dollars: there is some danger that the true character and importance of such excellent fundamental work as is done, for example, at our own Lick Observatory, or which has been consistently followed for so long a time at our Naval Observatory at Washington may not receive the appreciation which is justly its due.

That the appeal of astrophysics was so instant and successful was not surprising. Its fundamental principle,—the principle of the spectroscope,—can be very readily explained to the man on the street. Its photographs tell their story clearly, and almost at a glance, and its revelations are easily grasped and appeal to the imaginations strongly, even of those who are not astronomers.

But with the Older, or Fundamental Astronomy, it is far otherwise. Dr. Furness, of Vassar, writes entertainingly of the disappointment felt by one, who, fired by a love of astronomy, visits an observatory for the first time, and watches an astronomer at his work. He is not found sitting at the end of a great telescope, looking at a Lunar landscape or a planet, and uttering from time to time an irrepressible exclamation of delight at what he sees, nor is he ever hunting in the sky for something new. Instead, he is probably passing hour after hour placing a fine spider's thread most carefully upon the exact centers of

successive stars, or determining to the hundredths part of a second the instants when other stars are crossing his meridian—occupations which to the uninitiated seem utterly uninspiring and devoid of interest.

But the interest and inspiration are there in soul-satisfying measure. What at first sight seems less interesting than this long continued, painstaking, hyper-accurate determination of the exact longitudes and latitudes of the centers of thousands of star discs upon the celestial sphere, and what book can be dryer than one containing the hundreds of thousands of figures in which such results are written down? But it is from these figures, and from them only, that the structure of our stellar universe can be determined, that the weights and distances and the streaming of its host of suns is made known to us, and that we are given a solid basis for the grandest generalizations as to its extensions into the depths of space and its slow, but never ending, transformation into that new universe which shall exist in ages inconceivably remote from the present.

The continual striving for a higher accuracy in all work connected with astronomy of position is indeed a partial source of its absorbing interest. The apparent displacement of a star by an amount equal to the thickness of the finest spider thread may lead the astronomer to an unexpected discovery of the highest importance. To indicate a little of the work which has been and which will be done in astronomy of position, and to point out the fundamental importance of such work in practically every department of astronomy is the object of the present paper.

Evidently to form a just conception of the universe around us, the very first step must be to obtain some idea of the distances of the stars. As is well known, however, the measurement of these is exceedingly difficult, and in fact affords perhaps the best of all illustrations of the extreme accuracy of modern methods. It is only when a star is so near that it is slightly displaced in its position upon the sky owing to our own motion around the sun that we can directly measure its distance

from us. And the distances of even the nearest stars are so enormous that when our earth alters its own position by 180,000,000 miles (which it does every six months), the change in the apparent direction of the star is excessively minute.

So early as the second century B. C., Hipparchus, the Father of Astronomy, began the first systematic observations in astronomy of position. He discovered the precession of the equinoxes, and also that the sun is nearer the earth at some times of the year than at others. He also made the very first catalogue of the stars, recording from his observations the positions of 1,080 of these, but neither he nor the Greeks of the following centuries had any but speculative theories about the true size of our stellar universe.

Upon the announcement of the Copernican Theory in the sixteenth century, it was at once recognized that if the earth is really moving about the sun the nearer stars should be, at least slightly, displaced in the sky. The long-continued, systematic observations of Tycho Brahe, though they were made with instruments which were by far the most accurate ones constructed up to that time, and though they enabled Kepler to prove that the paths of the planets about the sun are ellipses, and not circles, and thus laid the foundations upon which Newton's great Law of Gravitation afterward rested, yet failed to show any displacement of any of the stars. Hence Tycho Brahe rejected the Copernican theory and assumed that the earth is at rest.

The telescope had not yet been invented. If we assume that the smallest displacement observable in Tycho Brahe's naked-eye instruments was 100 seconds of arc,—a liberal supposition,—it will follow that he could not have detected a displacement in any star unless this star should have been so near the earth that its light occupied but eleven days in coming from the star to us. But actually the nearest of all the stars is so far away that the light with which we view it has been four and one-third years upon its journey.

After the time of Tycho Brahe, the first great step forward

was made by Halley, when, in 1718, he announced the definite discovery that at least three of the brightest stars, Aldebaran, Arcturus, and Sirius, had, since the times of Hipparchus and Ptolemy, changed their positions upon the celestial sphere. This was the first proof ever given that the so-called Fixed Stars are not actually fixed, and that therefore they are not infinitely distant.

It was but seven years later that Bradley began his classic observations upon the single star Gamma Draconis. He found that the distance of this star from the celestial equator did indeed regularly and progressively change, but not at all as it should have done if the displacement of the star's position was due to our own motion about the sun. In short, it was from Bradley's observations that two other causes were first revealed which affect the apparent place of every object in the heavens. The first of these was the so-called Aberration of Light, and the second was the Nutation, or trembling, of the axis about which the earth is turning, and whose position at any instant fixes the position of the equator at that instant upon the sky.

Each of these remarkable and very important effects causes far greater displacements in the position of a star than our own motion about the sun could do; we now know that until they should both have been discovered and their influence allowed for it must ever have been hopeless to attempt to find the distances of the stars. Bradley's most accurate observations showed, however, that Gamma Draconis must be at least three light years away, and so gave men for the first time some definite conception of the immense scale upon which the universe of stars is planned.

It was in 1838 that the great problem of directly measuring the distance of a star was solved for the first time. In this year three observers secured definite results simultaneously: Henderson found that Alpha Centauri is $3\frac{1}{3}$ light years away, Bessel discovered the distance of 61 Cygni to be 10 light years and Struve found that the light from our brilliant northern star Vega occupies 16 years in making the journey to us.

The direct measurement of the excessively minute stellar displacements is, however, a work of extreme difficulty, and to determine the distance of a single star by the older methods is a very long process. Every minute influence,—unequal refraction, precession, nutation and aberration,—must be computed and eliminated, and hence up to 1880, of the host of stars about us there were but twenty whose distances were known. Gill and Elkin, observing at the Cape of Good Hope with a very accurate instrument called a heliometer, steadily increased this number, and the latter astronomer, by twenty years continuous work at the Yale Observatory, added about ninety more.

It was in 1887 that Pritchard, of Oxford, suggested the use in this work of the delicate photographic plate. By taking successive photographs of a selected region of the sky at different times of the year and afterward carefully measuring the relative positions of the star images under a microscope, the displacements of such stars on the plates as happen to be nearest us will readily become apparent. This is a far more rapid method than any previously employed and it is a method of wonderful precision. The first notable result announced by its use was the accurate determination of the distances of twenty-five stars by Schlessinger at the Yerkes Observatory in 1910, and this was quickly followed by the determination for forty stars at Cambridge, while now, at Cambridge, Oxford, the Yerkes Observatory, the Allegheny Observatory, the Sproul Observatory of Swarthmore College, and in several others, this high grade of truly fundamental work is being vigorously carried on. At present we know the distances of some three hundred stars, and it cannot be doubted that in the course of a few years this number will be increased to many thousands. So accurate is the new method that if a star is no farther than 163 light years away its distance can be thus directly measured.

But the great cloud of suns around us contains millions upon millions of objects. The latest estimate from Cambridge is that the number of visible suns in our universe is no less than

1,600,000,000. Though we can directly measure the distances away of but a few thousands of these, we can reach no reasonable conclusions in regard to the true distances, sizes and distribution of the others. We can indeed acquire much reliable information on these points, but it must be obtained indirectly. And our greatest source of information comes from the so-called Proper Motions of the stars.

By the proper motion of a star is meant its drift over the face of the sky, owing to its own inherent motion through the great star cloud. The stars are all in motion in every imaginable direction, some of them with velocities so high as 100 miles a second, and hence every star must have some proper motion. For the determination of this it is of extreme importance that the positions on the heavens of many stars should be determined with the highest possible accuracy. The results are published as a so-called Star Catalogue, and these catalogues, beside revealing much of interest themselves, also serve as a fundamental basis to which observations are referred in the most diverse fields of astronomy.

Perhaps on the whole the most important single astronomical publication of recent years is the late Professor Lewis Boss's fundamental "Catalogue of 6,188 Stars." The position of each star of this great catalogue is determined with all possible accuracy from every modern observation made upon it and the proper motions are also stated in every case as exactly as is at present possible. This work was published in 1910. To extend it to the stars of the Southern Hemisphere, Professor Boss, in 1909, perfected the establishment of a meridian observatory at San Louis, Argentine Republic, under a grant from the Department of Meridian Astrometry of the Carnegie Institution. Here, between April 8, 1909, and January, 1911, 87,000 single observations were secured upon 15,000 stars, the places of 1,600 of which are so accurate as to be regarded as fundamental.

Catalogues of this kind contain comparatively few stars, whose positions are, however, determined with the utmost

accuracy. Another great work, not yet quite completed, is the catalogue of the Astronomische Gesellschaft. In this the whole sky is divided into some twenty-four zones, each zone being assigned to a different observatory for observation. Twenty-two volumes have already appeared, the last being from Cordoba, Argentine Republic, where the stars in the zone from twenty-two to twenty-seven degrees south of the celestial equator were observed. The whole work contains thus far the accurate positions for some 125,000 stars. Our own Naval Observatory has been for two years engaged in the continuous observation of the so-called Intermediary Stars, a work which will probably be entirely completed in the course of about ten years. And lastly, under the head of catalogues which, unlike Boss's, are wholly formed from observations made for the purpose of the catalogue itself, there should be mentioned the great Astrographic Catalogue which is to cover the entire heavens with a series of photographic plates. No less than 70,000 separate plates must be secured in the course of this work, the sky being, as with the Astronomische Gesellschaft Catalogue, divided among many observatories. When all these plates are taken and measured there will be secured the positions of millions of stars, extending in faintness down to the eleventh and even the twelfth magnitudes. This very extensive piece of work was begun in 1887. Thus far, only the Royal Observatory of Greenwich and the observatory at Oxford have finished the shares allotted to them; it has been variously estimated that from thirty to seventy-one years will elapse before the whole shall be completed.

It may be of interest to point out a few of the less obvious directions in which star catalogues are essential for the solution of, apparently only distantly, related problems in astronomy.

The shape of our earth, for example, may be determined by direct geodetic measurements and also by pendulum observations, both of which methods, as is well known, rest immediately upon the accurate determination of the positions of certain stars. In these ways the reciprocal of the values for the flat-

tening are found to be 297.0 ± 1.2 and 298.3 ± 1.1, respectively. But this flattening of the earth causes a decided disturbance in the motions of the perigee and node of our moon's path, and from this source the value is found to be 293.5 ± 0.5. Indeed, unless we assume that our moon is more dense at its surface than at its center—a very improbable supposition—it can be shown by this method of investigation that the number cannot exceed 296.0. The much smaller probable error of the result determined from the moon than of that from geodetic measures is very noticeable. But the last result depends upon the value assumed for the mass of the moon itself, and to determine this the so-called lunar inequality and the distance of the sun must be accurately known. Our knowledge of these, and indeed of all of the elements of the solar system, will be much improved when suitable observations have been made upon the little minor planet, Eros, when this again draws near the earth in 1931. And to determine accurately the motion of this little body as it apparently moves among the stars, a knowledge of the exact positions of these reference stars will be absolutely essential.

Again, recent searching inquiries into the exactness of Newton's Law of Universal Gravitation, upon which all of our science of celestial mechanics rests, will be found upon examination to depend wholly upon the exactness of observations in astronomy of position. Bollinger and de Sitter, for example, examine into the question whether there is not some evidence that the pull of the sun upon the moon is decreased when, at the time of a lunar eclipse, the earth is placed between these bodies. Such a possible slight disturbance will be found, if it exists, from the positions of the moon with reference to stars whose places are accurately known. And, finally, the proposal to test the new theory of relativity by the apparent displacement of a star when this is seen near the edge of the sun rests entirely upon the accurate determination of a stellar position.

In fact, there are very few problems in modern astronomy

whose solution could even be approximated were it not for the measures made in astronomy of position. The approximate structure of the stellar universe would, of course, be wholly unknown; the temperatures, luminosities and weights of none of the stars could be found, since we would not know their distances away. The physical constitutions of the stars and their motions in the line of sight would be about all that would remain of our astronomical knowledge.

Faithful and continued observations in astronomy of position are thus seen to be absolutely essential for the development of practically every part of our science. But, aside from this, its fundamental importance, its pursuit, has high rewards of its own, wholly irrespective of its value to other branches of astronomy.

In the year 1905 Kapteyn brought to a close a prolonged study of the proper motions of 2,400 stars of the Auwers–Bradley catalogue. He discovered from this that there is a remarkable streaming of the stars of our universe. He grouped the stars from the Pole to thirty degrees south latitude into twenty-eight regions, and found that while the motions of innumerable stars are apparently in a haphazard direction, and while there is necessarily an apparent backward drift of all of the stars owing to our sun's own motion through the depths of the great star cloud, yet when this is allowed for there remained a great and steady streaming of the stars in parallel lines along two streams, the one motion being directed toward the star Xi Orionis, and the other toward a point in Sagittarius, on the opposite side of the heavens.

As to the cause of this universal motion on so grand a scale of the stars about us, we can only speculate. Eddington, Beljawsky, Schwarzchild and Dyson have extended and confirmed Kapteyn's investigation and have, in some cases, attempted to give a rational explanation of the phenomenon.

Thus, Eddington, supposing that the cloud was formerly much elongated, shows that the contrary motions may have been caused by the falling in toward the center of the out-

lying stars. This is, perhaps, the simplest possible explanation. If it is a true one, we are here led to a contemplation of the surging and changing of our universe as a whole during a time so infinitely long that even the vast intervals which we have hitherto considered in astronomy shrink to nothing in comparison.

From a study of the figures of his own catalogue, Boss discovered the remarkable Taurian cluster of stars. In this constellation there are from forty to fifty rather bright stars which look to us quite widely scattered, but which are actually gathered into an isolated group, moving through the depths of space. The center of this little cloud is now 140 light years from us, but it is drawing away from us with a speed of 28.7 miles a second, and 67,000,000 years from the present time, these widely scattered stars will be seen as a condensed little cluster, which, on account of its great distance from us, will then appear but twenty minutes in diameter.

Another most interesting group of related stars which are moving together in parallel paths through space was discovered by Lindendorf. This is composed of five of the bright stars of Ursa Major; and Hertzsprung has shown that the bright Dog Star, Sirius, though from where we now are it appears in so widely a different part of the sky, is also a member of this group. The center of this cluster is about 100 light years from us; Sirius, only 8.6 light years away, is thus far out of the center. The stars, oddly enough, lie almost exactly in one plane, and they are all far more luminous than our sun.

It has even been suggested that many of the thirty stars which are nearest our sun belong to an isolated Solar cluster whose diameter is about twice that of the cluster in Taurus. But the evidence on this point is not yet complete.

I particularly wish that the time today would permit me to tell you of the analysis of the proper motions of the fainter stars. To show you why, although we are certain that many, and perhaps most, of them are great suns which only appear faint because they are so far away, yet that many others of

them are small or dull suns immersed in the cloud of their brighter neighbors. And to show you the evidence, which is perhaps the most interesting of all, that there is a definite thinning out of the stars as we penetrate to vast distances into the star cloud; evidence which has convinced us, contrary to our former belief, that we are reaching or have reached in some directions, the true limit or boundary of our immense universe.

Almost infinitely extended though our wonderful universe is, when we have reached its boundaries it is impossible for our minds to stop there. Whether beyond is infinite but empty space, or whether one universe succeeds another, absolutely without end, one conception is as utterly beyond the powers of our little minds as the other. But if, having seen that our Milky Way universe is limited, we shall ever discover that there is another, almost infinitely distant one, its existence, so far as we can now see, can only be revealed to us by its disturbing pull upon our own vast cloud of suns. And this slight but continuous disturbance of our system as a whole will, if ever, only be revealed to us by the exceedingly accurate measures belonging to the science of astronomy of position.

JERUSALEM, THE HOLY CITY

By James A. Montgomery
Professor of Hebrew and Aramaic

As Director of the American School of Oriental Research in Jerusalem, I was due in the Holy City by October 1st of last year (1914). On September 28th my family and I entered it with dramatic pomp. As we drove up from the railroad station, which lies almost a mile away from the Jaffa Gate, we came abreast of the Turkish garrison, some 3,000 strong, returning from a day's trial march. We passed along under the walls of Mount Zion at the side of the khaki-covered, weary-looking troops, the air laden with their dust and lurid with the light of the setting sun. It was an impression never to be forgotten, for the Holy City was practically at war, a forepost of Mohammedanism and of one of the two parties to the great struggle in Europe. Insignificant strategically, it was a prize of that war, and the atmosphere not only of nature but of men's hearts was full of apocalyptic hopes and fears, for in that oriental land war means the strife of religions. It seemed as if the age-long cruel and kaleidoscopic history of the Holy City was to repeat itself. No such year as this had come upon her since Saladin restored her to Islam or Godfrey de Boulogne was crowned her Christian king. Bereft of her glory, the Virgin Daughter of Zion sat expectant, conscious of her dignity as object of the world's ideals of holiness, with fluttering bosom as to the outcome of the world's crisis, but certain of her eternity in men's hearts. To whom are her everlasting gates to open their doors,—so ask her sons, Jew and Christian and Mohammedan, with bated breath, and none dare answer, for although the object of all prophecy, there is no prophesying of her fates. Her history is inscrutable like that of humanity. But therefor men love her, for her tragedy is theirs.

On that same morning we had reached Jaffa by boat from Beirut. There we met a number of friends, missionaries whose acquaintance we had made in the Lebanon, and they strongly advised us against proceeding with our journey to Jerusalem. They painted the conditions as most unsafe for Christians. But unlike Jonah, we did not flee from Joppa, for I was determined to reach my destination, if only for a day. But so uncertain were we that we left our luggage behind, thinking that the chances were against a sojourn. We arrived and decided to remain for a few days: the days became weeks, and in the sum three months.

These few months marked notable history for the "Immovable East." On October 1st the Ottoman Empire reasserted its rights against the foreigner by the Revocation of the Capitulations, the ancient treaty rights which reserved to the Christian nations extra-territorial dominion over their citizens in the land. This involved not only the abrogation of the excellent foreign post offices, but also the subjection of the foreigner to the Turkish Kadi and tax collector, and the imperial control of every foreign school and church. Our great American Protestant College at Beirut is now suffering from vexatious restraints on its religion and education and from demands for taxes; in the case of one German charitable institution near Jerusalem taxes have been claimed for twenty years back. Ancient compacts no longer hold. In consequence of cowardly construction of the rights of American citizens abroad, America has no standing in the Orient except for its gold.

The political crisis came with Turkey entering the lists against the Allies. In the Orient one gets no exact news, and we never learned when war was specifically declared. But on October 31st the fact was significantly indicated. The American flag was flying over the British Consulate, the Italian and Spanish over those of Russia and France, and soon the church buildings and schools of the hostile nations were commandeered for military use as barracks and hospitals. Thus the Turkish commandant found grim satisfaction in establishing his headquarters in the Russian hospital. The consuls of the hostile

powers were made prisoners, an innovation in international usage that is not native even to Turkey, and all hostile aliens were put under military arrest, not only the laymen but also the clergy and monks and nuns, a treatment unknown in Islam's history, for Mohammed enjoined kindly treatment for the Christian religious. But the empire is following the beck of a new and alien statecraft. For weeks there hung over these people the doom of confinement at Urfa, the ancient Edessa, a distant inland point east of Aleppo, but with the opera bouffe characteristic of the empire, exaggerated by its endeavor to keep pace with the latest innovations in military and diplomatic practice, these orders were changed from day to day, until some of our good French and English friends were distracted with packing and unpacking. Through the efforts of the American consul the English consul got away via Jaffa much earlier than his colleagues; half an hour after his embarking orders came to hold him. Finally it was decided to expel all the religious, including the nuns and teachers, and so they at last safely departed. The Frenchmen, including the noble staff of scholars at the Dominican convent, famous the world over for its biblical studies, actually were started on the journey northward to remote Urfa, but at Damascus they were switched off to Beirut and so escaped by sea. The laity were treated worse. There are Englishmen, sóme of whom I know, still confined as military prisoners for no other offence than that they were born English. The prisoners at Damascus, one of them a notable physician, were threatened with death and the time of execution was several times announced to them. But the admiral of the English fleet sent notice to the Turkish governors in Syria that his government had a complete list of those worthies and these would be held personally responsible for every murder—a threat which had its salutary effect.

Among these perplexities the one man who distinguished himself was our American consul, Dr. Glazebrook, who did much to alleviate the lot of the hostile aliens. He was the only bright star in the American firmament that we could see, except

the inevitable American gold that poured in for the relief of the famine-stricken Jews. For two months after the Great War began no American warship appeared in the Syrian waters to take up the duty of policing the Turkish coast and protecting American interests. Our Government was waiting and watching at the respectful distance of 6,000 miles.

In the beginning of November broke the Jihad, the Muslim Holy War. I know of the Jihad only through books, but the native Christians knew what it meant by blood tradition. Our servants, two excellent German women, shivered and believed we should all be massacred. They knew, as they heard it in the streets, that the Jihad to the popular mind has no distinction of race and politics, only that of religion. They knew, as do all intelligent people, that a Holy War means something different from a political war, and that it was meant in this case to mean something different, to fan religious hate in a fanatical people. They knew that it meant, legally, death without quarter to men, slavery for women and children. But the fear of all Christians was not realized in Palestine; the intended consummation has been reserved for Armenia. But in Jerusalem Muslims and Christians live on too good terms to wish to cut one another's throats. And so we could witness rather as comedies than tragedies the several attempts to fan the spirit of the Holy War, countenanced by the local representatives of Christian Powers. One of these occasions was the triumphal entry of a sacred banner from the Prophet's tomb at Medina. It was a gala day when everybody turned out to see the sight. At last, with a great cavalcade the sacred emblem made its entry, but alas, a very modern tawdry banner, said by scoffers to have been made in Jerusalem. However, as sufficient substitute, the flagpole was very old! In the Orient the antiquity of relics is of minor importance. The Mufti who had accompanied the relic from Weissnichtwo died the next day; according to one story he was poisoned by the Germans, which was unkindly, malicious we may suppose; according to another view it was an evil omen from Allah. In either case we observe the easy oriental sense as to cause and effect. Then

we all went home and forgot about the Jihad, for as the comfortable Muslims said: This is a war of the Unbelievers and not of the Faithful.

Meanwhile the troops came pouring in on their way south to Hebron and Beersheba for the far-famed expedition against Egypt. Jerusalem became more and more a military center. Its streets were full of camel lines laden with grain, with ammunition, with light guns. One day we saw by the Damascus Gate the great zinc boats by which the expedition should cross the Canal. We saw these boats later in Egypt, riddled with grape shot, the spoil of war. The Canal which connects Europe with India separated Africa and Asia. German officers were billeted in the French convent of Notre Dame, Turkish soldiers in the church buildings of St. Anne. Our expected Thanksgiving turkey was commandeered by the military commissariat.

However, these weeks of suspense were not without their compensation in humor. The Turk was fired with the idea that he must imitate his bigger brothers, and no fancies were too large for his fertile brain. One day there came an order for all citizens, dutifully or compulsorily, to deliver their empty oil cans, those universal vestiges of the Standard Oil Company, the most striking symbol of American influence in the Orient. And for what purpose those mountains of tin cans? Forsooth, they were to be packed with sand and dumped into the Canal to form a causeway for the expedition. Or what mean these long strings of lean and ill-fed camels? No doubt they are to be driven thirsty to the Canal, into which they will plunge to slake their thirst, and with the great stream gurgitating into their bellies the soldiers of Allah would walk over dryshod into the Promised Land. Most humorous of all was the report which brought upon the English cathedral a visitation of a military force. Canon Hichens was routed out and ordered to reveal hidden arms, for they had learned on good authority that the English there made cannons at the altar. Despite the clergyman's protestations they explored about the church, and finally dug up a side-altar, laying it bare to the earth.

It turned out that the rumor was based on a misunderstanding of an English word. Mr. Hichens' title under which he served at the altar had been translated into big guns.

But the end came for us. In the midst of all these excitements our Consul ordered us to leave. We spent Christmas Day at Jaffa and the next day sailed for Egypt. Here we stayed for three months, hoping against hope that we might have the chance to return to Palestine. We were there when the Turkish expedition was repulsed from the Canal. No idea was entertained on that side of its possible success, but all knew that its success would have meant a general massacre of Christians. A German acquaintance in Jerusalem said to me before leaving: You will be safer here than in Egypt.

I have given you not of egotism a few pages out of a personal diary for a memorable year in Jerusalem's history. I failed in my purpose of archæological study; I did not see what I expected, but I saw something far rarer in the unexpected. Jerusalem was stripped of its monotonous aspect as a tourists' city. It was no longer under the protection of the Christian Powers, but under the aegis of the Holy War. This was, indeed, an impotent attempt, and I learned there that Islam is politically dead. But this was the atmosphere in which to see that Holy City. For since the time of Nebuchadnezzar and Antiochus Epiphanes and Pompey and Titus, of the Saracens and the Crusaders, it is the city whose religion is writ in blood. The temple hill with its sacred altar-rock running with the blood of holocausts or of the myriads slain by Titus' soldiery in the last awful days of the Jewish state; or the little knob of rock in the Church of the Holy Sepulchre where Jesus was crucified; or the nearby Valley of Jehoshaphat where, according to the Prophets, the Lord would give his sacrificial feast on the bodies of the slain—every point and tradition is redolent with blood, of the greatest and best, as of the worst and most fanatical. How difficult it is to associate with this actuality the ideals that Holy City has given birth to, but never realized, within her borders:

"Many peoples shall come and say:
Come and let us go up to the Mountain of the Lord
To the House of the God of Jacob;
And he will teach us of his ways
And we shall walk in his paths.

. . . . . .

"And he will judge between the nations
And give decision to many peoples;
And they shall beat their swords into plowshares
And their spears into pruning hooks.
Nation shall not lift up sword against nation,
Neither shall they learn war any more."

Or there is the Apostle's thought that here Jesus "reconciled all things unto God, having made peace through the blood of the cross." But it is just this reeking history of the past that has riveted men's minds on that city, and the things fought for there and the deaths of martyrs have transformed a city of naturally crude religion and barbarous aspects into a visionary home of ideals. Thither the Christian pilgrims came to be buried in its soil, thither the Jewish colonists are coming to revive their City of God on earth, while the faithful over the world who have never seen it elevate it to a seat in heaven, the everlasting abode of peace. And none can understand Jerusalem who does not view it from this high point of idealism or sympathetically read himself into it. Jerusalem is like Rome. You can explain neither the one nor the other, with their fascination upon men, from historical geography or ethnological origins, nor can you blot them out of the page of history. In each the spirit of man has risen to its heights and its depths, in each has been born the will to world-empire, and from these roots of his history man cannot detach himself. He may sublimate his inherited memories into ideals, but these are the visions seen by Jerusalem and Rome; or these holy cities may still grip men with their concrete demands and you have the institution of the Catholic Church and the powerful movement of Zionism.

Such is the political condition of the Holy City in this Year of Grace. And what is Jerusalem like? you may ask. In

replying I have to apologize to you as I did to the Provost when he asked me to give this lecture. It should properly be illustrated, should be all pictures with few words. But my pictures which I took in Jerusalem, especially illustrating the walls and the recent excavations, and the slides I had made there, I was forced to leave behind, for all photographs, I was warned, were contraband. And as I subsequently learned I should have had great trouble in getting them through the police examinations at almost every port in the Mediterranean. And so I must give you pictures in words.

Jerusalem within the walls is disappointing, rather a mean-looking city. Its life is provincial, its bazaars, unlike those of Cairo and Damascus, uninteresting, with little for sale apart from produce and the necessities of life. The streets are narrow and in large part steeply stepped because of the hilly nature of the ground; no vehicles pass through the city, only at two points may they enter the city and then only for a short distance. The ancient gates are too narrow and in some cases too low, so choked up are they, to admit such traffic. Only man and the old-world donkey and camel traverse these alleys. In the inhabited quarters there are no prospects, no plazas and broad streets. One threads a narrow crooked lane to reach the Holy Sepulchre, and comes upon it well below the city level, or passes through long tunnels in approaching the Haram, the area of the ancient Temple. You can live your life in those narrow quarters and remain a provincial despite the city's traditions. Even the Temple hill does not dominate the city, for it stands lower than the western hill. One must climb the Mount of Olives to the east or the highland to the north to get that sacred territory in the center of the focus. In the poet's words, "Unto the hills lift I up my eyes;" one must of purpose raise his glance and thought from the sordidness of the city's life in order that he be not lost in its religious vanity.

Apart from the Haram it is peculiarly from without the walls that one obtains the best impression of the ancient city. The grim walls encircle the city for its full circuit and satisfy the imagination as representing the walls of Herod or of the

Judaean monarchy, though the present structures are for the most part modern, built or rebuilt in the seventeenth century, and do not follow the lines of any one of the classic cities. Except for the hill to the northwest where the fine modern quarter has grown up, Jerusalem without the walls is in the state of nature, almost deserted of human habitation, and here one can wander at his will, clambering over the rocky soil, trying to make out the ancient lines of circumvallation, with the hills and valleys about him, looking as they looked when David made the city of the Jebusites his capital. From the Jaffa Gate, in the center of the western wall, the valley to the west of the city falls very rapidly toward the south; then it makes a sharp turn to the east, becoming a rockbound gorge, the Valley of Gehinnom, the Gehenna of religious fancy, still crowded with ancient tombs and containing still, as I believe I have discovered, the altars where the rites of Molech were practised. The southern wall of the city does not follow its ancient line upon the ridge surmounting this deep valley, but has been pushed far back, running northeast to strike the southwest angle of the Haram, which continues the fortification on the eastern side. This now almost deserted area, except for some religious buildings, is for history's sake as interesting as anything within the present city. Within it on the western hill good tradition finds the site of the earliest conventicle of the Christian Church, the "Upper Room," where Jesus instituted the love-sacrament of his Church and where the disciples met for fear of the Jews, persisting there in the "teaching and fellowship, in the breaking of bread and the prayers." This site, the so-called Coenaculum, is, unfortunately, part of the pile known to Muslim tradition as David's Tomb. And that long spur of sloping hill to the east which runs down from the Temple area, we cannot ignore, for despite the forgetfulness and inventions of tradition, that is none other than the site of David's City, the fortress he took from the Jebusites. Following the weight of tradition's authority, the city itself has forgotten its past, has ruled that territory out, and transferred its associations to the western hill. It is strange that the birth-

place of the Holy City and that of the Christian Church today lie outside the walls. On that old Jebusite hill only the Virgin's Spring below its eastern edge, the rock-hewn water tunnel millenniums old connecting the spring with the Pool of Siloam on the southeast side, and recent excavations testify to its rare antiquity as a city site. But now, in the Prophet Micah's words, this oldest part of Jerusalem stands "plowed as a field."

The Valley of Gehinnom empties in the Kedron valley to the south of this eastern hill. We ascend up this latter dirt-choked gorge, with the village of Siloam perched high up on its eastern bank, its unmannerly inhabitants perhaps the children of the ancient Canaanites. We keep on under the ridge of the hill of David's City, past the Virgin's Spring, now a deep cavity in a mass of débris. Here, as at the Pool of Siloam, women draw their water and wash their clothes and soldiers are taking their baths, the bath being taken at the higher level. Despite all the hygienic canons the race persists. Still farther on we come abreast of the southeast corner of the Haram enclosure, the lofty walls perched far above the deep valley. Here some of the most ancient wall construction exists, and excavations prove that at this point the wall was 120 feet high, justifying Josephus's remark on the dizzy precipice below the Temple's battlements. Farther on one passes, looming far above, the Golden Gate of the Temple, perhaps the Beautiful Gate of the New Testament, with its great double-arched doorways, closed according to Muslim tradition until the day that a strange king shall come and overthrow the True Religion. It is over this valley, too, the valley of Jehoshaphat, of God's Judgment, that fancy places the line of thin rope over which Believers must walk to gain Paradise, while the Infidels tumble into the chasm beneath. Indeed, the whole region outside the wall to the south and east of Jerusalem is so rugged and dreary that we can understand how it became the stage of every kind of myth and apocalyptic fancy. It is from these uncanny surroundings of Jerusalem that one imbibes some of the breath of the local nature which inspired the religious imagination and the desert-born fanaticism that have marked those who have possessed the

Holy City. Only on one quarter, as I have said, to the northwest, does the city join with the inhabited world. The two valleys that embrace it are dry wadies which drain, if ever waters flow in them, into the Dead Sea. Like Mecca, symbol of the desert faith Mohammed gave the world, Jerusalem stands facing the wild desert, with only her back door open to the peoples of the world, symbol of her worldly and other worldly associations. Yet we must remind ourselves that the modern visitor does not see the noble city that once was, when the southern slopes were covered with palaces and mansions and the streets thronged with a lively populace. Theirs was a living faith, although very much of this world, that made that city noble and great, and we of today possess only the dregs of ancient reminiscence, for its shorn memories only the more insistently demand the New Jerusalem which comes from above.

Within its walls Jerusalem, like Rome, is a city of many hills, like Rome with its history starting on one of the hills, creeping on to enclose one after another as the city grew and strategic lines demanded. The city's area consists of two ridges, running north and south, each of which has several eminences; between them lies a deep descending valley, the greater part of which is a dump heap overgrown with cactus, choking the gate at its outlet so that one can hardly walk upright through it. In fact, one of the surprises in visiting Jerusalem is to observe how much of the modern city within the present walls, much more circumscribed than they were in the days of Herod or the monarchy, lies unoccupied. This valley is deserted, the Temple area is, of course, void of inhabitants, there is a large section in the northeast by the Mohammedan quarter which is waste, while a considerable part of the southern half of the western hill is occupied by convents and gardens. Perhaps a third of the city is destitute of inhabitants, and Josephus may not have been wrong when he gave the population of his day as half a million, while today there are hardly 70,000 within the walls. Yet these vacant stretches are most grateful to the student; he can roam over them undisturbed by the drab modern life and visualize the

past as one may still do on Rome's ancient hills, the Palatine and Aventine. The historical geography of both cities has many identities, even as their ideals of world-empire challenge comparison.

Is there much of antiquity left in Jerusalem? so I am often asked. It is a hard question to answer with yea or nay. I have in sum to reply: It is the same ancient city of Melchizedek and David and Herod and Omar and the Crusaders, the glorious sky and atmosphere above, the gaunt surroundings about, just the same, only with the city's proportions changed, and its ancient glories crumbled in the dust and buried under fathoms of débris. Despite easy-going tradition it is hard to make sure of any one spot invested with sacred history. Every point is contested, first by rival faiths and sects, then by orthodoxy and radicalism. Your sacred geography is Greek or Latin or Protestant or skeptical, as the case may be. The courses of the ancient walls are all in dispute, despite the lively and accurate accounts of Nehemiah and Josephus. It is still argued whether the eastern or western hill was the site of the original city, and it must be said of the clues of ecclesiastical tradition that while they run back well to the fourth and fifth centuries, a leap is made to the first which imperils assent. Just one spot there is which is sure, to the mind of almost all: the holy rock on the Temple hill, the site of the bloody sacrifices of the Jews, perhaps one of the hoariest sanctuaries of the world. It is covered now with the glorious Arabic-domed structure, wrongly called the Mosque of Omar, after the Arab conqueror of the city. But where the Temple stood is disputed, although hardly without doubt just to the west of the rock. The rest of the area has been so much changed that we cannot identify its historic points. It is only in its subterranean structures that we come upon the actual remains of antiquity, but then archæologists wrangle over Herod and Solomon, so indefinite are Jerusalem's datings. On the west side of the Haram and without, approached by narrow lanes, one comes to cyclopean stones which may well be Solomon's own work, and which, the Jews resorting thither to wail, feel are all that

is left to them of the fabric of the Temple. At the north of the area is a higher ridge of rock, from which the Roman police guarded the Jewish assemblies on their holy days as now the Turkish soldiers keep order among the Christians at the Holy Sepulchre, and here a centurion snatched away Paul from an irate mob. However, whatever the exact identifications may be, just here and about here was the sanctuary of Israel of which the exiled poet bethinks himself, "How I went with the throng and led them to the house of God, with the voice of joy and praise, a multitude keeping holiday." Here is rich satisfaction enough to the historical mind despite all the riddles for the archæologist.

To the south of the Temple area runs the long rump of a ridge which is, as I have said, the site of the original city, although now lying without the walls. On the east of this lies the Virgin's Spring, the Gihon of the Old Testament, feeding the Pool of Siloam on the west side by a subterranean conduit 586 yards in length. The entrances at either end of this tunnel can be easily seen, but in that troublous year no permit for exploring it could be obtained. These waterworks go back to 700 B. C. On this hill, commonly given the biblical name of Ophel, some remarkably interesting excavations have been made by a committee of English Jews under the leadership of a Captain Weil. The results have not been published, but the excavations carried over a large area down to the solid rock show the remains of a very ancient settlement.

Passing to the western, the so-called Zion Hill, we come upon some remarkable excavations which have been made at its southern extremity, outside the walls, facing the east. Here in their own grounds the French Assumptionists have uncovered the remains of the city in Roman times before the destruction of Jerusalem, and perhaps of the later city Aelia Capitolina, Hadrian's foundation. Here alone in all the city can we gain an idea how it looked at the beginning of the era. The streets, the mansions with their rock-cut cellars, the bases of Roman temples, baths, and the inevitable accompaniment of far more primitive tombs,—this ensemble although little advertised as

yet in the West, is one of the most interesting points in the city, second only to the Temple and the Holy Sepulchre. This region is the Pompeii of Jerusalem. And Church tradition invests it with peculiar interest, for that tradition places here the palace of Caiaphas, the scene of the Jewish trial of Jesus and of the denial of Peter, and if the belief of the learned archæologists at work there that in a remarkable stone mansion with its dungeons we have the actual palace of Caiaphas, can never be demonstrated, we have at all events the dwelling of one of Jerusalem's old-time magnates. Two stone-paved streets have been laid bare, one of fine Roman workmanship, the other older, of Jewish origin. On this I looked with sacred sentiment, for it would be one of the few spots in Jerusalem, encumbered as its ancient surface is with the débris of the ages, on which the steps of the Saviour must have trod.

The walls of the city are a source of fascination to the newcomer, and one can loiter about them, inside and out, without interruption, for a large part of their course is through deserted tracts. The lines of the original walls, of David and Solomon, of the later monarchy, of Nehemiah, the crucial details of whose account of his heroic rebuilding cannot be identified, of Herod and Agrippa, of Hadrian and of the Christian patroness the empress Eudoxia, are all a matter of dispute. But on the southwest, on the Zion Hill, and along the southern limit of the ancient city, one can trace the bold rock-scarpings which in very early times marked the course of circumvallation. And most fascinating were the visits into the shafts and tunnels left by the American explorer Bliss, into which one may descend and in one case pursue the strata of ancient wall now buried fifteen feet or more. Is the lowest stratum the remains of the pre-exilic wall which Nehemiah found, and that rougher built construction on top of it Nehemiah's and his colleagues' work in their hasty rebuilding? And that stratum at the top is probably Eudoxia's, of the sixth century A. D. Here is an archæological stratification of possibly 1,200 years and more. On the west side of the city loom up by the Jaffa Gate three great antique towers, one of them still bearing David's name,

towers which Josephus describes in glowing terms, of which their structure is worthy. Other pieces of ancient fortification there are, all enticing to historical combination, all problematic. My three months' stay was quite too short for clinching final results and weighing justly the archæological data.

So far I have dealt with the salient points of the biblical topography of Jerusalem. And many who go there desire only the Jerusalem of the Bible. For these the city will prove disappointing, even as Rome is to the traveler who seeks the remains of the Republican or even the Augustan age and ignores the subsequent history. But there is no reason why the student should terminate his interest in the Holy City with the first century, when the Jewish state came to an end and the Christian Church went forth a colonist of the world. At least down to Saladin's time, when Jerusalem fell under the ban of Muslim inertia, the romantic history of the city continued, and for the student of Christian origins and history it has a compelling interest, just as the history of Rome has never stopped and her catacombs and ancient churches prove to us her eternity. It is true that with regard to the points hallowed by Christian association the arrant credulity of oriental and ecclesiastical superstition arouses its skeptical antithesis. That strange and wonderful Church of the Holy Sepulchre, or as the Greeks better call it, of the Resurrection, a bewildering pile of buildings, extending from ancient rock-hewn tombs through Constantine's wonderful basilica and all ages of reconstruction down to the present fabric, rebuilt from fire in 1808, does not at first sight invite belief in its traditions. Yet I must confess a closer study of the place and the data made me more open to the conviction that here Golgotha and the Saviour's tomb may have stood. For Jerusalem just as for early Christian Rome there has been a decided reaction on the part of archæologists toward an open-minded study of ecclesiastical traditions, in fact, it has been forced upon them. No student of Jerusalem now approaches this question of Golgotha with the Protestant dogmatism of our great Edward Robinson, who records that he began his explorations of the Holy Land with the firm purpose to ignore all

monkish superstitions. I believe that the local traditions as to this site and also as some other localities connected with the birth of Christianity, for example the Coenaculum, the Mother House of the Church, must be seriously weighed.

But apart from these identifications, whose uncertainties must haunt the historical if not the entirely devoted mind, there is one aspect of early Christian Jerusalem which none but those of limited interest dare ignore. These are the sites which Christian affection has consecrated for at least sixteen centuries, since for many of them we can carry the tradition back to the fourth and fifth centuries. Just as the bare stones of the Jews' wailing place are sacred for the tears shed there by countless of the dispossessed nation, so these Christian sites are consecrated by the aspiration of the Christian world, which through the ages has counted pilgrimage thither as not only the most meritorious, but also the most soul-satisfying endeavor, and which to this day brings the pious Russian pilgrims in tens of thousands in pursuance of the Church's ancient devotion. And hardly of less interest must be the remains of the brief century in which the Crusaders triumphed over the Crescent, especially the glorious churches they built, transported product in large part from western Europe. There is the Church of the Holy Sepulchre, Constantine's foundation, contemporary and rival of his noble basilicas in Bethlehem and Constantinople and Rome, for which the Christians of the West shed their blood and that of the Saracens. Or there is the Mosque el-Aksa, at the south of the Temple area, going back to a foundation of Justinian's, becoming then a mosque, and again the home of the Christian Hospitallers, and once more a Muslim prayer-house. Or St. Anne's Church, built over the reputed site of the birthplace of the Mother of the Lord, some ancient rock-hewn habitation; here the Crusaders reared their Gothic Church, which Saladin replaced with a school for Muslim girls; fallen to ruins the Turks gave it as a reward for Crimea to Napoleon III, and the White Fathers have built here a glorious church on the ancient lines. And now within this last year the Turks have seized it again for use by the soldiers, but those

superstitious people dread the desecration and say they have bad dreams in that holy place. In such places there is a kaleidoscope of history that challenges attention. And if you ever visit Jerusalem, I would bid you take along not only your Bible, but also the records of the fierce and loving piety of the Christian Church.

The modern Jerusalem has also its attractions. The devotion of the faithful and the political ambitions of the Great Powers have conspired to rear great and handsome buildings, churches, convents, schools, hospitals, hospices, which stand for modern Christendom's ideas of religion, philanthropy and art, and as well for political claims upon the Holy City. Most of these stand outside the walls, to the northwest and north. The Russians have an immense area, with a stately church and great buildings for the accommodation of pilgrims. The Germans have marked their recent advent into eastern politics with several sumptuous and admirable religious structures; the splendid Benedictine convent on the Zion Hill, with its lofty tower dominating the city—the traditional site of the Dormitio—the Passing-away of the Virgin Mother; the Evangelical Church, a handsome building upon the site of and incorporating some remains of a Templar church; a too ponderous convent for the Lazarists on the north; and a splendid hospice on the Mount of Olives. The French, continuing directly the ancient Frankish rights and traditions, have several notable churches and convents, distinguished by characteristic fineness of taste, among which should be named St. Anne's and St. Stephen's, on very ancient sites. The English have a fine cathedral church with schools and hospitals; the Italians are completing a splendid hospital. And in this tale of religious benevolences should be included the remarkable list of Jewish philanthropies, showing less in architectural display, but built for myriads of needy co-religionists. There are hospitals, day and trade schools, hospices, and vast areas of tenements, all built and subsidized by foreign funds, the account of which deserves a special chapter in the history of philanthropy.

The interest of this ancient city is eternally religious, that

interest remains, marked not only by this stately tale of houses of religion and of charity, religion's handmaid, but by the people who live there and throng the streets. It is a people that lives for religion and, I may add, on religion. In St. Paul's words, addressed to a very different city, they are a little too religious. From all over the world they come, bringing their outlandish robes with them and mingling with the bright variety of the local oriental life. Christian priests and students are there, each order with its own costume, hats and gowns and footgear all different. There are the dignified Muslim sheicks, least demonstrative of all. And then the dominant element of Judaism, which makes two-thirds of the population, incessantly on the way to and from the prayer-house, those from eastern Europe, the Ashkenazim, dressed in long robes of wonderful hues and fur-tipped beavers. These live in the ancient Ghetto in the southern part of the city or in the colonies which swarm to the northwest. Then there are the bodies of Protestant origin, mostly of communistic origin and eschatological hopes connected with the Holy Land. The so-called American Colony is of this order, most useful members of Jerusalem society. There is a large and flourishing German colony in the suburbs to the southwest. In addition all kinds of eccentrics are drawn hither from every part of the world, typical of whom is, or was, the old English lady who had a cup of afternoon tea ready every day to give to the Lord upon his return. Even our very own indigenous American religion I found represented, that of Mormon. Indeed Syria, the mother of sects, finds her brood returned hundredfold into her bosom. All these bodies live alongside of each other, as a rule respectful of one another's rights, but entirely strange to one another, with hardly speaking acquaintance. Now and again there is a flare-up of ancient fanatical spirit, as at the ceremony of the Holy Fire, when Greeks and Catholics fight, or in the tussels of Zionists and old-school Jews, when the political instincts of the former drive them to crack their brethren's heads.

This picture of the motley population turns my thought to the present social condition of the Holy City, and that is the

saddest phase of my subject. Jerusalem is socially a pauper city; the Mohammedans, a minor element, alone seem to take care of themselves. The Christians are subsidized by the great convents, especially of the Franciscans and the Greek patriarchate. At one of these I was told that they baked and gave out 1,600 loaves of bread weekly. The Greek Church largely pays the house rent of its clients. But most distressing is the condition of the Jews. They have settled here in hordes with the pious intent of acting as the vicarious representatives of their brethren throughout the world and claiming the right to live upon the alms of the faithful, the Halukka, as the benevolence is called. Thousands of these people would literally have starved last winter if it were not for the enormous sums poured in by American Jews; in the three months I was there at least $75,000 in gold was thus contributed. The English Rothschild School for girls gave dinner every day to its 600 pupils.

The city is without natural industries, it has no manufactures; religion is its only business. Far more important than the political problem, Is Jerusalem to be Muslim, Jew or Christian? is the social one: What is to be done with these myriads of non-producing devotees? The Christian population has been for long pauperized out of the ample endowments of the convents, but the problem is acute for the fast-growing Jewish population, brought hither by sentiment but without industrial reason. The leaders of Judaism must take cognizance of this problem lest Jerusalem become a social plague spot on the earth, with a people incapable of autonomy because not self-supporting. That eternal city keeps its face toward the past for its ideals and for its claim upon the benevolence of the world; but the eternal future before it imperatively demands of it as of all religion that its religious life, stagnant, antiquated, still unrefreshed, be translated into social and moral terms. The New Jerusalem on earth cannot arise there out of the present elements.

THE LAWYERS OF GEORGE MEREDITH

By William H. Loyd
Assistant Professor of Law

When a playwright or a novelist, be he great or small, holds up the mirror to society, it is curious to see how all crowd to get a peep at their own faces in the glass, sometimes astonished and charmed at the reflected image; sometimes, let us hope through a flaw in the polished surface, disconcerted by a comic squint or a rueful twist of countenance. But greater would be their disappointment if their gaze was unrewarded, if no friendly face should nod to approving nod. The group photograph as we know has no charm for the man who moved.

When friend Jones relaxes from the cares of business by reading the latest novel on commercial depravity, it is with the pleasure of superior knowledge rather than the anger of one maligned that he points out the mistakes of the wicked promoter and the author's ignorance of the refinements of rascality. So we lawyers scan our fiction for crumbs of law, delighted when the popular authoress fails to appreciate the difficult questions of domicile in divorce or when, in melodrama, the heroine visits the judge at his home at the "witching hour," so to say, and reveals to him the duplicity of the villain in an extrajudicial conference that in real life would produce a scandal of the first magnitude. We are glad that our activities are appreciated, even if misunderstood, and are blended with those of the merry throng that fills life's stage. A play all law would empty the house, a novel based solely on the Rule in Shelley's Case would not be likely to appear among the "six best sellers."

Nevertheless, many of the glimpses of the courts and the legal profession in literature are based on personal knowledge or recollection, since the bar has long been one of the recognized

gateways to literature. For one thing—it has afforded ample leisure for reflection: a chrysalis state, as it were, in an empty chamber from which the author finally takes flight with the dust of parchment still on his wings. Sir Walter Scott and Robert Louis Stevenson were Scotch advocates; Fielding, Sheridan and Thackeray were Templars. Of our contemporaries who have deserted law for letters, one need only refer to Henry James, Maurice H. Hewlett, Owen Wister and John Luther Long.

If in offering a few words on George Meredith and the law the juristic contribution is but slight, it may, nevertheless, serve as an excuse for recalling to memory some episodes in the career of the great Victorian, poet and novelist, whose robust philosophy has so often put to flight those blue devils that haunt the victims of a sedentary life. If references to the legal profession in his pages seem few, it was not for want of opportunities for observation—distinguished barristers, such as Sir Frederick Pollock and Lord Haldane, were among his friends; but because Meredith was primarily a poet and philosopher, a connoisseur of life and conduct, rather than a portrayer of incident. Hence the treatment of his characters is largely subjective, so that while his soldiers, sailors, merchants, musicians, lords, ladies, gypsies, tinkers and tramps are drawn with rare insight, the portrait is generally of the mind—the personality—of the man or woman; rank and occupation serving often as a mere background, vivid but subdued.

Meredith's introduction to the world was as a law student, but this episode in his career was brief and disappointing. His father, a tailor of Portsmouth, son of the "Great Mel" of "Evan Harrington," was continuously unsuccessful and proved of no help to him. His mother died while he was a child, leaving him a little money which rapidly disappeared, either through the bad management of the trustees or in Chancery. Returning at the age of sixteen from the Moravian school at Neuwied, on the Rhine, near Cologne, he was, in 1844, articled as a clerk to Richard S. Charnock, F.S.A., a solicitor

with chambers at No. 10 Godliman Street, a dingy thoroughfare, leading from St. Paul's churchyard to Doctor's Commons, the quaint home of the ecclesiastical courts, where Dickens, a few years before, had sat as a reporter, gathering those impressions of the sleepy procedure immortalized in "David Copperfield" and "Sketches by Boz." Charnock was an antiquary of literary and bohemian tastes who is believed to have combined certain traits of the two uncles in "Richard Feverel." He was the means of introducing his pupil to some of his earliest literary friends, but his own interest in the law was at this time probably slight, too slight certainly to inspire the clever youth in his office with any enthusiasm for the intricacies of special pleading and land tenures. The lonely boy was thus inauspiciously launched in an uncongenial pursuit. For the law he appears to have had no taste, and, destined as he was for the lower rank in the profession, excluded from the historic atmosphere of the Inns of Court, there was little to fire his ambition. His income, too, at this time was small and irregular. It is said that he frequently lived on a bowl of porridge a day, a diet approved by great Scotchmen as well suited to lay the foundations of a philosopher, but repellent to the epicurism of the modern man of affairs. In "Diana of the Crossways" there is, no doubt, an autobiographical touch in his description of Arthur Rhodes, the clerk articled to Mr. Braddock—"a nice lad of about two and twenty, mad for literature," whose volume of verse was an introduction to the mercurial heroine. A poet fascinated by a witty woman but untroubled by hope; poor, yet rich in his capacity for the enjoyment of out-of-door life, he is pictured descanting to the invalid Lady Dunstane "on the rapture of a walk out of London in the youngest light of day, and on the common objects he had noticed along the roadside, and through the woods, more sustaining, closer with nature than her compulsory feeding on the cream of things."

Meredith at this time read widely in classical and German literature, took long walks into the country and turned instinctively to belles-lettres as a career. As he grew older,

Charnock brought him into his circle of literary friends, a somewhat amateurish set that edited a manuscript magazine to which Meredith contributed "Chillianwalla," his first published poem. In the group were Edward Peacock, son of Thomas Love Peacock, the novelist, and his sister, Mrs. Nichols, a young widow of literary tastes and brilliant wit. At the age of twenty-one Meredith married her, although she was seven years his senior, and cut adrift from the law.

So ended Meredith's career as a law student. But in deserting Themis for the Muses, he entered no garden of Epicurus. For years he drudged at journalism, literally snatching the time for higher creative work. An Egyptian bondage, he called it. The reading public ignored him, steeped as it was in mid-Victorian sentimentality, without wit to master his philosophy, without taste to appreciate his style. Noble indeed was the battle he fought for his art, and in the end he compelled recognition. But with the courts he had no more to do, except on one occasion to appear as a witness. It was a good thing for the law—into which too many young men temperamentally unfit are thrust by parents or guardians infatuated by the notion that, as General Ople would have put it, the law is a gentlemanly profession; it was a good thing for English literature that this gifted intellect was not wasted in the gloom of Doctor's Commons and Chancery Lane. Indeed, it is one of the ironies of life that in the ranks of every profession there should march to success no less than to failure, men whose true instincts call them to other fields of endeavor. The tragedy in this instance was happily averted.

The case referred to in which Meredith appeared on the witness stand occurred many years later and had a literary setting. Sir Alfred Burdon Ellis, son by a second marriage of Sir Samuel Burdon Ellis, whose first wife was Meredith's aunt, and who was the original—the much maligned original his family insist—of Captain Strike of the marines in Evan Harrington, offered to Chapman and Hall, the publishers, the manuscript of a volume entitled, "West African Stories." Meredith, who was their reader, recommended its acceptance

and the book was published. One of the stories was an account of a villainous West Coast trader styled James Peacock. Unfortunately a retired trader, James Pinnock by name, became convinced that the story was intended as a sketch of himself and brought an action for libel against Chapman and Hall. The case, tried January 8, 1891, before Mr. Justice Denman, Sir Charles Russel, afterwards Lord Chief Justice, appearing for the plaintiff and Mr. Asquith, now Prime Minister, for the defendant, resulted in a verdict for the plaintiff for £200 damages. From the legal point of view, the case presented no unusual features, and Meredith's appearance as a witness was its most striking incident. The distinguished author's testimony was parodied in *Punch*, where there also appeared a portrait cartoon entitled "By George!"

It is curious to note, in the light of his personal history, although too much must not be made of it, that most of Meredith's lawyers are solicitors—the office lawyers we would say, who are, in England, a group distinct from the barristers, the trial lawyers. To be sure, there is Seymour Austin in "Beauchamp's Career," "the working barrister who is also a working member of Parliament;" who is "occasionally reminded that this mortal machine cannot adapt itself in perpetuity to the long hours of labor by night in the House of Commons as well as by day in the courts, which would seem to have been arranged by a compliant country for the purpose of aiding his particular, and most honorable ambition to climb, while continuing to fill his purse." But he is not shown in action—he runs down at odd times to Mount Laurels for a holiday and rest. Cecilia Halket, the heiress, would have married him, had he said the word, as a refuge from the contentions for her hand. But he bore the scars of an old love affair and "the frost had settled on the hair about his temples" —his advice decides the day for the successful suitor.

The solicitors Meredith pictures at work are the wheel horses of the Bar who, without right of audience in the Supreme Court of Judicature, assume some of the gravest responsibilities of the profession. Theirs is to plan, to advise,

to keep dread secrets, "lawyers and doctors being the rats who know best the merits of a house and on what sort of a foundation it may be standing." Corporation law, the growth of estates, and the enlargement of county court jurisdiction have decidedly increased the prestige of the solicitors since Meredith lived among them, and his is a somewhat old-fashioned picture. Mr. Thompson, Sir Austin Feverel's solicitor, is "a thin stately man of law, garbed as one who gave audience to acred bishops, and carrying on his countenance the stamp of paternity to the parchment-skins, and of a virtuous attachment to port wine sufficient to increase his respectability in the eyes of moral Britain." In "Evan Harrington" there is the country solicitor, "Lawyer Perkins," of Lymport, officiating as mourner and family friend at the funeral of the "Great Mel." He it is who marshals his fellow townsmen, creditors of the tailor "above buttons" at the funeral banquet, advises them to pocket their black gloves and bands as perquisites of office, and sees that the head of the table is kept for the unfortunate Evan, heir to unpaid debts. In smoky London there is that nice, comfortable old solicitor, Mr. Bannerbridge, "with eyebrows like a rook's nest in a tree," who picks up little Harry Richmond, lost in the streets, while his mountebank father is incarcerated in the Fleet, and takes him to his cosy home. The Fleet, that grim debtors' prison which gave its name to a medieval law book and contributed for centuries scenes of misery, vice, and horror to the pencil of art and the pen of romance. It is to this mysterious Fleet that schoolboy Harry runs away from Riversley, searching for his father, in company with his friend young Temple, a lawyer's son destined for the bar, and midst fog and fire is lured to the adventures that form the prologue to his career.

Boys are favorites of Meredith. He pictures them with a certain dog-like fidelity in the comradeship of adventure. The friendship of Temple and Harry Richmond has its counterpart in the headlong loyalty of Master Ripton Thompson to Richard Feverel, the spoiled heir of Raynham, a devotion

that nearly brings him within the toils of the law through the rick-burning episode at Belthorpe Farm. Even his haughty leader admitted, when all was over, that "getting among policemen and magistrates makes you ashamed of yourself."

The unmasking of Ripton, the law student, on the occasion of Sir Austin Feverel's visit to the solicitor's office is a delicious bit of comedy. The proud father leads his distinguished client into the clerk's room where the son is supposed to be devoting himself to the study of Blackstone. "A tome of the classic legal commentator lay extended outside his desk under the partially lifted lid of which nestled the assiduous student's head—law being thus brought into direct contact with his brain pan." Ripton, surprised, closes his desk in dismay. Asked to inform the baronet what particular part of Blackstone he was absorbed in mastering at that moment, he blurts out "the law of Gravelkind." Now "gavelkind" is the name for the custom by which lands in the County of Kent were commonly held, a good old Saxon custom (gaful-gecynd) not to be frivolously mispronounced by one aspiring to a profession in which manner is so often preferred to matter. The offender is commanded to show his notes. Alas, papers, not legal nor the fruits of study, were found, as well as a book which "set forth in attractive characters besides a colored frontispiece, which embodied the promise displayed there, the entrancing adventures of Miss Random, a strange young lady." A picture of the back eddies of the student mind; for the culprit was sturdily for the law and proves himself a good fellow and staunch friend before the story is brought to its harrowing close.

Young Temple, Harry Richmond's friend, after a few years in the navy, returns to the Inns of Court and is duly called to the bar; but in one of his first cases, in which he is junior to his father, he has an experience with that excellent but truly wearisome person, the too conscientious client. The barque "Priscilla," belonging to their old friend the very religious Captain Welsh, had run foul of a merchant brig near the mouth of the Thames. In the admiralty suit that

results, Temple is victorious, but in the moment of triumph warns the captain to keep an eye on his men. The hint is enough to cause the captain to question his men closely and, arriving at the conclusion that some of them had sworn falsely, he insists on paying the damages. Temple, disgusted at this turn of affairs, tries to persuade the old seaman to let well enough alone. "Toss common sense overboard, there's no end to your fine-drawings; that's why its always safest to swear by the judge." But Captain Welsh is immovable. "Is a verdict built on lies one that my Maker approves of? If I keep possession of that money, my young friends, will it clothe me? Ay, with stings! Will it feed me? Ay, with poison. And they that should be having it shiver and want!" Old acquaintance may be the excuse for the breach of etiquette involved in these consultations between barrister and client without the intervention of a solicitor—a point seemingly overlooked.

In "Diana of the Crossways," which, by the way, is inscribed to Sir Frederick Pollock, a famous legal battle is fought to a conclusion. Characteristically, the prelude to the engagement is given and the reader is allowed to hear the distant rumble of the guns, but the occurrences in court are indicated rather than described. Meredith's method of condensation and repression led him to avoid the description of scenes likely to involve an elaboration of detail, in marked contrast with his minute analysis of motive. And this is one of the reasons for his unpopularity, for the modern dramatic appeal is increasingly to the eye. The torments of a sensitive woman, forced for her reputation's sake to face the ordeal of a public trial when she would have preferred to hide herself in exile, are sympathetically described. "Her visits of curiosity to the Law Courts where she stood spying and listening behind a veil, gave her a great deal of tough substance to digest. There she watched the process of the tortures to be applied to herself, and hardened her senses for the ordeal. She saw there the ribbed and shanked old skeleton world on which our fair fleshly is moulded. After all your Fools' Paradise is not a

garden to grow in." Eventually the "Bull's Head or British Jury of Twelve, with the wig on it, was faced . . . and the plaintiff in the suit involving her name was adjudged not to have proved his charge."

The trial, a prelude to the novel's true plot, was in an action brought by the heroine's unamiable husband against the elderly cabinet minister, Lord Dannisburgh, who had made a political confidante of the lovely Diana. Although warned expressly to read the story as fiction, there is no difficulty in identifying the occurrences from which Meredith drew his inspiration. The lady from whom Diana was "partially modeled," as he told Robert Louis Stevenson in a letter, was an old acquaintance. He had met her years before as one of the literary and artistic set that were frequent visitors at the country residence of Sir Alexander Duff-Gordon and his talented wife, the daughter of John Austin, the jurist, neighbors of Meredith's at Esher, who appear in "Evan Harrington" as Sir Franks and Lady Jocelyn.

Diana, in fact, is drawn from Caroline Sheridan Norton, granddaughter of Richard Brinsley Sheridan, a popular poetess and novelist of the Victorian period. Her husband, the Hon. George Chapple Norton, a barrister, brother of Lord Grantley, was, through Lord Melbourne's influence, appointed to a city magistracy, but becoming unjustly suspicious of the friendship of the Prime Minister for his wife, brought an action for damages for the alienation of her affections against the statesman. The trial, which took place June 23, 1836, resulted in the triumphant acquittal of the accused parties who were not called upon to produce their witnesses, the evidence being merely the tattle of dismissed servants and some harmless notes from Lord Melbourne to which counsel sought to attach a sinister meaning. Charles Greville states in his memoirs that politics was at the bottom of the suit, and that the plaintiff was urged on by some of the lesser Tory politicians with a view to discrediting the Whig leader. The result caused great exultation on the part of Melbourne's adherents and corresponding disappointment to his enemies.

Lord Campbell, then attorney general, who, with Sergeant Talfourd and Mr. Thesiger, appeared for the defendant, states in his autobiography that this retainer caused him more professional anxiety than he had ever experienced; for if the action had succeeded the Premier's private character would have been ruined and there would have been an end to his administration, and, to make things worse, the morals of the noble defendant were not supposed to be very strict. The attorney general, indeed, lay awake the greater part of the night before the trial and then overslept himself, so that he was obliged to hurry to court without his breakfast. On his arrival at the Court of Common Pleas he found the doors surrounded by such an immense crowd that the police could scarcely procure his admittance. In his own words: "I was in a state of great tremor till Sir William Follett, counsel for the plaintiff, read the much-talked-of letters, of the Prime Minister when I could breathe, for they were ludicrously immaterial like the parody of them by Dickens about 'chops and tomato sauce' in the trial of Pickwick. My confidence increased when the first witness, the clergyman, who performed the marriage ceremony, stated to me in cross-examination that in visiting Mrs. Norton he entered the house by the same private door which was to establish the clandestinity of the visits of Lord Melbourne, and that 'he did so without any improper views upon the wife of his friend.' Here there was a loud laugh, in which judge and jury joined, and I felt that the verdict was in my pocket. Nevertheless a large body of evidence was brought forward which, if believed, would have been fatal, and the plaintiff's case did not finish till past six in the evening. Being somewhat exhausted, and afraid that the jury might be so too, I applied for an adjournment, which was luckily refused, for I then made a far better speech for effect than I could have made the next day. When the jury gave their verdict for the defendant there were shouts of applause in court and in Westminster Hall, which were heard in the House of Commons, then sitting, and caused a great sensation during the debate."

The incident in the novel which finally brings the plot to a crisis, Diana's revelation to the editor of a leading newspaper of the political secret confided to her by her lover, the Hon. Percy Dacier, had its foundation in the political gossip of that day. On December 4, 1845, London was electrified by an article in the *Times* stating that Sir Robert Peel would, on the assembling of Parliament in January, recommend the repeal of the Corn Laws. The story was denied, but, in the end proved true. The Tory party was rent in twain and free trade became the economic policy of Great Britain. "The general conclusion," says Justin McCarthy in his History of Our Own Times, "was that the blandishments of a gifted and beautiful lady with a dash of political intrigue had somehow extorted the secret from a young and handsome member of the cabinet." The rumor did Mrs. Norton and Sidney Herbert, the suspected parties, a cruel injustice. As a matter of fact, Lord Aberdeen, the Foreign Secretary, had sent for Delane, the editor of the *Times*, and had told him the substance of what appeared in the article. Although he did not tell him to publish the story, it was obviously his intention that it should be published in time to go in the American mail, which left on the day that the *Times* article appeared, for there was no cable then; news traveled slowly, according to the standards of today. It was hoped that the prospect of a market for American grain would have a favorable influence on the Oregon boundary dispute. Aberdeen was over-confident; the ministry broke up in dissension, and it was only the inability of Lord John Russell to form a ministry that compelled Sir Robert Peel to resume office and carry the repeal of the Corn Laws with the aid of the Whigs and the free trade Tories like Graham, Gladstone and Aberdeen.

While by no means the best of Meredith's novels, "Diana of the Crossways" is one of the best known. It is, therefore, unfortunate that its dramatic climax should be artistically imperfect. Meredith, after drawing Diana as an impulsive but true-hearted and courageous woman, fastens upon her an act of treason of which a woman of that type would be

incapable. Taking the legend as he found it—the facts did not come to light until the publication of Greville's Memoirs—Meredith seems to have set himself the task of laying bare the mental processes by which such a moral somersault might be possible, but the chapter dealing with the incident is no more than a brilliant and unconvincing example of literary virtuosity. Like Browning, Meredith loved the solution of intricate problems of character. In this instance the material proved most refractory. But into what a labyrinth would he have been drawn had he known the truth!

Brief reference must be made to a lawyer of a different type and country, Sigismund Alvan, the civilian, socialist, orator and pamphleteer, favorite of society, feared by the old aristocracy. A doctor of law too proud to win the high-born Clotilde by stealth, he seeks her honorably of her family to be met with scorn and to die in a duel with his rival for her hand. It is but a thinly disguised picture of the romance of Ferdinand Lassalle, founder of the socialist-labor party in Germany, and Helene von Donniges, the daughter of a Bavarian diplomat, a distinguished actress, followed by Lassalle's death in a duel near Geneva, fought in 1864 with the Roumanian nobleman, Yanko von Racowitza, thus bringing to an untimely close the career of one who, in spite of a tempestuous youth, seemed destined for a brilliant political future. "Tragic Comedian," Meredith calls him, but not unkindly. "The characters of the hosts of men are of the simple order of the comic. Not many are of a stature and a complexity calling for a junction of the two Muses."

Little enough of law, one might say. And yet those who hug the profession may have reason to be glad there is no more. Scribes, ancient and modern, have seldom spared the pettifogger, who, like any other charlatan, gets his deserts. But the lawyer at his best is frequently compelled to play an unpopular part in upholding "the principle" amidst loud clamor for "the exception." "Justice, in such a case," says Dr. Kohler, "lies in the real result (dinglicher Erfolg) for which the legal order strives; it does not lie in the result in

values (Werterfolg) that is connected with the real result, and which, on the contrary, is unjust." Nevertheless there is a distinction between bravely facing and rashly courting the scalpel. Our foibles, benign as well as malign, are easily exposed. There are courts of other lands as well as our own, that would have proved excellent targets for the merciless shafts that Meredith hurled at egoism. Thankful we may be that he never attended a bar meeting. One can picture the Comic Spirit and its attendant imps rapturously attentive to the turgid rhetoric. There lie, too, under our institutions, in spite of all that enlightened jurists have done and are doing to remove them, explosive materials for poet and philosopher not possessed of foresight, patience, and an abiding faith in the future. Grateful we may be for the sane, if critically humorous, outlook on life recommended in his novels, the hallmark of comedy that rings true.

The flavor of that humor, with a touch of irony added, he has given to his Old Chartist, participant in that forlorn rising of the 1840's, returning home from transportation, as he recalls his wife's loyalty on the day of his trial—and while the old rebel's feminist conceptions may sound antiquated to this audience, at least we have a court scene that may fittingly serve as a conclusion.

"She suffered for me:—women, you'll observe,
Don't suffer for a Cause, but for a man.
When I was in the dock she show'd her nerve:
I saw beneath her shawl my old tea-can.
Trembling . . . she brought it
To screw me for my work: she loath'd my plan
And therefore doubly kind I thought it.

"I've never lost the taste of that same tea:
That liquor on my logic floats like oil,
When I state facts, and fellows disagree.
For human creatures all are in a coil;
All may want pardon.
I see a day when every pot will boil
Harmonious in one great Tea-garden!

SANITY AND DEFINITENESS IN EDUCATION

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Is Modern Education Efficient?

I. Two almost opposite points of view are conspicuously present in current educational discussion, especially in the part of it that has its inspiration outside the teaching body itself. The one is the general lament, sometimes expressed in a business man's letters to a son in college or through the confessions of the undergraduate himself, that the educational system in its entirety is inefficient on account of a few conspicuous defects. The other is the equally sincere belief of many successful men that some branch of knowledge or form of professional training or experience is effective and essential as a systematic whole on account of some important contributions it has made to their success. In seeking an adequate judgment of the collegiate curriculum, for example, there is not much to choose between the thumbs down of the boy who finds a general education inefficient because it fails to prepare him for certain specific social needs and the thumbs up of the man who believes a course in engineering is the best possible preparation for the manufacture of household utensils because it taught him never to conceal a blunder.

Both viewpoints deserve respect because they are the sincere judgment of men who have put some fraction of the educational product to practical test. But the fact that the public school system or a college training fails to contribute some of the factors essential to efficiency in some field of work, or even to efficiency in general, no more necessarily demonstrates that it is inefficient than insistence that a particular branch of knowledge or form of training contributed essential factors, demonstrates the necessity for its mastery as a systematic whole. The

educational problem is so complex, the educational aim so many-sided, that no one institution, form of training or branch of knowledge can contribute all the elements essential to adequate preparation for life.

II. Concerning the public school system, the college, or any other educational institution, it is necessary to inquire: What parts of the educational aim does it serve? What parts does it serve uniquely or more effectively than other institutions? What are its limitations? Has it ill effects—avoidable or unavoidable? What other institutions must supplement its work? Should its work precede, be preceded by or accompany that of other institutions?

It is quite possible that an analysis such as this may demonstrate that if the highest educational efficiency is to be realized, all forms of academic training and educational instruction, even after they have realized their fullest efficiency, must not only be supplemented but paralleled by some form of non-academic training. The gradual working down of the professional school into the college, the requirement of part time for school work now made by law for children working in factories and mills, the introduction of vocational training into the elementary school grades, all tend to make such a paralleling possible. The success of the boy who works his way through college is probably due quite as much to habits of industry that carry over to academic work as to his proverbial seriousness of purpose, while much of the lack of application which college presidents are apt to blame upon the doctrine of interest and individualism as applied in elementary education, can be traced to an absence of the old industrial routine that used to be characteristic of every American home. In an age when the kindling comes already chopped, when the groceries are ordered by telephone and delivered by wagon and motor car, when the pump has given place to the hydrant, and the postman delivers the mail, some of the ill effects attributed to high school and college may be traced to changing economic conditions which prevent the boy of today from doing what the boys a generation or so ago did outside the school.

Is it not possible that this phase of education must still be gained in part outside the school? If education is to include the things that cannot be learned in the school; if it is to carry over habits of application and industry from outside routine to school work and to apply the knowledge and activities of the school in work outside; in short, if through an early start and continuity of development, it is to build up and interrelate the efficiency systems essential to school education and industrial occupation, it may be proven that school work should at the earliest possible point be paralleled by some wage-earning occupation or specific preparation for it. The early employment of every individual in some non-academic field of work, with educational intent, may be found to be as essential a part of compulsory education as the continuation of academic education through continuation school and part time work, after wage earning has become an economic necessity.

It is not for a moment assumed that the larger part of academic training must be subordinated or even related to indistrial work. The paralleling of the academic with the industrial is perhaps no more necessary than the paralleling of the academic with the social and the political. The point to be constantly held in mind is that education is specific as well as general and that much that is essential to specific training must be realized outside of school or through the co-operation of the school with other institutions.

III. The efficiency of the school or college within the academic field itself must be measured with a view to determining the details of the educational aim as a whole, which it can further more effectively than outside agencies. The object of this measurement is not the fullest possible educational contribution for each branch as a whole, but the fullest possible realization of the educational aim as a whole. To show that each branch of knowledge contributes something that practical men of affairs have found useful is no more adequate a defence of its educational worth than the old saying that it is "good for your mind." Every branch of knowledge has something in it that is good for the mind. Everything is useful some time or other,

in some way or other, to some one or other. The true point of view is not that everything that is taught must be educationally useful, but that every form of educational usefulness must be adequately taught. Somewhat opposed to this is the growing tendency on the part of specialists and teachers of the various school subjects to show all the possible uses to which they can be put. Notable examples of this are the work of the International Committee on the Teaching of Mathematics and the recent exhibit in impressive concrete form of the various applications of the Latin language in modern life.

The inadequacy of this sort of investigation lies in the fact that it is apologetic rather than scientific. It is a step toward complete analysis, but is misused to justify the emphasis of certain subjects as wholes. The true question that must be asked of each branch of knowledge is not: Is it useful? Does it train the mind? But, What sorts of usefulness does it further and what kinds of training? What does it contribute that is unique, and what more economically or more usefully than other subjects? What is the relative worth of these contributions as compared with those of other subjects to the same or different ends? What parts of its subject matter and how much of it are essential to them? What parts must be built up into certain and permanent system? What method is essential to develop these particular kinds of usefulness to the highest efficiency?

The lover of each branch of study must find other justification for its educational existence than a multitude of uses. Every subject contains a vast number of useful things that cannot figure in an efficient course of study. Educational usefulness is determined by relative worth. Educational subject matter must not only be useful, but have the greatest possibility of usefulness as compared with the great mass of experience which does not figure in the course of study. It must not only have the greatest possibility of usefulness, but a greater probability of usefulness. This greatest possibility is dependent on relative educational worth, greater probability upon definiteness of presentation.

IV. What does it matter whether an idea is high in its possible educational appeal, many-sided in its possible useful associations, and frequent in its recurrence if it is presented to the learner merely as an interesting fact that may be retained in a relationship that is non-emotional, that limits or prevents many-sidedness, and that recurs without educational significance? Possible educational usefulness becomes actual only as a matter of chance, if definiteness of presentation fails to point out the association or relationship on which the greatest possibility of usefulness depends.

To illustrate: The discovery of coal in Pennsylvania is included in most elementary text-books in United States history because its many-sided industrial effect gives it a great possibility of usefulness. This effect is often so obvious to the text-book writer that he fails to add it to the mere fact of discovery. If he happens to associate the two in the text, he fails to do so in his chronological summaries, and as a result the teacher is far more likely to dwell upon the discovery as occurring in Washington's administration or the year 1791 than to ensure its greater probability of usefulness by definitely associating it with rapid industrial development in Pennsylvania, and hence with the Reading Railroad, the growth of Philadelphia, and the effect of coal deposits and discoveries in other regions.

The obviousness and seeming accuracy of chronological location make history especially liable to the omission of the definite associations on which greater probability of usefulness depends. The introduction of the steamboat into the Ohio and Mississippi rivers is more likely to be taught as occurring in 1811 and Madison's administration—a fact which opens the way to few or no associations—than to be definitely associated with the consequent shortening of time for travel and commerce, and hence not only with the opening up of the Ohio and Mississippi valleys to settlement and industry and the struggle for the possession of New Orleans, but with the early roadway from Cumberland to Pittsburgh, Pacific and Trans-Siberian railroads,

and Suez and Panama canals, with their almost limitless train of accompaniments and consequences.

In ancient history where chains of causes and effects run through the whole course of civilization, lack of the definiteness essential to probability of usefulness is even more serious. Think, for example, of associating the fall of Syracuse with Alcibiades or a date soon forgotten, and failing to connect it through the resulting introduction of Greek luxury, with the resistance of Cato to Greek rhetoricians, the Germania of Tacitus, the decline and fall of the Roman Empire, and the effect of luxury on civilization.

It is not mere definiteness as definiteness that counts, but the definiteness that presents the things which have the greater possibility of educational usefulness in relation to the ideas on which their greatest probability of such usefulness depends. The definite association of a manuscript or obelisk with a particular Egyptian dynasty, or of some paltry event with Peter the Simple or Charles the Bald may have a genuine usefulness to the historical specialist, merely because it is a fact or because of its relationship to other facts, but it is educationally useless to the ordinary learner. He does not know enough or is unlikely to know enough of Pharaohs and Carlovingians for the idea to make any contribution to his development. It may be many-sided, recurring and strong in its emotional appeal for the trained historian or for the specialist who for the sake of knowledge is living again the life of some dead reign or epoch, but from any other angle than that of specialization—specialization in work or specialization in leisure—no definiteness is educationally useful that does not connect what is taught with the experiences common to those with which the learner is to think and live. Without recurrence in everyday life no definiteness can be permanent; without centering many-sidedness or emotional appeal on the present, no definiteness can be controlling.

Nothing, whatever its logical definiteness or academic usefulness, is educationally useful which does not result in definiteness which is retained by the learner and which continues to control his future experience.

V. Every form of control depends upon definiteness for its usefulness and efficiency, and definiteness that is educational must lead to some form of control. Here is the fundamental interrelation and interdependence between knowledge and power. Knowledge is power when it is definitely retained in the relationships that secure the various forms of control. Hence, the usefulness of the various branches cannot be determined without analyzing usefulness and efficiency into their various forms of retention and control. In what forms is knowledge retained? Through what forms does power control?

1. Now any intelligent mind is capable of the analysis necessary to determine the forms in which past experience is retained. Most of it is forgotten. Much of it is retained in a haphazard, accidental relationship or so, varying with the immediate interests and past experience of each individual. Part of it becomes increasingly many-sided through the addition of association after association which, like those responsible for bare retention, vary with individual interests and experience. A little of it is made definite and certain through repetition in unvarying relationships. Still less of it takes on a general enough form for it to be identified in other fields or situations than the one through which it is retained. Past experience, then, is retained as forgotten knowledge, barely retained knowledge, many-sided and varying knowledge, definite and certain knowledge, and general knowledge.

2. For each form of retention there is a corresponding form of control. Forgotten knowledge, especially when it has been emotional in its form, controls through a cumulative impression which results in interests, opinions, attitudes of mind, points of view, tastes and ideals. Barely retained knowledge controls mainly through vocabulary; that is, the number and kind of words largely determine what knowledge shall be retained and the kind of relationships which it shall form. Many-sided and varying knowledge controls through mental interconnection which either brings the right kind of idea into association with others, makes many-sided ideas continually reach out after new experience, or incidentally provides the network of associa-

tions which may relate any idea to any other idea. Definite and certain knowledge controls through habit and the cumulative systems of habits which constitute specific discipline. General knowledge controls through the transfer or general discipline or application which carries over an idea, an activity or a habit to some instance or field of experience other than the one through which it is acquired.

VI. Each of these forms of control depends for its educational usefulness and efficiency upon a different sort of definiteness. As the definiteness essential to each is made increasingly clear through successively specifying and illustrating the particular kinds of knowledge or associations which give the highest probability for each, (1) failure to ensure these kinds of knowledge or associations in the subjects that can best develop them becomes glaringly apparent, and (2) the question that must be asked of each branch of study becomes definitely concrete for each form of control.

VII. Impression control depends upon the definite and cumulative centering of highly emotional material about the thing that is to be made controlling. In place of depending upon the incidental appeal of some fact or incident impressive in itself, but often counterbalanced by an opposing one or not cumulatively associated with those that are similar, instruction must carefully select the idea that will be most usefully controlling if strongly enough emotionalized, transform it to an emotional center by certainly associating with it two or three exceptionally impressive incidents in their most emotional form, and then at the most effective intervals adding the most emotional impressions possible until control is ensured. For example, if in place of a vague emotionalizing of temperance or the giving of total abstinence a coldly scientific sanction from temperance hygiene, the fact that it is unsafe to take the chance involved in occasional drinking is selected as most controlling, has strong enough facts or incidents associated with it to make the chance of personal immunity seem, for the time at least, pitifully small, and then is again and again re-enforced by a variety of strong emotional instances which are related by

allusion to the initial impression, the temptation to be jolly or sociable will be counteracted by a more impressive realization of personal risk.

Failure to make impression thus definite and cumulative is one of the most serious weaknesses of present-day education. Think of the almost inconceivable inefficiency of a course of study and methods of instruction which rest satisfied with the incidental formation of such ideals as obedience to law or equal rights; which present the lessons of history unemotionally and expect to develop a love of literature by analyzing masterpieces into details of technique; which rest satisfied with a vague interest in a branch of study as a whole without creating the specific ideals upon which even its own efficiency depends; which fail to counteract the erronous feelings and opinions that result from the conflicting repetitions of incidental experience, with the ideas made controlling by the greater definiteness, emotional appeal and cumulativeness which instruction can ensure. To ask of a particular school study, does it develop ideals, is to ask whether it definitely, cumulatively and adequately centers highly emotional material upon the most fundamental ideas that are to be emotionalized.

VIII. Vocabulary control depends not only upon the broadening of all phases of experience rich in words, and the emphasis of words in all phases of experience, but upon the memorizing of words many-sided in their suggestion of others, in definite association first with the three or four ideas that make them suggestive along particular lines and, second, with the locations that are likely to bring them into contact with the greatest number of other words. Without definite association of the vocabulary centers which should reach out after new words with vocabulary makers and vocabulary locations, upon which their greater probability of suggesting and retaining other words depends, even the most many-sided general terms will be used to merely identify new experiences under an old and familiar term, in place of conjuring up new words with each new recurrence.

Stone, or flower, for example, in place of throwing emphasis

upon what makes for the variation and individuality which demands a new name, merely result in recalling continually recurring experiences that are really different and new by the name that denotes their common qualities. All stones are stones and flowers but flowers appear. But if stone is definitely memorized in association with such vocabulary makers as color, hardness, fracture and luster, which will mechanically come to mind whenever attention is called to a new stone and point out the variation and individuality which demand a name, quartz, chalcedony, sandstone, granite, and a multitude of other new terms are soon fixed in the memory.

Even so effective a vocabulary center as the word clothing with its constant suggestion through style and variation of large groups of words can be made more controlling through definitely associating it with such vocabulary makers as protection, ornamentation, etc., and then further associating the vocabulary center and makers with such vocabulary locations as occupation, nationality, historical period, etc. Clothing associated with protection and located in the field of occupation soon adds to the familiar coats and gowns, the fisherman's oilskins, the blacksmith's leather apron and the electrician's and the surgeon's rubber glove; while, located in the middle ages, it suggests armor, breastplate, coat of mail, shield, and a host of other new terms for details otherwise likely to be overlooked or forgotten.

In place of ensuring this definiteness that suggests and multiplies words, academic training teaches dictionary definitions and scientific concepts that merely identify; in place of distributing Latin roots through the school grades, where they will be effective vocabulary centers, and eliminating useless or rare derivatives, it has abolished etymology from the course of study; in place of making sure that each branch of knowledge is contributing all the new words which it alone can present or which it furnishes earlier than they will otherwise be gained, it is juvenilizing children's literature and guarding popular books and lectures from difficult and scientific terms. To ask whether a school subject or form of training develops vocabu-

lary is not enough. It must be determined whether it is furnishing its proper quota of vocabulary centers in definite association with the vocabulary makers that help them to suggest and retain the greatest number and the most useful kinds of words, and whether words are made conspicuous in its subject matter with a view not only to their greater usefulness but to their greater probability of retention.

It is not that the experience of the ordinary individual in school and out has not been vastly broadened—moving picture shows, phonograph records, and the multiplication of books and periodicals have attended to that—but that instruction has not seized upon definiteness as a means to ensuring greater and more useful vocabulary development than incidental experience affords. And this is as true in the field of mental interconnection as in that of mere vocabulary.

IX. Interconnection control depends for its likelihood of usefulness and efficiency upon a definiteness of association of the most useful and many-sided ideas with interconnection makers and locations similar to vocabulary makers and locations, but not identical with them. Just as there is a difference between the possibly useful general term which merely identifies new experience with the old and the definitely suggestive vocabulary center which emphasizes variation and individuality, is there a difference between the mere vocabulary center and the possibly many-sided idea definitely associated with the few terms or notions that compel it to reach out not merely after new words but after new thought and experience.

1. The definite association with stone of color, hardness, fracture and luster goes no further than to make more probable the identification of a particular stone with its specific name. But if stone is further associated with use, locality, stratum and origin it serves a larger purpose. The great boulder balanced on the hill may be identified and named as granite without a further thought or question. But use connects it with quarry, building, monument, durability, polish; locality, with New England, Quincy, Westerly, Tennessee, and if it is found on a Pennsylvania or New Jersey hill, with rocking-stone,

glacier, terminal moraine and glacial epoch; stratum, with fossil, stratification, and geological age; and origin, with aqueous or igneous formation and with other rocks similarly formed.

There is no limit to the chain of interconnections made more probable through definitely associating a many-sided idea with its interconnection makers. One of the most fundamental educational questions is what three or four terms definitely and surely associated with the most useful ideas will give them the greatest suggestiveness for mental interconnection. If instruction is to be effective at this point, pedagogical definition must take the place of logical, popular, or technical definition and ensure the memorizing of interconnection makers for the most useful ideas, and the presentation of relatively less useful ideas in connection with the interconnection makers that will be most suggestive, if they happen to be remembered, and that are therefore most likely to be remembered because they are most suggestive.

2. In determining the form of usefulness for a word or idea, definiteness of location serves a similar purpose to definiteness of association with other ideas. The one is determining through what is associated with an idea, the other through what an idea is associated with. Exact location in some time or place with which little else is associated, like partial or dictionary definition, increases the probability of an idea being remembered and nothing more. But the location of an idea in some period, place, field of experience or branch of knowledge with which many other ideas are associated not only increases its chance of being barely remembered through a possible association with ideas as well as with the locality, but makes it highly probable that its consequent mental nearness to other ideas will bring out similarities, contrasts, and other relationships which otherwise might have remained undiscovered. The educational value of exactness of location is proportionate to the amount of knowledge which the learner has associated with the location or is likely to associate with it. Usually one does not know enough about an exact date, such as April 14, 1511, or even

1511 with all of its thirties and thirty-firsts, for location to add a single association. To fix an event there, merely gives an additional fact to be remembered. But locate an experience in the Elizabethan Age, and royal progresses, religious dissensions, Mary Queen of Scots, Shakespeare, Sir Walter Raleigh, Westward Ho, and a hundred other associations may be intimately associated with it.

3. If it is an interconnection center that is thus located—in the age of Elizabeth—such as clothing associated with fabrics, manufacture, and importations, its increased definiteness of suggestion leads to spinning wheels and weavers' guilds, Genoese silks and velvets, Italian sailors and Italian bankers, wool raising and its interference with agriculture and tenant farmers both in the time of Henry VIII and in the development of our own southwestern States. So a manufacturing city associated with accessible raw materials, cheap power, and ready market, has a different but no less definite suggestiveness as it happens to be located in Massachusetts, Germany and Japan.

4. Still further interconnection is made probable through the association of fundamental interconnection locations in definite sequence. With Germany next to France, or the Roman Empire following the Age of Pericles and Greek colonization in Sicily, ideas leap over time and space to find associations that otherwise would be remote. The unique contribution of history and geography to mental training and efficiency lies in the great network of related locations and sequences which not only form a great mnemonic system for the retention of words, but an essential basis for completeness of interconnection for all ideas that have to do with remote regions and past ages. Similarly each branch of knowledge and field of experience has its interconnecting outline which definitely associates together the more general divisions and subdivisions, which are sufficiently related to the experience of the ordinary individual to accumulate many details which otherwise would have no academic or scientific explanation or bearing.

5. In short, it is overwhelmingly obvious that a vague many-sidedness of experience is ineffective for interconnection

control, and that efficiency through the interrelating of ideas cannot result when undirected individual apperception is emphasized at the expense of definite association that will multiply variation and individuality for all, when the thoroughness of exhaustive detail in two or three subjects prevents the memorizing of what is definitely essential to all, when dictionary definition is substituted for the definition which definitely retains new words and suggests new experience, when a particular period in history is exhaustively studied to the exclusion of the definite system of periods and sequences which constitutes the more favorable condition to the interrelating of all ideas belonging to the remoter past, when for a similar location system in geography is substituted petty political and physiographical locations too empty of associations to be suggestive, and, to crown all, when the Herbartian five formal steps to complete apperception stop short at "generalization" without certainly and definitely associating with the most many-sided ideas the three or four terms or notions that will definitely suggest a variety of things with each new application.

From the standpoint of instruction, then, as distinct from incidental experience, it is not sufficient to ask, does a subject or form of training further mental interconnection, but does it furnish few or many interconnection centers firmly associated with the interconnection makers which compel them to reach out after new knowledge and experience, and does it ensure the memorizing of interconnection locations and sequences full of the details with which new ideas may be brought into contact?

X. All this definiteness essential to the forms of control already discussed but serves to emphasize the necessity for habit and system control, both in the familiar sense of specific activities and in that of those whose usefulness can be made general. Permanent definiteness is habit and system. But there is a distinction between the definiteness that is necessary to ideals, vocabulary, and interconnection in general and the definiteness which is specific in its own usefulness.

1. Specific usefulness is definite in the kind of activity it certainly furthers. The definiteness that results in morality,

health, industrial efficiency, social service, good citizenship and preparation for social intercourse or individual leisure, is not only specific, but certain, because it is direct and specific. The usefulness is certain because the habit is certain, and the habit is useful in itself. The habits of truthfulness, of obedience to law, of discounting bills, of sleeping in fresh air, are all specific and certain. Efficiency in the specific sense is due to certainty. The man who invariably follows a useful routine adds to the world's knowledge and does most of the world's work. He alone would not leave the world different from what he found it, except that through him every useful thing is repeated and multiplied. His relative efficiency depends upon the certainty and number of his useful habits and the extent to which they are interrelated into system. Many a captain of industry has risen to power and dominion through the habitual use of the originality and invention of others without ever thinking an original thought or doing an original act.

2. The definiteness that results in general usefulness is in itself no less certain than specific usefulness. In fact, it most frequently is specific before it is made general. But its general usefulness does not lie within itself, but in a multiplied usefulness to which its certainty is but a means. For example, the fact that a particular river has beautiful scenery, fertilizes the soil, is navigable, and furnishes water-power, is certainly and specifically useful. But while the association of the idea of river in general with scenery, fertilization, navigation and power can be made equally certain, the application of these interconnection makers to each new river and the usefulness of each application remain uncertain. If the general idea is to be carried over in such a way as to multiply associations and suggest new knowledge, it must be under favorable conditions which may or may not be present. If each application is to be useful, many-sidedness and variation must be controlled by specifically and certainly useful ideals and habits. Otherwise, in the absence of a firmly established æsthetic point of view, the thought of scenery in connection with each new river may suggest an effective location for advertising signs; the idea of

naturally fertile land, without right economic conceptions, may result in the rapid exhaustion of a rich soil; the thought of navigation and commerce in a dishonest and adventurous mind may lead to piracy and plunder; while realization of the presence of water-power is useless if not supplemented by ability to recognize or to put to use all other factors essential to a manufacturing center. That is, many-sidedness and variation are not certain to result; and if they result, are not certain to be useful. They are dependent for their extent upon habits in the form of vocabulary and association makers and locations, that may or may not have specific usefulness in themselves. They are dependent for their usefulness upon specifically and certainly useful ideals and habits, which may or may not carry over to them, and which are partly dependent upon them for making their usefulness general.

XI. In short, all forms of control find their completion in transfer control, which is dependent for its efficiency upon an idea or activity general enough to be carried over to new instances and fields of experience in the presence of favorable conditions which include the definiteness essential to all other forms of control and must add other kinds of definiteness to them. Transfer is the multiplication table for efficiency. It brings together in one individual the interconnection control exercised through the man who is always thinking new thoughts, associating remote ideas, seeing witty connections, having flashes of imagination and invention; and the habit and system control built up in the man in whom one idea or activity naturally leads to another with increasing certainty and complexity. It takes a familiar and useful habit or system of habits and applies it to a multitude of new instances in the remotest fields of thought and experience. It takes the idea newly discovered through some kaleidoscopic turn of the mental content and multiplies its usefulness by associating it with a system which in turn passes it on from a general idea it transforms, to individual groups and sequences until it modifies and makes more useful a thousand and one particulars. It is hard to tell which is more absurd—the assumption that because

a formal subject, such as mathematics, or a language, certainly develops some general ideas and activities, they will carry over to other fields as a matter of course, or that because Mr. Thorndike's and Mr. Bagley's experiments show that certain general ideas and activities have not carried over, they cannot carry over at all.

1. No idea or activity is likely to be very generally applied just because it is put in general form, and the more systematic a group of ideas from the standpont of specific usefulness, the less likely they are to be generally applied. On the other hand, any idea or idea group that has a possibility of general usefulness may have its usefulness greatly multiplied, if it is definitely and certainly associated with the conditions essential to transfer.

Take, for instance, so common an ideal and habit as honesty. Almost everybody is honest in some fashion or other, and few, if any, are honest in all things. Starting with whatever honest habit the individual has formed, with its limited, specific and certain usefulness, there must be associated with it the general idea of not taking or retaining what is not one's own. In turn, this general idea of honesty must be associated not only with concrete things, but with payment for any sort of thing, the use of ideas, social relationships and other fields of experience; with the typical cases of honesty in each field most likely to suggest a variety of others, and with the habit of seeking out new applications. With the general idea of honesty and each typical case must be definitely associated the emotional incidents and material that will idealize them and make them incentives to action; the words and, where necessary, the vocabulary makers and locations that will lead to the acquisition of new words concerning honesty in all of its phases; and the interconnection makers and locations that will make them suggest new experience. With each general idea the relative importance of these definite associations may vary and additional habits may become essential—such as the habit of analysis and synthesis in the most probable fields of application, as in the case of arithmetical problems; or the habit of recalling all

of a series of connected ideas or conditions when one is identified, such as all of the factors essential to a manufacturing city when some one of them has become apparent. When every other fundamental idea or habit of morality has been added to honesty, and health, industrial efficiency, social service, good citizenship, social intercourse and individual leisure have been similarly analyzed into their essential factors; when with each one of them has been definitely and permanently associated all conditions essentially favorable to general application, their control of the most varied and many-sided experience will be given the highest probability.

2. When generally useful ideas that are not specific, such as vocabulary and interconnection centers, are definitely and certainly associated with their makers and locations, the greatest possible retention of experience through words and of the interconnection of ideas with each other, will be assured and the highest probability given to originality and variation.

3. Taken together, all that is definitely essential to useful certainty and to variation constitutes a great system of ideas, vocabulary, associations and habits, which usefulness and efficiency demand and instruction must cumulatively ensure. It must be sharply distinguished from merely logical system, logical outlines in the various branches of study, and the system peculiar to branches as wholes, though it will in part include them. It is not an academic system that is to be remembered for a little time for the sake of a few general ideas or some useful habits and then forgotten, but a dynamic system that must be cumulatively developed from all branches of knowledge and phases of experience, and certainly retained through a greater continuity of instruction, and continual recurrence in the every-day experience which it must in turn retain and control. It is not merely something that is to be remembered, but something to remember by and think with—knowledge that is power because it is definitely related to the ideas and activities upon which its power depends.

4. Since efficiency is thus dependent upon definiteness, memorizing and mechanical drill regain the fundamental

importance that they have lost through their misapplication to petty details and non-essential associations. Verbatim memorizing of text-books, drill upon empty names and dates and facts have gone forever. But no amount of individuality, interest or many-sidedness can take the place of the definiteness upon which all educational usefulness and efficiency depend.

Every minute of the little time that can be economically and effectively devoted to memorizing and drill should be utilized, but only for the mastery of what is most useful in the definite relationships that make it most useful, and for the memorizing of what is to be permanently retained. Determination of the relative educational worth of the subject matter in the various school subjects and of the experience involved in various educational institutions and forms of training, combined with continuity of retention for the resulting efficiency system, is basal for maximum retention of useful past experience and maximum control over future experience.

XII. Now each step of this progressive analysis has given increasing definiteness to the usefulness, the relative worth of which is to be measured. Usefulness rests (1) in contribution to the five forms of control, (2) in the definite kinds of knowledge and associations which give greater probability to each, and (3) in either the specific usefulness of these kinds of knowledge and associations to such phases of the educational aim as industrial efficiency and good citizenship, or their general usefulness in various fields of knowledge and experience.

In the light of these successive degrees of definiteness and probability of usefulness it is not only easier to see that the question which must be asked of each branch of study is no longer, is it useful or does it train the mind, or not merely, (1) does it develop impressions, add to vocabulary, multiply interconnection, ensure habits, and result in transfer, but (2) what has it to offer that is specifically useful—useful to morality, health, citizenship, etc.—as emotional centers and the emotional material which it will definitely and cumulatively add to them; as vocabulary and interconnection centers, makers, locations, and sequences which extend their control;

and as habit, which makes them certain, and system, which extends their certainty? (3) And what has it to offer among these kinds of knowledge and associations, that is generally enough useful to be transferred to other fields, or that definitely ensures conditions favorable to transfer?

More than this—when the definite usefulness of details within the various branches of knowledge has been thus fixed, and each detail put into the definite asssociation upon which its highest educational usefulness depends, it will not serve as justification or apology for the exhaustive mastery of the subjects as wholes.

XIII. The need of material which definitely furthers each of the specific phases of the educational aim, as distinct from that which is generally useful, in itself demonstrates both the necessity for selection from a great variety of branches as opposed to the detailed study of a few branches as wholes, and the inadequacy of any academic institution or scheme of education which is not paralleled or supplemented by outside activities to which its own are definitely related.

1. It is not only that no two or three subjects contain enough material useful to the teaching of all forms of morality, health, industrial efficiency, social service, good citizenship and adaptation to the varying needs of individual leisure, but that even if they did, selection from a greater variety of branches and from experience outside the academic field is demanded by the greater relative worth of some of their details for most of the purposes peculiarly furthered by the two or three subjects. Hygiene may furnish most of the material essential to health and sociology to social service, but material of the highest usefulness to each may be found in some subordinate phase of history or natural science.

2. Selection from a great variety of branches is also compelled by the fact that each specific phase of the aim requires the material most useful for each of the five forms of control. Civil government or history might contain all the subject matter essential to the vocabulary and interconnection side of citizenship, but literature, biography, music and art must be drawn

upon to emotionalize civic ideals, while habits and transfer must be assured through co-operation between the school and numerous non-academic or outside activities.

3. When definiteness is still further carried into such details as are necessary to specific emotional centers, specifically emotional material, vocabulary and interconnection centers, makers and locations for specific aims of life, the words useful to each that are most likely to be retained, habits specifically useful in themselves and the numerous conditions favorable to their transfer and general application, there is little room for details not definitely and highly useful which are included to make the study of one or two branches exhaustive and thorough.

In short, even the definiteness of a partial analysis finally and surely demonstrates that efficiency in the sense of specific preparation for life lies not in the exhaustive study of a few branches, but in the partial study of many.

XIV. More than this—it is equally obvious that a purely academic study or a particular type of educational institution utterly fails to meet the demands of most forms of specific training. Hence the need for a paralleling of the academic with the practical—the Gary system, Miss Lewis' open-air school at Buffalo, William McAndrew's Washington Irving High School and Dr. Lewis' William Penn, manual training and domestic science, the school playground, the Home and School League, continuation schools, vocational guidance, college and university social centers, and the host of social activities which President Wilson once called the side-shows that interfere with the main college tent.

Educational definiteness and efficiency demand these side-shows. They are not the causes of the college's inefficiency, but means to a higher efficiency than the college has yet attained. Without them its contribution is incomplete. To make social activities effective, however, their definite contributions to each form of control and for each kind of specific usefulness must be pointed out, their relative value to each scientifically determined, and their essential or most highly useful parts related through course of study and methods of instruction both to

the academic work and to what must supplement it on the outside.

And yet there is apparent justification for the simile of side-show and main tent. It is false in so far as it relieves the college from a responsibility for social training which it assumes can be safely left to everyday life undirected by instruction and unrelated to academic education. It holds true in emphasizing the relative importance, of general education as distinct from specific training. Each is essential to the other.

However broad the culture and thorough the discipline of an academic course of study, it must not be mastered to the exclusion of what is essential to its domination by the specifically useful. The world is already full enough of lawyers or physicians without ethical or civic ideals, and college graduates who are industrially inefficient or socially weak. The traditional education would be condemned for its over-emphasis of the formal, even were its over-emphasis partly justified through a resulting general efficiency. Every academic institution and form of training must definitely insure the kinds of knowledge and relationships that give higher probability to each phase of specific training. But while the formal or the generally useful must not be given over-emphasis, it is as useful through its variation and extent of application as the specifically useful through its certainty. More than this, it is equally independent of the sort of thoroughness that demands the mastery of branches as wholes.

XV. Just now, to be sure, the main tent is seeking general efficiency through excessive specialization. It is assumed that if its tumblers and its acrobats are drilled in a few academic activities until they attain superlative skill, their tight-rope and sawdust specialties become the open gateways to every form of achievement outside the magic ring; in short, that the thoroughness of exhaustive detail is the only means to all-round ability.

If there is anything that has been demonstrated by the foregoing analysis in its application to general as well as to specific training, it is that thoroughness of selection based on

relative contribution to definite forms of control must displace the thoroughness of exhaustive detail.

General training, like specific, is analyzable into impression, vocabulary, interconnection, habit and transfer controls. There is no potency in indefiniteness, no general power that does not express itself in one of these five forms. But the impression control is exerted through ideals that, like those of persistence and analysis, can serve as incentives in every field of experience; the vocabulary and interconnection control is exercised through vocabulary and interconnection centers, makers and locations, that further the multiplication of words in general rather than of the kind that serve a specific utilitarian or even academic end; while the habit control must be exercised through transfer to a variety of fields of experience, if it is not to be as narrowly academic as the specifically useful habit is narrowly utilitarian.

1. The ideas, and especially the habits, which are general enough to be carried over to most subjects and fields of experience, may be found in two or three branches, and the most generally useful may even be found in one. The very fact that they are found in most makes it inevitable that they shall occur in almost any one or two. The champions of formal discipline make the mistake of assuming, however, that their occurrence must be in some one or two rather than in parts of all. From struggling over whether they do not all occur in one and whether that one should be an ancient language or mathematics, they have gradually united on mathematics, a language and science as essential to a thorough general training, and are tending toward a more thorough study of some one branch of mathematics, a single language, ancient or modern, and one or two natural sciences. The advantage in this concentration lies in the fact that the subjects in question through their necessary organization or method compel the continual recurrence of the generally useful activities and so insure habit formation, while other subjects which can insure the same habits are dependent upon a pedagogical organization and method with which the teacher may or may not be familiar. Once train specialists in effective pedagogical organization and method, and it will not

be so difficult for them to take the further step of developing the generally useful activities through selecting those parts of all subjects that most certainly insure the conditions favorable to transfer and general application. For after all, the continual recurrence compelled by the organization and method peculiar to a particular branch merely ensures the certain retention of the idea or activity which has possible general usefulness.

2. But the habit thus formed is dependent for its greater probability of usefulness upon the certain association with it of conditions favorable to transfer and general application, without which they are not only uncertain but even improbable. Obviously, aside from the presence of these conditions, the more the habits are exclusively associated with some one branch as a whole, the less likely they are to be transferred. The one exception to this is the fact that thoroughness of exhaustive detail furnishes through many-sidedness within a single subject a favorable condition to general application within that special field. That is, academic concentration gives at least one condition favorable to the limited transfer which is essential to the efficiency of the academic specialist. But the more general many-sidedness of knowledge and experience which can be gained only by the partial study of many subjects, is indispensable to the widest possible extent of usefulness, while a still greater probability of usefulness is gained by definitely associating the generally useful thing with a variety of the most useful fields for its application, with typical and impressive examples of application in each field, with the vocabulary and information in each field most closely related to application, and the habits of analysis and synthesis in each field necessary to the identification of the generally useful thing when it occurs there.

For example, literature and original composition are peculiarly adapted to the development of the habit of preparedness for a variety of alternations. Mathematics develops it more certainly though more abstractly, in the stage of solution where one makes quick choice of a variety of ways of proving two angles equal or a variety of consequences from inter-related lines being parallel. But it is less likely to be associated with

everyday life than if it is taught through phases of science, history or literature which are more similar to actual experience. Its only advantage lies in a certainty which, even in mathematics, is partly conditioned by pedagogic method.

In literature or composition every sort of alternation which the efficient man must be prepared to meet can be emotionally presented. The Moonstone, for example, bafflingly suggests a number of solutions for its mystery. But even though the habit of anticipating the plot in literature, or suggesting alternative results for some action occurring in original composition, is repeated often enough to result in habit, similarity to important situations in ordinary experience is, of itself, neither likely to suggest them nor to result in transfer. First, the general idea of preparedness for alternations must be emotionalized by highly impressive instances, such as Germany's invasion of England or indirect attack through the Balkans, the resourcefulness of some industrial leader, or even the humorous farce where Lew Fields prepares his boon companion to keep the barkeeper from knowing they have but a single nickel by successively coaching him to refuse a drink, a cigar and finally something to eat.

Then, it must be associated with the boy's own experience, through such typical occurrences as going to buy something which the store does not happen to have, without being prepared for the alternative of a satisfactory substitute purchase, finding out when the necessary article will again be in stock or going to another store; or calling upon an important business errand, when the other person involved is not at home, without being prepared with the alternatives of finding out where he is, making another appointment, waiting until he returns, leaving a message, asking to be called up on the 'phone, or finding some one else who will serve the purpose about as well. Here special vocabulary or information may not be needed, but the habit of looking for other possible alternatives will unite with the other favorable conditions suggested to make transfer more probable. Without conditions such as these, certainty of habit will not result in probability of general

application, while even certainty of habit formation itself—the sole condition favorable to general training that is associated with the exhaustive study of two or three branches as wholes—frequently fails to outlast a high school or college course because subjects mastered as complex wholes are soon forgotten because they are complex.

3. But generally useful habits and transfer are not the only forms of general training. The traditionally formal subjects are formal in very minor degree when it comes to general impression, vocabulary in general, and the general system of mental interconnection which is essential to associating any idea with any other idea, as distinct from the carrying over of a useful habit to new instances of application. A general training that does not mean these forms of control is incomplete and inefficient. But general ideals that are not emotional in themselves must, like those specifically useful, be emotionalized from literature, music and art, while each branch of knowledge must contribute its portion of words more readily retainable, ideas more readily put into connection with others, vocabulary and interconnection centers which multiply the number of words and ideas in general, and the many-sided locations and sequences which will be cumulatively filled with the words and ideas most likely to be interrelated.

XVI. The thoroughness of exhaustive detail is an end in itself rather than the means to all ends. It is essential to general efficiency that here and there in every subject the learner shall be compelled to perform pieces of intensive work to which he must stick until the last task is done. Somewhere he must form the ideal and the habit of cheerful persistence in the face of complex difficulties. But it is destructive to general efficiency that the exhaustive study of any branch as a whole shall take the place of the partial study of all branches containing material essential to the five forms of control or more highly useful to them than material similarly useful in other branches. The purely academic system essential to a highly organized branch of knowledge omits essential pedagogical definiteness and contains a great surplus of academic definite-

ness, the mastery of which is unnecessary to its more useful contributions to mental development through the five forms of control. While the subjects rich in subject matter, as distinct from the formal or abstract branches, are not thus fixed in their definiteness, each may be organized into a variety of logical systems, some one of which will be familiar to the teacher. Unfortunately, the efficiency system resulting from the selection of the most useful material from all branches of study and fields of experience, and its organization in the definite relationships upon which its highest usefulness depends is neither essential to a logical mastery of the academic subjects nor familiar to the teacher.

XVII. If education is to be efficient, the first step is to lessen the confidence of academic specialists in the adequacy of academic system and method for general training, by transforming them into teachers familiar not only with efficiency system and the definite distinctions and standards for determining relative educational worth, but with the relative efficiency of the methods by which efficiency system is to be cumulatively built up and retained in the mind of the learner.

For if probability of usefulness is dependent upon definiteness of association for the useful idea with the things upon which its highest usefulness depends, efficiency or the highest probability of usefulness is dependent upon the method which insures the mastery by each individual of the largest part of that definiteness which his native retentiveness makes possible. Efficiency is quantitative. It is the method by which the five forms of control are developed in the highest degree, with the greatest permanency and to the furthest extent. It is its successful effort to point out the definiteness necessary to usefulness, to analytically determine relative worth, and to experimentally discover relative efficiency in method, that is, transforming the philosophy of education into a science. From a subject grudgingly admitted as a college elective because it seemed too technical to be counted for the arts degree and too non-essential to be compelled of students being equipped to teach through their more or less exhaustive mastery of an

academic specialty, it is certain to become a subject required of every student because no other single branch can take the place of one that inexorably conditions the highest usefulness of all.

As teachers in general become as familiar with relative educational values and efficiency system, as with the French Revolution or the technique of a foreign literature, a general education will be as effective a preparation for life as academic training now is for specialization, and each educational institution, form of training, and field of experience will perform its unique or relatively more useful service to the making of the man and the citizen.

XVIII. This more efficient general education will mean not only adequate preparation for life, but more effective specialization. The specialization which has been creeping down into the college and the high school, with a view to the thoroughness of exhaustive detail falsely assumed to be necessary to thoroughness of mental training, will be begun in the earliest years of the elementary school itself. Like the non-academic training that must parallel the education of the school, specialization must parallel it both in order that individuality shall have the earliest opportunity of expressing itself and that the efficiency system essential to specialization shall have the same opportunity for cumulative development and continuity of application as those essential to general education and non-academic abilities. While no learner will be required to master branches of mathematics, languages or natural sciences as wholes for the sake of general training, more learners will be so effectively educated that they can successfully elect them as wholes for the sake of specialization. Even a limited specialization, with its concentration through thoroughness of detail, is not an essential condition to general training, but general training with its assurance of greater efficiency is an indispensable condition and accompaniment to specialization.

XIX. Meanwhile, successful men in every field of activity will proudly proclaim the educational worth of the forms of training and branches of knowledge which they know have contributed to their own efficiency. Trained in them as aca-

demic wholes, they naturally enough are as unanalytic in their treatment of a successful education as they were in their business methods until efficiency experts showed them greater economies and larger gains. How can they analyze long-forgotten studies and discriminate between the parts that really contributed to their efficiency and the parts that were relatively useless? How can they be made to see that others equally successful have gained the same general efficiency through various forms of training? Their faith in traditional educational institutions, strengthened by a love of alma mater, is one of the finer phases of their idealism and largely contributes to the public sentiment and individual philanthropy that make the advancement of learning possible.

On the other hand, the precocious undergraduate, or the alumnus whose graduation is too recent for him to assume that his education as a whole has won him success, sees branches of learning and forms of training in details and in parts. His realization of academic omissions and failures, sharpened by his competition with men who have been engaged in practical activities while he has been in school, makes his judgment analytic but incomplete. Notwithstanding the fact that, looking from too close an angle, he sees in each partial failure a defective whole, his personal contact with a college course undergoing readjustment and the growing likelihood of his having some training in education as a science, tend to make him the controlling factor in safeguarding public opinion from two serious obstacles to the popularizing of educational efficiency and the science which must bring it about.

The one is the confusion of loyalty to traditional forms of education with a conservatism that is sincerely opposing all amendments to constitutions and social solutions for economic and industrial problems. The other rests in a still more threatening menace to educational betterment through scientific research and experimentation—the danger of confusing it with other and more fundamental social readjustments that can be brought about only through economic revolution and industrial reform.

USEFUL USELESS EXPERIMENTING

By Owen L. Shinn
Professor of Applied Chemistry

An eminent mathematician some years ago who was asked what practical value his researches had, answered, "None, thank God." This was the attitude of a large number of scientific men for many years. If a problem had any practical value it was of a lower order and was considered beneath the notice of the experimenters in pure science. Indeed, the workers in one field of science looked with contempt upon the workers in other fields, which they were pleased to call "Bread and butter sciences," and the workers technologists. Not only was there a dividing line between different sciences, but even in the same science the distinction was drawn, and it has been but a comparatively few years that the distinction between pure and applied chemistry has been made less conspicuous—even now it has not been entirely abolished. On the other hand, the industrial workers looked upon the investigator who worked only for the purpose of ascertaining the truth and adding to the sum of human knowledge, as one who was not spending time to the best advantage, and the money expended upon apparatus and materials was considered wasted. This condition of affairs went on for years and the term research was restricted to work along the lines of pure science, if I may use the term, as done in the laboratories of colleges and universities. At the present time the term research is one of the most badly overworked words in the language and all kinds of work, other than the routine testing, in industrial plants, goes on under that name.

What I wish to show this afternoon is that much of the work done under the old heading of pure science has met with indus-

trial application, and that much of the modern industrial progress is due to taking advantage of the results of the experimenting of the abstract seekers after truth. In order to show this I must bring to your attention some concrete example, and therefore make this paper more or less disconnected. The technical application has in some cases been an afterthought by the experimenter, and in other cases the principle laid down by one has been developed by others.

Sir Humphrey Davy, in the year 1816, in experimenting with flame, found that upon holding a piece of wire gauze in a flame that the flame would not go through, and also that by holding a gauze over a gas supply the gas could be burned over the gauze without the gas underneath becoming ignited. This was an interesting experiment and gave rise to speculation as to the cause, but it was generally conceded that the cooling effect of the metal gave the striking result. Thus the experimenter and the philosopher had ample opportunity to solve a problem in pure science. To Davy, however, came a second thought. Numerous mine explosions had wrought great loss of life in the coal mines of England, due to ignition of the firedamp from the lamps of the miners. If a flame would not penetrate a wire gauze, why could not the flame of a lamp be enclosed within a wire net and thus prevent the ignition of the mine gas? Davy constructed such a lamp and placed it inside of a jar filled with a mixture of gas and air, and to his delight found the whole interior of the wire cage filled with flame, but the outside mixture was not ignited. As a result we have the Davy Safety Lamp, and that the results of the abstract experimenting were appreciated, was shown by the demonstration of the miners at the home and at the tomb of Davy some years ago.

A young man, Carl Auer, working in the laboratory of Bunsen, was making a study of the rare earths, paying particular attention to lanthanum, studying the preparation and properties of its compounds, methods of separation from other members of the group, etc. This group of chemical elements was as far removed from practical utility as anything that could be

imagined. The very name "Rare Earths" indicates that they occur in small quantities and in but few minerals and few localities. Many who have studied chemistry have never heard of the elements, Lanthanum, Cereum, Thorium and the other members of the group. Those who have come in contact with them know that their chemistry is of the most difficult kind. Yet here was a man making a study of those useless substances, devoting much time and energy to the work. Surely, according to the man of practical mind this energy might be used to better advantage. In the course of the experimentation some pieces of filter paper and some pieces of cloth were saturated with the solution of a lanthanum salt, and were allowed to dry. For some reason or other these were afterward heated in the colorless flame of the Bunsen burner. The result was striking —an intensely bright light resulted, and what was more surprising, the resulting ash retained its original physical form and could be handled. Here a new thought was suggested. Could this substance be gotten into a form which would enable it to be used for lighting rooms and buildings? Upon trial it was found that lanthanum compounds were unsuitable, as the resulting oxids would absorb moisture and slake, crumbling to a fine dust. Other members of this same group were then tried, and as a result we have the present commonly used Welsbach Light, which consists of the oxides of thorium and cereum. No one would have thought of experimenting with thorium and cereum with any utilitarian idea. They have been studied in the abstract with the sole intention of adding to the sum of human knowledge without any thought of usefulness, yet as the result of this useless experimentation we have the great blessing of brilliant and satisfactory gas illumination.

It is a far cry from noting the action of a heated platinum wire upon a mixture of air and an inflammable gas, contained in a beaker glass, to the manufacture of sulphuric acid; yet the early experiments along the one line have made the other possible. In the year 1817 Davy found that if a freshly heated platinum wire was introduced into an atmosphere consisting of

air mixed with some carbon monoxide methane, cyanogen, or other inflammable gas, that the oxygen of the air and the gas would combine and the wire would glow. The temperature of the wire at the outstart was far below the temperature of the ignition point of the gas. Later, in 1820, Edmund Davy found that when precipitated platinum was moistened with alcohol, oxidation took place. In 1823 Doebreiner studied these actions and found that if a jet of hydrogen or other inflammable gas be caused to impinge upon finely divided platinum, the gas would be ignited without any heat being used. This experiment gave rise to a toy known as Doebreiner's Lamp, but was without any application. Since that time innumerable gas-lighting devices have been patented and used.

In 1836 Berzelius published the results of investigations which he made upon the decomposition of hydrogen peroxide by platinum black; the change of starch into sugar; the fermentation of sugar, and gave the name to the agent which caused the change a catalytic agent, and the action catalysis. He gave the same explanation to all of these changes, the platinum black producing the first, the diastase the second and yeast the third. This claim has been proven to be incorrect, and that it is only in the first case that true catalysis takes place, the other changes are brought about by different causes. Various other substances were studied as to their action upon spongy platinum, and it was found that combinations and decompositions resulted without the platinum being affected. Many other experimenters then investigated the question as to whether platinum was the only substance which would act in this way, and other substances were found to react, although not to the same extent as platinum.

For many years this problem has been before the minds of chemists. Why is it that a substance like spongy platinum will cause two gases, on neither of which it has any action, to combine, and at the end of the reaction it will be just the same as it was at the outstart. The study of catalytic agents has led to many valuable commercial processes, notably the manu-

facture of sulphuric acid. The old method of making sulphuric acid consists in burning brimstone or some sulphide, passing the resulting gas into large rooms made of lead, where it is brought in contact with nitric acid and water. These chambers are expensive to construct; very heavy, they take up much floor space, need frequent repairing, and the nitric acid is an expensive substance and an elaborate plant must be constructed for its recovery. In addition the resulting acid is not concentrated, and expensive platinum concentrating fans must be used.

The practical experimenter heard of this catalytic action and the thought came, why can we not cause the product of burning sulphur to combine with the extra oxygen required to make sulphuric acid through the agency of spongy platinum? Sulphur dioxide is the end of the reaction in burning of sulphur in the air. This started a new line of investigation, and it was soon found that as far as the chemistry was concerned, it would work. It required a number of years to overcome the mechanical and engineering difficulties and to learn to control the method; but now a very large percentage of the oil of vitriol of commerce is manufactured by the direct combination of sulphur dioxide and the oxygen of the air through the agency of platinum black, which remains in the apparatus unchanged.

Not only were the experiments of those studying catalytic action taken advantage of here, but also the results of the experimenters along other lines. For many years it was known that the combination would take place, but only a small percentage of the gases would react. Certain experimenters, studying the action of temperature upon gases, found that reactions took place better under definite conditions and that too high a temperature would bring about decomposition of compounds which would be formed at but a slightly lower temperature. The study was also carried on into solutions. Chemical equilibrium was studied; that is, to determine under various conditions how nearly complete a reaction would

progress, and from this determined under what condition the reaction would reach its maximum. The studies of chemical equilibrium and the gas laws are some of the most abstract that are carried out; but it was just such studies that served to solve the problem in the manufacture of sulphuric acid. In this particular case it was temperature. Years of technical experimenting, numerous plants erected, but all characterized as failures, thus much money was lost and in fact wasted. The problem was solved by "pure science"—by a scientific study in the realm of physical chemistry, and what was formerly looked upon as a dream is now a reality.

The manufacture of sulphuric acid is only one of many practical applications which has been made of the action of catalyzers. Let us glance for a moment at one of the most recent developments.

We know that some of the fats are solid, such as tallow, lard, etc., and some are liquid, such as cottonseed oil, olive oil and the fish oils. The fats have two large uses—foods and soap stock. Many of the liquid fats are of little value. They are used in making some kinds of soap, as lubricants, and have some other use, but they are produced in greater quantities than the higher grade fats. Chemically the soft fats belong to what are known as unsaturated compounds, and the difference between a soft fat, say, olein, and a hard fat like stearine, is merely that it does not contain as much hydrogen as the latter. Now hydrogen and olein will not combine directly, but if they are brought together at a favorable temperature in presence of some catalytic agent, their combination takes place and we have high grade soap stock prepared from what was of little or no value. We have a high grade lard substitute produced from a fish oil which, before treatment, was not edible, was in fact revolting. Much, in fact most, of the experimenting along these lines was done with the utilitarian idea in view, but these experiments were suggested by the seemingly valueless experiments made in the early part of the nineteenth century.

In seeking for a method for the production of hydrogen on a

large scale, a great many methods were tried, but the one that has proven to be satisfactory is the old lecture table experiment, passing an electric current through water containing some electrolyte, a by-product being oxygen. This latter gas is of value now, particularly as it is used in a piece of apparatus devised by one of the early professors of chemistry in this University, Robert Hare. It had long been known that if a combustible body be burned and a jet of air blown into the flame, that the heating would be concentrated and that a high temperature could be obtained at the point desired. Hare, experimenting with gases, conceived the idea of using this principle with hydrogen and oxygen, and produced the compound blowpipe. This has been used in a small way for years, but it has only been since the introduction of the oxyacetylene flame that this has reached large industrial application. Today we see huge sheets of steel being cut into any desired shape by the application of this toy, if you please, of Robert Hare.

In connection with the hydrogenation of oils, another class of experimenting is suggested. It is enough for the average person to know the percentage composition of a compound, but if you will look over the files of any of the journals devoted to chemistry, you will find that a vast amount of work has been done in proving in what way the atoms are arranged in the molecule; in what way the carbon, oxygen and hydrogen are linked together.

On looking over the mass of literature devoted to this subject, one is apt to say, "What is the use of all this?" But by means of this study it has been shown that the way in which the elements are combined will influence the properties as much as the percentage composition, and in fact even more. Were it not for the study of the composition of organic compounds, and methods of determining the internal structure of compounds that were worked out by the investigators in pure science, the chemistry of the coal tar dyes would not have advanced to the place it now occupies, and the synthesis of the large number of dyes would not be possible.

While it is not practical to take up the discussion of the methods of manufacture of the coal tar dyes, we should mention some of them. Indigo, which has been until recently derived entirely from the indigo plant, is now largely made synthetically. While the actual method used has been developed by industrial research, the methods of preparing the intermediate products have been suggested by the results of researches in pure organic chemistry, involving the molecular structure. The same thing is true of other dyes—the azo-dyes, rosaniline derivatives and many others. Frequently we find more than one dye with the same percentage composition, but with greatly different properties. The methods of determining the molecular arrangement will explain what is the difference and tell us what raw materials are needed in the production of each.

Two German investigators, studying the composition of a certain class of organic bodies, found that it was possible to prepare alizerine, the basis of turkey red (one of the most valuable dyes), by synthetic methods. They followed up their experiments, and today, madder, the former source of turkey red, and which was grown in enormous quantities, has been almost driven from the market, and we have the dye produced in the laboratory by the method of men who were simply seeking for knowledge.

The mere mention of an organic synthesis calls to mind the work of Wöhler, who, in 1828, was experimenting with a series of inorganic compounds and converted one, ammonium cyanate, into an organic derivative, urea. This synthesis itself was of little or no value from an industrial standpoint, but it was the first time that an organic compound had been prepared without "vital force," and it opened the way to the enormous field of synthetic organic chemistry which has been so fruitful of results.

This shows that the experimenting of the abstract scientific investigator may be commercially valuable in one of two ways: either by the direct adaptation of the experiment itself, making use of the product or making the method commercially im-

portant, or the second way, to suggest a method of solving a problem.

Cavendish, in the latter part of the eighteenth century, found that there was a residue when he tried to absorb the nitrogen of air by magnesium and by other methods. Try as he would all of the gas could not be absorbed. He did not recognize the true cause of this result, but attributed it to imperfect apparatus. Over a century later Rayleigh and Ramsey, studying nitrogen, found that the gas made from the atmosphere and that made by chemical means did not have the same specific gravity. The search for an explanation of this phenomenon resulted in the discovery of the new elements: argon, helium, krypton, neon and the others. Now elementary nitrogen is characterized by its inertness, and it is only with the greatest difficulty that it is made to combine with other elements, but with great care combinations can be affected. Not so with these other atmospheric gases; they will not combine with anything. Now surely, one would say, here is something that has no value. The way that they are made would make it impractical. Air is liquefied, and the nitrogen and oxygen separated from the argon and neon by the differences in boiling point. Nevertheless, the information obtained in studying this gas, both as to its properties and method of preparation has been put to practical use, and today we have the most efficient incandescent lamp, consisting of a tungsten filament enclosed in an atmosphere of neon. To fully appreciate this we will just recall the well-known structure of an incandescent lamp. It consists of a filament which is heated to incandescence by its resistance to the current. If this heating takes place in air the filament would be oxidized and destroyed. The old type lamps have the air removed by pump, but the lamps gradually deteriorate, largely by volatilization of the substance which forms the filament. If an atmosphere could be obtained which would have no action upon the filament, this volatilization would be reduced. This fact was the result obtained from experiments in Physical Chemistry. Nitrogen was tried and found to be a

great improvement. Now neon is used and, as could be predicted from its properties, or lack of them, has proven to be much more efficient and the life of the lamp has been increased many fold. Thus we have practical application of two kinds of abstract experiments, one the study of gases, the other on the volatilization of metals, neither of which has any practical aim and neither of which gave any practical promise at the time of their completion.

The preparation of argon and neon is not the only application that is made of liquid air. This today is one of the chief sources of pure oxygen which is so much used in high temperature work, as well as for medical uses and in some metallurgical operations. It is also the only source of pure nitrogen which is so largely used in the preparation of artificial fertilizers, such as cyanamid, and in the synthesis of ammonia. Liquid air is also used for the production of low temperatures. Now why was this first made? First, to see at what temperature air would liquefy; second, to see whether the air would liquefy as air or as its components, but more particularly it appeared as part of the work in attempting to reach very low temperatures approaching the absolute zero. None of these questions had any practical value. None of them was suggested by any industrial problem, and for some time after it was made liquid, air was an interesting scientific plaything, but these uses have been developed.

While speaking of air, another adaptation of an old experiment comes to mind. In 1775 Priestley found what he called a new kind of air by the passage of an electric spark through ordinary air. Cavendish, in 1789, repeated this, and described the new gas as nitrous acid. This action was studied by various experimenters during the last century. At the present time we have, particularly in Sweden, large factories where nitric acid, or nitrates, are manufactured from the nitrogen and oxygen of the air by passing the air through the electric arc with proper precaution as to temperature, etc.

Let us look at the industry of bleaching as it is now practiced,

and we find that two compounds are used for bleaching purposes, chloride of lime and hydrogen peroxide. How did they come to be used? Chlorine, a gas, was discovered by Scheele in 1774. In studying its properties it was found to have that of bleaching colored substances. It was first tried in a practical way in 1785 by Berthollet; later, in 1789, it was used in aqueous solution. Still later, 1796, it was found that the gas could be absorbed by an alkali and subsequently released by an acid, and bleaching lime was the result. The subsequent experimenting had the practical in mind, but it was all brought about by Scheele in his examination of the new gas which he had made from manganese ore and muriatic acid. Hydrogen peroxide has been known since 1818, and its bleaching power was observed when it was first made; yet it was only used in practice to bleach hair and occasionally silk. The reason for this was its high cost of production. It is now quite commonly used for finer bleaching, as it can be obtained at a low price. The reason of its lower price is that engineers have adapted some old experiments to practical conditions. Years ago metallic sodium was prepared by electrolysis. It was known for a number of years but not used. Then Wöhler discovered aluminium, and the value of this metal was soon recognized, and as sodium was used in its preparation, it was studied. Soon the electrolytic method for the production of aluminum drove the sodium method out, and sodium became a metal that was only to be seen in the college laboratories. In studying sodium, air was passed over it while in the molten condition, and a compound found to be the peroxide was obtained. This compound, when treated with water and dilute acids, gives a solution containing hydrogen peroxide, which can be used for bleaching. Now we have two sets of experiments to thank for this: first, Davy's electrolysis, and second, the scientific study of the metal, one result being the discovery of the peroxide, again showing the intimate association between pure and applied chemistry.

Look at the results which have been obtained from the study of the electric current upon solution. At first water was found

to decompose into its components, then aqueous solutions were studied, and it was found that many metals could be deposited from such solutions. From this has developed not only the art of electroplating, but also methods of obtaining metals from their ores by getting into solution and then electrolyzing. Other metals are purified in this same manner. Davy, in 1807, acted upon fused compounds with the current; today we have electro metallurgy developed from this idea as well as the ordinary method of producing caustic soda (lye) and chlorine (for bleach).

As a matter of fact, practically all of the developments along the lines of industrial chemistry have been adaptations of experiments made in the realm of the abstract science.

What is true of chemistry is even more strikingly shown in physics, and but few examples need be mentioned. What could be more useless than the study of the passage of the electric current under high tension through vacuum, yet it gave rise to the Crook's Tube. But what could be more of a toy than a Crook's Tube, passing the arc through a vacuum in which was placed certain minerals and noting the display of the peculiar colors and rays; yet it was by playing, if you please, with such toys that Roentgen discovered the ray which bears his name. What could be more practical than the use of these rays in medical and surgical diagnosis, or of a still more commonplace use in searching packages of cotton and fibre for hidden metal, contraband in present war, or by custom inspectors searching for smuggling, or the testing for spurious gems?

We are so accustomed to the use of electricity that we take it for granted and think of it as one of the most practical of things; we have to go back but a few years to find this form of energy used only in the scientific laboratory. In a book that is not so ancient as to date, only old as scientific books are rated, we find the description of a small toy which contained revolving wheels, the movement being caused by the electric current. This description is accompanied by the statement that "while the toy can be made to work, it is not at all likely that any

practical use can be made of the idea." Here you see that the practical value of the discovery was recognized, but it was not thought that its utilization was possible. Physics is an abstract science and the problems solved, as a rule, seem to have no bearing upon the industrial problems of the age; yet how are the problems of engineers solved except by taking the results obtained by the physicist and the methods of the still more abstract mathematician and applying them to the practical problem.

We may take the other sciences: Botany, Zoology, Bacteriology and the various branches of Medical Science, and they have developed the arts of Horticulture, Agriculture, Animal Husbandry, Sanitation, Curative and Preventative Medicine.

My claim then is that no experimentation is useless. As one trained in pure science, I urge the claim that anything that will add to the sum of knowledge; that will help uncover the secrets of nature, is of value and should be encouraged. But also as one who is interested in the manufacturing and industrial problems, I can see that no line of experimentation can be said to have no practical importance. Not any of the examples cited this afternoon appeared to have any practical value at the time they were made, but application was made of them later.

To those interested in experimenting I would say continue. Your work is sure to be of value in one way, and who knows perhaps in a practical way that cannot be thought of at this time.

I would, on the other hand, warn those who look upon applied science as belonging to a lower order, that the results obtained from even their most abstract researches may prove the means of solving some practical industrial problem and thus shattering their idol.

THE HISTORY AND PROGRESS OF MEDICAL EDUCATION IN THE UNITED STATES

By William Pepper

Dean of the School of Medicine

The year 1915, now drawing to a close, is the one hundred and fiftieth anniversary of the founding of the Medical School of the University of Pennsylvania, the first medical school organized in the American Colonies. Therefore, in speaking to you of the History and Progress of Medical Education in the United States, I will refer frequently to our own school, for one could not write an account of the history and progress of this school without at the same time telling the story of medicine in this country.

Previous to 1765, the year in which the College and Academy of Philadelphia, now the University of Pennsylvania, instituted the medical school, the training of physicians was, in this country, a rather primitive affair. Young men served as apprentices to practitioners of medicine for a year or more and then opened up an office of their own. Those wishing a real training went abroad, chiefly to Edinborough, and returned with a medical degree, while their less ambitious and less fortunate colleagues, who remained at home, practiced their chosen profession unadorned with the degree of Doctor of Medicine.

Two young Philadelphia students in the celebrated medical school of the University of Edinborough discussed the need for a medical school in this country, and made plans which subsequently were carried out most successfully. These young men were John Morgan, graduated from the College and Academy of Philadelphia in 1757 with the degree of A.B., and William Shippen, Jr., graduated in 1754 from the College of

New Jersey, now Princeton University. Morgan returned to Philadelphia and proposed the plan to the Trustees of his Alma Mater, and they approving, he was elected Professor of the Theory and Practice of Physick on May 3, 1765. Shippen, four months later, was elected Professor of Anatomy and Surgery. Thus the first medical school was instituted as an integral part of a College, or, as it was called a few years later, a University. Other colleges soon followed suit. King's College, now Columbia, three years later in 1768; Harvard College in 1783; Dartmouth College in 1798. Thus the four medical schools, organized before 1800, were actual departments of colleges and not separate independent institutions. Later came the swarm of independent, proprietary medical colleges, only in very recent years beginning to disappear as many think they all will eventually. Many a blot on the pages of the history of medical education in this country would have been avoided had Morgan and Shippen's plan of instituting medical schools as departments of colleges been thereafter followed.

It is most interesting in these days of high, state and school medical requirements to note the educational preparation of Morgan and Shippen. In the Preface to Morgan's "Discourse upon the Institution of Medical Schools in America," delivered by him at the College Commencement in the spring of 1765, he says, "It is now more than fifteen years since I began the study of medicine in this city, which I have prosecuted ever since without interruption. During the first six years I served an apprenticeship with Dr. John Redman, who then did, and still continues to enjoy a most justly acquired reputation in this city for superior knowledge and extensive practice in physic. At the same time I had an opportunity of being acquainted with the practice of other eminent physicians in this place, particularly of all the physicians to the hospital, whose prescriptions I put up there above the space of one year. The term of my apprenticeship being expired, I devoted myself for four years to a military life, principally with a view to become

more skilful in my profession; being engaged the whole of that time in a very extensive practice in the army, among diseases of every kind. The last five years I have spent in Europe, under the most celebrated masters in every branch of medicine, and spared no labor or expense to store my mind with an extensive acquaintance in every science that related in any way to the duty of a physician, having in that time expended, in this pursuit, a sum of money of which the very interest would prove no contemptible income. With what success this has been done others are to judge, and not myself.

"Thus I have arrived at the middle age of life in endeavoring to lay up treasures of useful knowledge before I commence a settled practice, and yet I have been told that to expect to gain a support here by my medical advice and attendance only, without becoming a surgeon and apothecary too in order to help out, is to forget that I was born an American. I am very happy that my country has always discovered too much of a laudable ambition to excel in every branch of polite literature, and has taken too much pleasure in the reputation of her sons to fill me with apprehension that an education in physic will be accounted too expensive, such as I have thought necessary to qualify myself for practicing my profession with ease of mind to myself and with benefit to the community.

"As far as I can learn, everybody approves of my plan for instituting medical schools, and I have the honor of being appointed a public professor for teaching physic in the college here. Can any man, the least acquainted with the nature of that arduous task, once imagine it possible for me to acquit myself in that station, in an honorable or useful manner, and yet be engaged in one continued round of practice in surgery and pharmacy, as well as physic?"

William Shippen, Jr., as already stated, was also a college graduate, holding the degree of Bachelor of Arts from Princeton; he was the son of a physician, William Shippen, Sr., and could have been content with the apprenticeship which he served in his father's office and then have started in to practice medi-

cine without further training had he so desired; but he went abroad and studied under those great masters, John and William Hunter, in London. He then entered, and later graduated, in 1761, from the University of Edinborough, following which he traveled in France. Thus he spent, following his graduation from Princeton, eight years preparing to practice his profession.

The education, therefore, of these two young men, was most thorough and complete, and showed in the excellence of their subsequent teaching.

Let us see what preparation was required of the students who wished to enter this first school.

In outlining the plans for the infant medical school John Morgan, in his Discourse, has said, "Medicine is a science as important in its object as it is difficult in the acquisition. It is very extensive in its researches and presupposes the knowledge of many other sciences," and also he said, "It will not be improper, however, to observe here, that young men ought to come well prepared for the study of medicine by having their minds enriched with all the aids they can receive from the languages and the liberal arts. Latin and Greek are very necessary to be known by a Physician," and, "The French Language has prevailed much in Europe. The advantages which we may reap from the writings of many eminent men, and of many learned societies, which are published in French, make the knowledge of this language very valuable also to a physician. An acquaintance with mathematics and natural Philosophy we cannot dispense with, since we can go but small lengths in natural or medical inquiries without their assistance."

Two years later, in 1767, when the young school was fairly started, the Trustees of the College decided to grant to approved candidates degrees in Medicine and announced that, "For a Bachelor's Degree in Physics, it was required that such students as have not taken a Degree in any College shall before admission satisfy the Trustees and Professors of the College concerning their knowledge in the Latin tongue, and in such branches of

Mathematics, Natural and Experimental Philosophy as shall be judged requisite to a medical education." And also they announced, "For the further advantage of medical students, a course of lectures will be given by the Professor of Natural and Experimental Philosophy each winter in the College, where there is an elegant and compleat (*sic*) apparatus provided for that purpose, and where medicial students may have an opportunity of completing themselves in the Languages and any parts of the Mathematics at their leisure hours."

These lectures upon Natural and Experimental Philosophy were delivered by our first Provost, William Smith. Dr. Smith's announcement read as follows:

"COLLEGE OF PHILADELPHIA, Dec. 17, 1767.

"At the request of the Medical Trustees and Professors, the subscriber having last winter opened a course of Lectures on Natural and Experimental Philosophy, for the benefit of the Medical Students, which he hath engaged to continue this winter on an extensive plan, notice is hereby given that on Monday, the 28th inst., at 12 oc., it is proposed to deliver the Introductory Lecture at the College. As these lectures are instituted and given gratis, with the view to encourage the medical schools lately opened, and to extend the usefulness and reputation of the College, any gentlemen who have formerly been educated in this Seminary, and are desirious of renewing their acquaintance with the above mentioned branches of knowledge, will be welcome to attend the course.

"To the standing use of the large apparatus belonging to the College, Mr. Kinnersley has engaged to add the use of his electrical apparatus which is fixed there, and to deliver the lectures on electricity himself, as well as to give his occasional assistance in other branches; so that with these advantages and the many years' experience of the subscriber in conducting lectures of this kind, it is hoped the present course will answer the design of its institution and do credit to the Seminary.

"W. SMITH.

"N. B. An evening lecture in some branches of Mathematics, preparatory to the Philosophical course, is opened at the College."

In 1792 Benjamin Rush delivered an address "On the Education Proper to Qualify a Young Man for the Study of Medicine." In it he recommends Reading, Writing and Arithmetic, Natural History and Geography, French, German

and possibly Italian, Natural Philosophy and Metaphysics, Attendance on a course of lectures upon the evidences, doctrines and precepts of Christianity, with the idea that this would be useful later in the treatment of insanities. History, Government, Poetry, Drawing and the principles of English Grammar. The study of Latin and Greek he rather deprecated.

Alas, these very proper standards of preparation for the study of medicine were not long maintained, and soon anyone able merely to read and write could choose between the medical schools throughout the land, and enter where fancy dictated and expect to be equally welcomed as a student with or without any preliminary education.

The University of Pennsylvania Medical School maintained, until 1811, its high standard of preliminary education demanded of those entering the school. The schools founded after the University did not require so much preliminary education of their students, and because of the competition the University of Pennsylvania, I regret to say, abolished the entrance requirements at that time. Benjamin Franklin in his Autobiography, on mentioning one of several mistakes he had made in his life, says, "And this I therefore reckon one of the first errata of my life," so this step of the University of Pennsylvania, in 1811, can be reckoned one of the first errata in the history of the Medical School.

In the early years after a student was admitted to the medical school it was required that "Each student shall attend at least one course of lectures in Anatomy, Materia Medica, Chemistry, the Theory and Practice of Physic, and one course of Clynical Lectures, and shall attend the Practice of the Pennsylvania Hospital for one year," and, "It is further required that each student, previous to the Bachelor's Degree, shall have served a sufficient apprenticeship to some reputable Practitioner in Physic, and be able to make it appear that he has a general knowledge in Pharmacology." We see in these regulations two most important provisions, namely, the attendance on the Practice of the Pennsylvania Hospital, and in addition the con-

tinuance of the scheme of apprenticeships to Practitioners of Physic.

The year the medical school was founded there were five physicians on the Board of Trustees of the College and Academy of Philadelphia—Thomas Bond, Phineas Bond, Thomas Cadwallader, William Shippen, Sr., and John Redman. Of this number three were connected with the Pennsylvania Hospital as visiting physicians, and thus the first medical school in this country was able to start in close harmony and practical affiliation with a hospital.

The close relationship between the College and the Pennsylvania Hospital is also made clear when we learn that before 1779 there had been at least eleven Trustees who also served as Managers of the Pennsylvania Hospital. Among these was Benjamin Franklin, who did more than any other man to create and to make successful these two institutions. A most interesting result of this affiliation was the course of Clinical Lectures delivered in the Hospital by Dr. Thomas Bond to the medical students of the College. Dr. Thomas Bond originated the idea of the Pennsylvania Hospital and Benjamin Franklin brought it into being. Dr. Bond not only served as a physician to the Hospital, but also as a Manager, and because he was a Trustee of the College and Academy of Philadelphia when the Medical School was instituted, was not elected a Professor. For never has anyone held at the University of Pennsylvania both positions at the same time. But Dr. Bond, although a Trustee, offered to give "A Course of Clynical Lectures to be delivered in the Pennsylvania Hospital wherein the Treatment of both Acute and Chronic Diseases will be Exemplified in the cases of a great number of Patients," and began these lectures in 1766. In the early days the students actually were taught at the bedside in the Pennsylvania Hospital, accompanying the Physician as he made his rounds of the wards. Soon, however, the increasing size of the classes made this difficult and the practice was later abolished. Dr. Bond seems to have continued his clinical lectures up to the time of his death in 1784.

Then for nearly a century clinical lectures, such as Bond's, and bedside instruction, disappeared, and not until Medical Schools built their own hospitals was it possible to again give a student proper clinical instruction. The University of Pennsylvania was again a leader, and in 1873 erected the first hospital in connection with a Medical School.

In the early days the University of Pennsylvania, as well as other institutions, gave two degrees in Medicine,—the Bachelor of Medicine and the Doctor of Medicine. Thus in 1768 the first class of ten graduated from the Medical Department of the College and Academy of Philadelphia with the degree of M.B. In order to obtain the higher degree, three years had to elapse and then the candidate had to write a thesis in Latin and be prepared to publicly defend it. In 1771 but four of the first ten graduates returned and received the degree of M.D. This plan was not followed exactly at King's College, or Columbia, as it is now called. At the Medicial School there, founded three years later than the School in Philadelphia, the degree of M.B. was first given in 1769, one year later than it had been given here, but the candidates for the M.D. did not have to wait three years; after only one year this higher degree was given. Thus in 1770 one man received in New York his M.D., which was first given here in 1771. At Harvard, for a number of years, both these degrees were also conferred, but eventually the custom was generally abolished and for a century only the M.D. has been conferred in this country.

The number of medical students did not increase for some years. Thus fourteen was the largest class graduated from the University of Pennsylvania before 1800. In 1810 sixty-five graduated, in 1819 one hundred and two, in 1831 one hundred and fifty-one, in 1841 one hundred and sixty-six, in 1849 one hundred and ninety, which was the largest class for a number of years.

The number of medical schools in this country also increased slowly at first. Thus between 1810 and 1840 twenty-six schools were instituted, and among these were some of the

proprietary schools or schools unconnected with any college or university. The first one of these was organized in 1807 in Baltimore. These proprietary schools sprang up, to quote the words of the Carnegie Report, "Wherever and whenever the roster of untitled practitioners rose above half a dozen, a medical school was likely at any moment to be precipitated. Nothing was really essential but professors. The laboratory is comparatively recent; and Thomas Bond's wise words about clinical teaching were long since out of print. Little or no investment was therefore involved. A hall could be cheaply rented and rude benches were inexpensive. Janitor service was unknown and is even now relatively rare. Occasional dissection in time supplied a skeleton in whole or part, and a box of odd bones. Other equipment there was practically none. The teaching was, except for a little anatomy, wholly didactic."

These proprietary schools so easily founded and so cheaply conducted were not all of course run for the money which they directly returned to the professors who were likewise the owners or stockholders. The dividends were not always from the fees of the students, but came in the form of increased office and consultation practice, brought about by the greater notoriety and publicity the learned professors obtained through their connection with the local medical school. Chairs in such schools had a price, and often to become a professor the would-be teacher had to buy stock in the school.

Even the University Medical Schools were not much better than the average proprietary schools. The seeds for this commercial taint were, unfortunately, sown at the organization of the Medical School at the College and Academy of Philadelphia. The college did not collect the tuition fees from the students and conduct the financial affairs of the Medical School. Instead the students paid the professors individually. One of the provisions of the rules prepared in 1767 by the Trustees for the conduct of the Medical School, part of which have already been quoted, reads as follows, "Fees to the Pro-

fessors. No Professor to take more than six Pistoles for a single course in any of the above Branches, and after two courses any student may attend as many more as he pleases gratis." A year later further rules were made as follows: "Every Student, on taking the Degree of Bachelor of Physic, shall pay not less than One Guinea to each Professor he has studied under in the College from the Time of his entering the Medical Classes and likewise the usual Fees for the Seal to his Diploma, and for the Increase of the Library."

The Trustees did not pay the salaries of the professors in the Medical School, but allowed them to depend for their remuneration upon the students they attracted to their courses. Perhaps this was an unfortunate step to have taken, perhaps it stimulated these early teachers to greater efforts and led to the great success that crowned the teaching in the Medical School. For years the only revenue received by the University from the Medical School came from the rent of the building used by the Medical School. In later years the Medical Faculty deducted from the fees received from students the maximum amount agreed upon for salaries and set aside a sufficient sum for expenses and equipment and the remainder was handed over to the Trustees. A professor's salary, therefore, depended largely on his own efforts. The more popular the teacher, the larger his classes. A student in one school might attend a course given in another school if he felt that in that way he would learn more about a certain subject.

In 1835 Dr. John Redman Coxe published a pamphlet, entitled "An Appeal to the Public and Especially to the Medical Public, from the Proceedings of the Trustees of the University of Pennsylvania, Vacating the Chair of Materia Medica and Pharmacy." It seems that the Trustees wished Dr. Coxe to resign his professorship which he declined to do, and so his chair was declared vacant and naturally Dr. Coxe felt deeply offended and hurt. During the controversy Dr. Coxe wrote to a committee of the Board of Trustees a letter, in which he said, "In complying with the wishes of the committee to obtain the

average value of my professorship for five years, I have arranged, in a tabular form, the outlines from which that average is deduced, and which, I believe, comprehends the intention of the resolution forwarded to me, as nearly as is in my power. With respect to the average charges of my chair, they are blended in the general charges of the Faculty in one common account, as kept by the Dean, embracing rent, fuel, and various items, together with a salary to the Dean of three hundred dollars—and of all which, my chair bears one-sixth proportion. These expenses are generally liquidated by the matriculation and graduation fees to each professor. When insufficient, each chair pays its proportion of the deficiency."

The table showed that Dr. Coxe received on an average $5,432 during the five years between 1827 and 1832. He charged each student $20 for his course of lectures.

This system continued in this country until in 1871 Harvard University undertook to collect the fees and to administer the finances of the medical department by means of an annual budget. At Yale this took place in 1880 and at the University of Pennsylvania in 1896. As Franklin would have said, thus was corrected that great erratum.

It was to the University of Pennsylvania that, in 1878, the first full permanent endowment of a medical professorship in this country was given in memory of Dr. John Rhea Barton, a distinguished surgeon.

The Medical Schools of the country had no endowment and, therefore, lived upon the fees of the students and were, in consequence, commercialized. Before the necessity for laboratory work became generally apparent student fees were sufficient, but as laboratories were built and equipped expenses mounted so rapidly that classes of ordinary size failed to produce enough revenue. As a result a school had either to admit larger classes than could be properly handled or omit the necessary equipment for proper teaching. At present this situation is well recognized in the first-class schools. A good medical school is not a money-making concern. In fact it costs such a

school two or three hundred dollars to teach each student over and above the receipts from tuition fees. Endowment is the crying need of the modern medical school. It is the solution of most of the problems in medical education today.

An idea may be gained of the rate of production of medical schools when it is learned that in the United States and Canada in little over a century more than 450 medical schools were founded. The State of New York produced 43 of these, Missouri 42, Illinois 39, Indiana 27, and Pennsylvania 20. Many of these schools were but diploma mills, as they were called, and some of the worst of these were in Philadelphia. Much confusion arose through the similarity in name of some of these ephemeral schools to that of the University of Pennsylvania. At a distance a stranger could not easily have differentiated between the Pennsylvania Medical College, The Philadelphia College of Medicine and Surgery, The Pennsylvania Medical University, The Philadelphia University of Medicine and Surgery, The American University of Pennsylvania, and The University of Pennsylvania.

At the beginning of the present century medical education was in a sad state. There were too many schools and many of the schools were utterly wretched institutions, and good schools were overrun with students and little or no laboratory instruction was given; educational requirements for entrance were very low or lacking altogether. But wonderful has been the improvement in the last few years, and the good work still goes on and it is the hope and expectation of most of those interested in medical education that in a few years conditions in this country will be in a very satisfactory state. A number of agencies have brought about this marked improvement which began sporadically here and there, but which now is general and steady and sweeping on irresistibly.

In 1846 the American Medical Association was founded, and pledged itself to improve medical education in the United States. The Association urged "That young men received as students of medicine should have acquired a suitable pre-

liminary education," and "That a uniform elevated standard of requirements for the degree of M.D. should be adopted by all medical schools in the United States." But the Association really did not seriously concern itself with medical education as it promised until recent years, but it has made up for the years of inactivity by making great progress during the last fourteen years.

Following this recommendation, in 1846, of the American Medical Association, the University of Pennsylvania lengthened her courses from four to five, and then to six months of study, "only to find that, in spite of their specious assurances, not a single one of her rivals emulated her courage; so that after six discouraging years of steadily diminishing classes she sorrowfully abandoned her advanced position."

Even the Medical Faculty of Harvard University, in 1849, sent to the American Medical Association a formal defence and advocacy of the four months' course of instruction in medical schools. The Association felt it necessary to appoint a special committee to prepare and publish a defence of the proposed six months' lecture term. Morgan and Shippen, unfortunately for American medicine, instituted in 1765 a course of but four months' duration, and a century passed before the schools of the country generally adopted a compulsory course of more than the original four months. This was another erratum, uncorrected for many years.

It seems to us, looking back, to have been almost criminal for the schools of the country for years to have attempted to educate physicians by merely giving a course of four months' duration, and the following year repeating, during an equally brief course, exactly the same lectures. Between these two courses of four months each, many of the students returned to their homes and filled in the eight months' interval with work on the farm. Undoubtedly, many of them should have remained there in the first place. Imagine the possibility of teaching an uneducated student the Practice of Medicine in eight months or in about 230 to 250 days' actual instruction.

Those of us who today are teaching medicine find it difficult enough in thirty-two months at our disposal, and with students, all of whom have had some college training before entering the Medical School.

Another amibitous attempt was made in 1865, by the University of Pennsylvania, to improve local conditions by the organization of the Auxiliary Faculty of Medicine; the original faculty was a notable one. It consisted of Dr. Harrison Allen, Professor of Zoology and Comparative Anatomy; Dr. H. C. Wood, Professor of Botany; Dr. F. V. Hayden, Professor of Geology and Mineralogy; Dr. Henry Hartshorne, Professor of Hygiene, and Dr. John J. Reese, Professor of Medical Jurisprudence. The course was an elective one and the lectures were given in April, May and June following the regular medical course in December, January, Februrary and March. This brought the course up to nearly eight months for those who elected this work. Gradually the duties of the Auxiliary Faculty became unnecessary by the increase of the regular courses of from two to three and then to four years, and in a lengthening of the school year, and by the inclusion in the regular courses of these subjects or their requirement for entrance. Thus the reason for which the Auxiliary Faculty was formed disappeared and this faculty went out of existence.

At the University of Pennsylvania the two-year course was raised to a compulsory three years for the class entering in 1877, and later the course was made four years for the class entering in 1893. Harvard University, in 1871, has made the advance of from two to three years, and in 1892 to four years. Thus deserving great credit for these important moves.

The opening of the Johns Hopkins Medical School, in 1895, added a great stimulus to progress in medical education in the United States. Founded with an ample endowment, a large student body was not a necessity. The preliminary educational requirement was for entrance to the school a college degree. Despite this high standard the classes already number on an average 90, and this figure has recently been set as a

limit beyond which the school refuses to admit any further students.

In the best schools of the country improvements were being made from time to time, and other good schools would imitate these leaders, and medical education in this way gradually progressed amongst such schools; but, unfortunately, poor schools were springing up and many of these were actually growing worse from year to year. General improvement was sorely needed when the American Medical Association took up the Herculean task of cleaning the Augean medical stables in 1900. In that year the *Journal of the American Medical Association* began compiling statistics, and in 1901 published the results of its investigations and has continued to do so once a year ever since. These reports on the condition of medical education in the United States led to the appointment, in 1904, of a committee, entitled the Council on Medical Education of the American Medical Association. In 1905 the council called together a conference for the purpose of discussing means of elevating the standards of medical education. These annual presentations of educational statistics in the *Journal* and the yearly conferences have done an enormous amount of good; much more undoubtedly than has been brought about by any other means. In 1907 the council prepared a classification of the medical schools of the country and rated them as belonging to Classes A, B or C. Subsequent classifications were published in 1910 and 1913, and revisions of this third classification have appeared since that time.

State Licensing Boards throughout the United States have done much to place medical education on a higher level. Some states require a certain amount of pre-medical training, others do not. At present ten states demand of those wishing to practice within their limits, two years of work in a college of arts and sciences completed before the candidate has studied medicine. Eighteen states require one year of college work. Two states, Pennsylvania and New York, require that all candidates for license shall have spent a year as an interne in

an approved hospital. Thirty-four states will now, as a rule, refuse to license a graduate of a medical school ranked as Class C by the Council on Medical Education of the American Medical Association, and of these thirty-four, three states will only recognize graduates of Class A schools.

The examinations held by the various state boards have had a most excellent effect on all schools, even the very best. The publication of the results of these examinations in the *Journal of the American Medical Association* has exposed the disgracefully poor schools of this country to public view. The good schools stand out conspicuously through the small percentage of failure of their graduates, and are constantly stimulated to improve their product.

Take, for example, the record of the University of Pennsylvania during the year 1914: 67 of the graduates were examined before 27 different state boards; 65 passed and 2 failed, or a percentage of failure of 3 per cent. Further investigation shows that one of these failures was in New York and the other in Oklahoma, and that one of them graduated before 1910 and the other before 1914, but later than 1909. Twenty-three graduates of the Class of 1914 all passed. A very good showing, indeed, but not a perfect one, and that is what all the good schools are striving to show. Every graduate of a first-class medical school should by rights naturally expect that he can pass any state board examination in the United States. The school has no right to graduate him if he cannot. The University of Pennsylvania is proud of the record of last year, when compared with other friendly rivals. For example, Harvard had 6 per cent of failures, Johns Hopkins 5.1 per cent, Columbia 5.2 per cent, Northwestern 7.1 per cent, and Rush 5.8 per cent. Of course a few schools had smaller percentages of failures than Pennsylvania's 3 per cent, but when one takes into consideration the number examined, the number of states before whom the candidates appeared, the years of graduation of the candidates and other factors, Pennsylvania ranked last year probably first.

The Report to the Carnegie Foundation for the Advance-

ment of Teaching, by Abraham Flexner, in 1910, on the results of his investigation of Medical Education in the United States and Canada, fell like a bomb from on high amongst the unsuspecting and poorer medical schools of the country. Imagine the explosion that resulted when a faculty assembled and read such a damaging description of their school as the following: "Laboratory facilities: The school occupies a few neglected rooms on the second floor of a fifty-foot frame building. Its so-called equipment is dirty and disorderly beyond description. Its outfit in anatomy consists of a small box of bones and the dried up filthy fragments of a single cadaver. A few bottles of reagents constitute the chemical laboratory. A cold and rusty incubator, a single microscope and a few unlabeled wet specimens, etc., form the so-called 'equipment' for pathology and bacteriology. This school is a disgrace to the state whose laws permit its existence." This report has been productive of great good in many ways.

Over half of the medical schools in the country now are members of the Association of American Medical Colleges, and this organization has done its share in raising standards. This association held this year its twenty-fifth annual meeting.

The result of these various reform movements has been extraordinary. Great advances have been made. The great overproduction of poorly trained physicians has been largely corrected. Last winter there were 14,891 medical students in the United States, a decrease of 47.1 per cent since 1904, when 28,142, the highest number of students, were enrolled. Every year there has been a steady decrease since 1904. The number of graduates last spring was 3,536, a decrease of only 58 below 1914, but a decrease of 2,211 (38.8 per cent) since 1904, when 5,747, the largest number, were graduated. The present yearly addition to the number of physicians by graduation is about double the loss by death from the ranks of the profession.

The late Dr. William Pepper, in 1877, published a very notable address, entitled "Higher Medical Education, the True Interest of the Public and of the Profession." It is still well

worth reading. In it he called especial attention to the overcrowding existing then in the profession of medicine, calculating that at that time there was about one medical man to every 750 inhabitants.

In the Carnegie Foundation Report on Medical Education in the United States, published in 1910, already mentioned, it was stated that in the entire United States there was, on the average, one doctor for every 568 persons, and that in our large cities there was frequently one doctor for every 400 or less. It is no exaggeration to say that the present medical men in the United States could easily look after the health of a threefold increase in the population of the country. There then would be fewer physicians peddling books and patent medicines.

The excessive number of medical colleges has likewise been reduced, and in the reduction naturally more poor schools have closed their doors than have good schools. In 1850 there were 52 schools in the United States; in 1880, 100; in 1900, 160; in 1906 the high water mark was reached, for in that year 162 schools were teaching over 28,000 students. Nearly one-half of the world's medical schools were located in this country. Since 1906 there has been a steady yearly decrease in the number, and at present there are but 59 in existence. Of 92 medical colleges which have ceased to exist since 1904, 52 were closed by merger and 40 became extinct. The good schools that have closed have nearly all closed by merger, the poor ones by extinction.

The American Medical Association calls attention to the need for further mergers, stating that there are 14 cities where mergers are possible and desirable. Among these cities are Chicago with 8 medical colleges, New York with 7, Philadelphia with 6, and Boston with 4.

The classification of medical colleges into Classes A, B and C by the Council on Medical Education of the American Medical Association has already been mentioned; in the last published grouping 67 colleges are ranked as Class A, or Acceptable Medical Colleges; 19 as Class B, or colleges needing general

improvements to be made acceptable; and 15 as Class C, or colleges requiring a complete reorganization to make them acceptable.

At present 38 per cent of the medical colleges require two or more years of college work for entrance, and 51 per cent require one year, and only 11 per cent are requiring but a high school course or less for entrance. In 1904, only eleven years ago, however, 97.5 per cent of the medical colleges were on a high school entrance basis. These figures demonstrate more conclusively the improvement taking place in medical education than any other facts that can be shown. The improvement is still going on, and in a few years, at the present rate of progress, medical education will be, in this country, on a very creditable basis once more. We have seen a satisfactory beginning turn gradually into a very discreditable state of affairs, followed, however, by a return to the high ideals of the founders, Morgan and Shippen.

Let us hope that there will not occur, as with the swing of the pendulum, another relapse. From the existing medical schools we may expect a constant improvement. The only menace to medical education in this country lies in the fact that the American public seem to fairly welcome each and every new brand of drugless healing. No matter how illiterate, how untrained in every branch of knowledge tending to enable them to diagnose disease, if these quacks but claim to be the exponents of a new cure our gullible public flock to their offices and often pay high for the folly. If uneducated individuals are to be allowed to spend but a few weeks or months, or to take correspondence courses to acquire a sufficient knowledge of the latest variety of drugless healing to enable them to go forth and treat their fellowmen, while regular practitioners of medicine must have graduated from a four-year high school and then have spent one or two years in college and four years in a medical school, then danger is near, and medical education will still need reform.

SOME BIOLOGICAL AND PRACTICAL ASPECTS OF GROWTH

By Merkel Henry Jacobs
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Several generations ago, the scientists of the day devoted much time to such occupations as rubbing pieces of sealing wax and glass with cat skins, and touching the hind legs of frogs with metal wires. They did these things purely from scientific curiosity, and if there were in those days any of the intensely practical persons who can see no good in any kind of investigation that does not promise large and immediate financial returns, they must have viewed with disapproval the waste of so much time and energy on such unimportant things as frog's legs and sealing wax. Had it been in their power, they would doubtless have put the scientists to such useful work as devising methods for manufacturing cheaper tallow candles and larger stage coaches instead of permitting them to lay the foundations of the science that has made possible the electric light and the trolley car.

At the present day there are even larger numbers of scientists engaged, in a somewhat different field of work, on problems that seem at first sight to have as little practical value to humanity as did some of those that occupied the attention of physicists a century ago. It is difficult for most persons to see how an exact knowledge of the daily variations in the weight of a white rat, or in the length of a tadpole's tail, or in the rate of reproduction of microscopic creatures known only to professional biologists, can effect the happiness of the human race. Nevertheless, it is not beyond the bounds of possibility that these studies may some day find even more valuable practical applications than any that have as yet been made in the field

of electricity. It is not too much to expect that the ultimate outcome of such work will be the possibility of the scientific control of the forces of organic growth.

The subject of growth is one of peculiar importance. To the biologist it is of especial interest because it brings him face to face with the deepest and most fundamental mysteries of life. No biological phenomenon is more remarkable than the process by which non-living matter is gradually transformed into living matter and built up into an integral part of a complicated living organism. To the rest of the world the significance of the subject of organic growth lies chiefly in its relation to the most universal of all human problems—the problem of satisfying hunger. The hunger of man and of all other animals can be satisfied only by the products of the growth of other organisms. No parasite in the last stages of degeneration is more dependent on its host than is man on the plants and lower animals that by their growth supply him with his food. The state of civilization of a nation is very largely dependent on the skill with which it appropriates for its own use the products of the growth of other organisms. In the United States one-third of the inhabitants, more or less, are devoting their lives to superintending the growth of various plants and animals that would not thrive without their constant care. It would be interesting to know what proportion of the total thought and conversation of the human race is devoted to questions of one sort or another connected with growth. It would also be interesting to know how many of the wars and migrations of peoples in the earth's history have been due to the failure of purely empirical knowledge to assist natural growth to the point of supporting satisfactorily a population in any but the most favored parts of the earth.

There is another way in which the question of growth affects everyone. Human beings themselves grow, and it is of the utmost importance that this growth should be as normal as possible in every respect. As matters now stand, this is far from being the case. Human growth is frequently abnormal,

not merely as it affects stature and conspicuous external features, but as it affects even more important internal relations. We do not as yet know exactly how much connection there may be between abnormalities of growth and crime, for example, or mental deficiencies of various sorts; perhaps there is more than is generally supposed. At any rate, it is astonishing that intelligent human beings should be content to know less about the kind and amount of food that is most suitable for their growing children than they do about the kind of oil and the amount of gasoline that is most suitable for their automobiles. It is also astonishing that more real scientific work has been done on this latter problem than on the former. Perhaps this is due to the universal recognition that anything having to do with machinery is "practical." In the meantime, it is fortunate that there is an ever-increasing number of "unpractical" scientists who are willing to devote their lives to investigating such questions as organic growth.

Before proceeding to a consideration of the discoveries that these scientists have already made and the various ways in which they are beginning to be of service to humanity, it may be well to consider for a few moments some of the general biological aspects of growth. Organic growth is something so peculiar as to be absolutely unique. A study of the growth of crystals throws little light on it; the same is true of the study of the remarkable osmotic growths, obtained in various ways, which sometimes show an almost startling superficial resemblance to plant growths. Even in organic tissues we must not confuse real growth with mere increase in size such as we can readily obtain by placing pieces of dry seaweed in water. True organic growth involves, in the first place, the formation from non-living material of that peculiar complicated arrangement of substances which we call living matter or protoplasm, and in the second place, it is perhaps always associated with a progressive series of complicated structural changes in the living matter thus formed. These changes are most clearly seen in the early stages of develop-

ment of an organism, but they seem never to cease entirely while the individual remains alive. There is no more mysterious or fascinating chapter in biology than the one that deals with the transformation of lifeless matter into living, changing, self-preserving, self-perpetuating protoplasm. The little knowledge that we already have of some of the steps of the process serves only to intensify our feeling of ignorance of the real principles involved. An example will make this point clear.

With the exception of water, which forms two-thirds or more of the weight of most organisms, the most conspicuous of the chemical constituents of living matter are the proteins. The process of true growth is therefore always associated with the production of new protein molecules. Let us see to what extent a consideration of the chemical nature of proteins will simplify the problem of growth. The proteins are the most complicated chemical compounds known. Frequently several thousand atoms are necessary to form a single protein molecule instead of perhaps half a dozen or so as in most of the familiar inorganic compounds. Furthermore, in place of being a single unit, the protein molecule is composed of a combination of simpler molecules united more or less firmly together. These constituent molecules or "building stones," as the Germans expressively call them are, so far as we yet know, of about eighteen sorts, all belonging to the class of compounds known as amino-acids. The amino-acids are well known chemically, and most of them can be artificially synthesized. It might seem a simple matter to take perhaps a hundred of these "building stones" in all and unite them together so as to form a molecule of protein. This indeed has been partially accomplished, although the number of "building stones" as yet joined together is far less than a hundred; nevertheless substances giving typical protein reactions have been artificially produced in the laboratory, and the difficulties in the way of producing full-sized protein molecules are practical rather than theoretical.

So far, the problem seems fairly simple. We seem almost to have in our grasp the mechanism of protein synthesis.

However, we must not overlook the remarkable fact of the specificity of the proteins. Each one of the several millions of species of organisms that probably exist today (to say nothing of the millions of extinct forms) seems to have its own specific proteins that are different from those found in other organisms. Even where chemical analysis fails to show a difference, certain marvelously refined biological reactions will distinguish, for example, between a minute stain of human blood and that of a cow or a pig, or will show whether in a sausage, in addition to its proper constituents, there may be proteins of canine or feline origin. It is possible that even individuals of the same species may have proteins peculiar to themselves alone, and also it must not be forgotten that two species differ from one another not merely with respect to one protein, but with respect to an indefinite number, since different organs of the body contain different proteins. Instead of involving, therefore, a single complicated chemical compound, the problem of growth involves such an enormous number of these compounds as to be beyond our powers of imagination.

A further consideration of the chemical nature of the proteins will make clear one reason for this remarkable diversity. Different proteins are made up largely of the same amino-acids, and of these only a relatively small number are known to be of importance. It therefore follows that any difference in the proteins themselves must be due to differences in the arrangement and the relative numbers of their different "building stones." If we designate the various amino-acids by the letters A to R inclusive, we can, by varying the proportions of the different letters used to make up a total of, say, a hundred, represent the composition of the different proteins theoretically possible. For example: AAAABBBCCCCC.....etc., to a total of 100 letters would represent one protein, while AAAAAA BCCCC.....etc., also to a total of 100 letters would represent another. The number of possible combinations that can be made by taking a total of 100 of these 18 letters is of the order of magnitude of a million million millions, and this

takes into account only proteins having exactly one hundred "building stones," which of course, is only one of many possibilities.

But in estimating the number of proteins theoretically possible, we must take into account not only the possible combinations of the "building stones," but the possible permutations of each of the combinations as well, since we have evidence that the arrangement of the various amino-acids in the molecule affects its chemical properties. Thus the protein, AABBCC......etc., would be different from the protein, ABC ABC......etc., even where the numbers of A's, B's, and C's are the same. It is not humanly possible to make the complete calculation of all the possible permutations and combinations, especially when we remember the complicating effect of an unknown amount of branching in the chain of amino-acids. It is sufficient to state the number of possible permutations of the single combination of six each of the letters A to J inclusive, and five each of the letters K to R inclusive, making a total of 100 in all, is of the order of magnitude: 1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000. There are other considerations that have not been mentioned that would bring in still other possibilities, but the addition of a few dozen more zeros to the above number would not change its effect on the human mind, and for all practical purposes we can consider the number of possible proteins as being practically infinite. This being the case, it is easy to see the remarkable nature of the process by which countless millions of molecules of a few kinds of amino-acids are picked up by the body of an organism as they come from its digestive tract and in one place are built up into one particular characteristic arrangement out of an indefinite number of possible ones and in another place into a different but equally characteristic one, while another animal supplied with the same raw materials uses them in its own particular fashion without infringing

on the patent rights of other organisms. A knowledge of the chemical nature of proteins, therefore, complicates rather than simplifies our ideas of the factors concerned in growth.

Furthermore, to appreciate fully the complexity of the process of growth we must keep in mind the scale on which the above chemical changes occur. The work of building up a single protein molecule of a particular kind more than taxes our powers of imagination, and yet, even in microscopic organisms, many different kinds are being constructed at the rate of millions every second. Let us take a concrete example. There is a small animal known as Paramecium to which every student in biology receives an introduction early in his course. In size, it is just visible to the naked eye, being about one one-hundredth of an inch in length. If we were to cut out of a newspaper a printed period of the smallest style of type and then divide it into two or three parts, each part would have roughly the weight of a Paramecium. Small as it is, this organism is anything but simple in structure. Its body is covered with several thousand hair-like organs of locomotion, the cilia, and internally it is even more complicated. Chemically considered, the complexity of Paramecium is almost inconceivable. If it could be resolved into its constituent molecules and these molecules distributed uniformly over the earth, there would be several to every square foot of the earth's surface. There would be perhaps a hundred thousand protein molecules to every square mile. If we imagine the animal enlarged until its molecules are the size of small shot, it would be possibly two miles long. Each of the microscopic hair-like cilia would be represented by a cylindrical mass of shot perhaps forty feet in diameter at the base and an eighth of a mile high. If we try to think of such a structure, made up of many different kinds of particles the size of shot, in themselves enormously complex, all in a state of frenzied activity, moving about at a rapid rate, combining chemically with one another, millions breaking to pieces every instant and millions of others being built up at the same time to take their place, the whole mass

bombarded constantly from the outside by countless billions of rapidly moving molecules which penetrate to all parts of its interior, setting up miniature molecular explosions there, it itself bombarding its surroundings in turn, and all the while adjusting and readjusting its myriads of chemical reactions in correspondence with external changes so as to preserve its peculiar state of organization intact through the vicissitudes of centuries and millenniums—if we try to think of a Paramecium in this way, it seems almost inconceivable that the natural forces of growth can produce in the short space of twelve hours or less two of these infinitely complicated structures from the one original one, and that in twelve hours more these two may have grown into four, and in a few days or weeks, these four into millions.

In the bodies of higher animals the same principles hold. The individual begins its existence as a single cell, the fertilized egg cell. This cell grows and divides, giving rise to other cells, and these in turn to others until the amount of living material has increased to thousands or millions of times its original amount. At the same time enormously complicated structural changes are occurring in the individual cells as well as changes in their arrangement that lead ultimately to the production of the various organs of the adult body. The marvelous processes of development that occur in such an exact manner as to produce out of a speck of living matter one-eightieth of the weight of a postage stamp a human being that resembles one of his parents in minute details of appearance, bodily structure and disposition, or as to produce twins that are practically indistinguishable, are among the most wonderful of the various aspects of growth.

Surely it must require more than ordinary scientific boldness to make the attempt to control and utilize in new ways for human needs such forces as the ones we have been considering! And yet such attempts have been made in the past and are being made today with greater and greater success. It must not seem surprising if results have often been obtained

in an empirical manner without an understanding of the principles involved. The same thing has been true in all fields of scientific work. Even today we do not know what electricity is, though there is no difficulty in utilizing it. In the case of the complicated problems connected with growth, whose study is still in its infancy, it must be a source of constant wonder that much real and substantial progress has already been made.

At the very foundation of a rational control of growth must come an understanding of the various factors on which normal growth depends. In the last few years a number of interesting discoveries have been made along these lines. The most important ones, so far as man and the higher animals are concerned, are those in connection with the part played by proteins in normal growth, the existence of hitherto unknown growth-stimulating substances and the relation to growth of the ductless glands. These may be taken up in the order mentioned.

The general part played by the proteins in growth has been known for many years. Since the tissues of the body (disregarding the water contained in them) consist chiefly of proteins, and since animals can construct proteins only from pre-existing proteins or their "building stones," it follows that growth is impossible in the absence of a sufficient supply of these compounds. The relation between proteins and growth is nicely shown by considering the rate of growth of the young of various mammals in connection with the amount of protein in the milk naturally supplied to them. The human infant, which requires 180 days to double its weight, receives milk containing 1.6 per cent of protein; the young calf which requires 47 days, milk containing 3.5 per cent, and the young rabbit which requires only 7 days, milk containing 10.4 per cent.

In addition to furnishing the raw materials which make growth possible, protein is necessary for the maintenance of the body in a healthy condition even in adult life. This fact has long been recognized and the question of the "protein

minimum"—that is, the amount of protein just sufficient to maintain the body in a normal condition—has received a great deal of attention. It is not necessary to discuss whether the maintenance protein is used to replace lost body proteins or has some other function; the important fact is that both during and after growth, protein food is necessary. A general recognition of the importance of proteins in both growth and maintenance is, therefore, nothing new. What is comparatively new, however, is the discovery that not only do different proteins differ widely in value in connection with either of these processes, but that certain proteins which are fairly satisfactory for maintenance will not permit growth, no matter how large the quantity supplied. It follows, therefore, that not only is the quantity of protein in the food important but its quality as well, and, furthermore, that a kind of protein suitable for an adult animal is by no means suitable for one that is growing.

These relations are clearly brought out by the experiments of Osborne and Mendel and others on the growth of white rats. The protein, gliadin, obtained from wheat, will maintain an animal in health for a considerable time, but will not permit growth. When it is desired that growth shall occur, it is merely necessary to add to the diet a small amount of the amino-acid, lysine, which is almost lacking in the gliadin, and the animal resumes its growth where it previously left off. Other proteins are known which, like gliadin, are sufficient for maintenance but not for growth. Young animals may be fed on them for extended periods and their weight kept about constant. As soon as the missing constituents are added growth is resumed. Ordinarily in rats the full body size is reached at the age of a year or less; in these experiments in one case a rat was kept stunted, but otherwise in good health, to an age of 532 days—an age corresponding to perhaps 45 years in man—and then by changing the diet the growth was permitted to occur that ought normally to have taken place in youth. It is interesting to know that in the rat, at least, the power of growth does not

appear to be lost until it has been exercised—that the rate of growth, in other words, does not depend on the age of the animal but on the growth that has already occurred. We must not be too hasty in trying to extend these conclusions to human beings and to imagine that individuals stunted in early life can have their defects remedied at any time later on, for such stunting may be due to a variety of causes, and besides, there are certain differences in the types of growth shown by the rat and by man. However, it is a fact of great scientific interest that to a certain extent at least we have it in our power to say whether an animal shall do its growing in its youth or its old age or whether it shall have several periods of growth or perhaps after a certain time none at all.

Certain practical considerations are suggested by these experiments. In the first place, it appears that different proteins are not of equal food value. Some permit growth, others merely maintenance and still others, such as gelatin, or zein, the chief protein of Indian corn, are insufficient even for maintenance. In the future, therefore, in feeding our domestic animals, it will be possible to take these differences into account and to secure, for example, as rapid growth by using large quantities of cheap protein to which small amounts of the missing constituents have been added, as we can now secure by using large quantities of much more expensive proteins. In the second place, the possibility of having maintenance without growth has led to the suggestion that by a proper regulation of the diet, the growth of tumors in adult human beings can be held in check. Experiments in this direction, made on mice by several workers, have given results that are by no means unpromising.

In addition to the proteins, other substances, as yet very imperfectly known, seem to be necessary to growth. These are the so-called vitamines. About the chemical nature of these substances we know very little except that those most important in growth seem to be associated with certain fats such as butter fat, fat from egg yolks, and codliver oil, though

lacking in lard and in olive oil. An animal supplied with the proper proteins and a diet entirely suitable in other ways does not increase in weight if the growth vitamines are lacking. The addition to the diet of a little butter or unskimmed milk produces results that are almost magical. The amount necessary is very small; a fraction of a teaspoonful of milk a day may make all the difference in the world in the growth of an animal. It is interesting to note that the milk that forms the food of the young mammal as well as the egg yolk used by the developing bird embryo both contain not only proteins peculiarly suited to growth but growth-stimulating vitamines. What the significance of these substances in codliver oil may be is not entirely clear, but at any rate their presence may have something to do with the high medicinal repute in which this preparation has long been held.

Finally, in considering the factors concerned in normal growth, we must not overlook the ductless glands of the vertebrates, which are receiving so much attention at the present day. Some of them, at least, have a decided influence on growth, though how they exert this influence is not known. For example, in man an insufficiency of the thyroid gland may lead to a condition of arrested physical and mental development known as cretinism. An over-development of the hypophysis may be connected with a condition of abnormal growth which either leads to the production of a giant or perhaps to the condition known as acromegaly, in which the unusual growth affects chiefly the extremities of the body. The sex glands also exercise a profound influence on growth. The part played by the other ductless glands is less understood, but in all probability the examples mentioned do not by any means exhaust the list of effects of these organs on growth.

A consideration of the foregoing factors concerned in normal growth leads to the question of a possible stimulation of growth by artificial means beyond its usual limits. It is obvious that such a stimulation might have a great practical value. For example, an increase of ten per cent in the amount of

growth of the crops and domestic animals of the United States would mean an increase in the income of the country of considerably over a billion dollars a year. A similar increase in the rapidity with which annual food plants reach their maturity would not only render possible more crops to the year in the warmer parts of the earth, but would make available for the production of human food the more northern latitudes which cannot as yet be used on account of the shortness of their growing season. Such a stimulation would be especially valuable in connection with the slow growth of trees, which often require a lifetime to reach a marketable condition. It is well known that the world is using up its timber supplies faster than they can be replenished. Any relief, therefore, that could be secured through the application to forestry problems of methods of growth stimulation would be most welcome.

A number of methods of accelerating and increasing growth have already been employed. In addition to the method of selection of chance favorable variations for propagation, and methods depending on cultivation and feeding, in modern times the methods of hybridization and chemical stimulation have been employed with promising results. The method of hybridization is not new, but its possibilities are only beginning to be realized. The results obtained by it are often puzzling as well as valuable. The offspring, instead of being intermediate between the two parents in powers of growth, or being like one or the other, may far exceed either of them. This is shown in Mr. Burbank's Paradox Walnut, produced by crossing the California Walnut with the English Walnut. Among the offspring resulting from this cross were some trees with powers of growth far surpassing those of either parent. The original Paradox Walnut trees, when 16 years old, had reached a height of 60 feet or more and a trunk diameter of 2 feet, while the parent trees growing beside them, although almost twice as old, had a trunk diameter of only 8 or 9 inches and a height of perhaps 40 feet. Evidently a new combina-

tion of characters had made possible a much more rapid growth than is normal for either of the parent species. It must be mentioned that not all of the offspring grew unusually rapidly; as a matter of fact, some grew unusually slowly. The range of variation was shown by trees of the same age, which ranged all the way in height from 12 inches to 18 or 20 feet.

Another method of stimulating growth is by employing chemical means. Long before this method was thought of by man, it was successfully applied by insects in causing certain plant tissues to produce gall-like growths for the protection and nourishment of their young. We are not able to produce such specific effects as these insects can, but it is possible for us considerably to accelerate in a more general way the growth of many organisms. It has long been known that certain plants show increased powers of growth when given exceedingly minute doses of poisonous substances such as zinc and copper salts. It is possible that valuable applications of this principle may some day be made. In the meantime, the observations of several English workers on the effects of plant growth of organic substances called by them auximones are of considerable interest. These substances seem to be produced by the activity of certain bacteria. They are present normally in decaying manure, but can be produced in artificial bacterial cultures. They are so effective that watering a plant with a solution containing only one part of an extract of such a culture to several million parts of water produces a wonderful increase in growth. The possible practical applications of such a discovery are obvious.

The growth of animals may also be stimulated chemically. Perhaps the best example of such stimulation is furnished by the effects on growth of the fat-like, phosphorous-containing substance known as lecithin. Small doses of lecithin given to growing tadpoles, as well as to various mammals such as rats, rabbits, dogs and guinea pigs, produce most striking results. It is not surprising to find that egg yolk, which we have seen contains other growth-favoring and growth-stimu-

lating substances, shows a high percentage of lecithin. The products of the ductless glands also have a decided effect not only on the growth of the animals to which they belong but on other organisms subjected to their influence. It has been found, for example, that tadpoles fed on the thymus glands of other animals have their growth stimulated but their development arrested, while the effect of thyroid tissue is just the reverse, causing a practical cessation of growth but a very rapid metamorphosis. The effect of substances contained in the thyroid tissue of all classes of vertebrates is to cause a marked increase in the division rate of the protozoon, Paramecium. Further experiments on the effects of the ductless glands on growth will doubtless yield important results.

There still remain to be touched upon briefly a number of miscellaneous lines of work on growth, whose scientific interest is great, but whose practical bearing is not always so apparent as is that of the ones already mentioned. Just as we are learning how to secure satisfactory normal growth, and to stimulate growth beyond its usual limits, so we have it in our power to direct the growth energies of an organism into abnormal or unusual channels. The results produced are often extremely bizarre. For instance, the treatment of fish eggs at a critical stage in their development with certain salt solutions will lead to the production of cyclopean forms, having one eye in the center of the head instead of two normal eyes. It is even possible sometimes to cause a fish egg to develop into one big eye without a body. Frogs can be made by other methods to develop four or even six hind legs. Tadpoles may be made to produce eyes in unusual places, such as in the middle of the back. A developing embryo of certain animals may be made to produce two individuals instead of one, or conversely, two may be fused so as to produce one individual. Flatworms with two heads are relatively easy to produce, while the common earthworm may be made to form a tail at each end of the body and have no head end at all. A

crustacean may be made to develop an antenna where an eye ought to be—in fact, there is almost no limit to the "freaks" that can be produced in one way or another. Of more practical importance, perhaps, than the experiments just mentioned are those on the transplantation of organs from one individual to another. Principles obtained in this way are already finding an application in human surgery. In young organisms especially, where the powers of growth are vigorous, remarkable results in grafting and transplantation are possible. Perhaps the most striking one ever obtained was the grafting together of the anterior end of one tadpole with the posterior end of another individual of a different species and the subsequent development of this composite individual into an adult frog in which the difference between the two halves of the body could still clearly be recognized. Much careful work is being done today in this field, and we may expect it to bear practical fruit in the not very distant future.

Finally, a word must be said about the possibility of growing in artificial culture media detached pieces of animal tissue. A practical method of accomplishing this difficult as well as interesting feat was devised by Professor Harrison of Yale University and used by him to study under the microscope the growth of isolated nerve cells. It is now possible to keep alive and growing in artificial cultures tiny fragments of most kinds of tissues. Some may remain alive and growing for a year or more while portions of heart tissue may beat rhythmically under the microscope for weeks. This method has been found extremely useful in attacking many difficult biological problems and probably will become more and more useful in the future. We must not, however, let our imagination be carried away by the novelty of the thing and picture to ourselves a time when pieces of meat will be kept growing in every household to be used as needed, for entirely apart from a variety of other difficulties in the way of such a desirable arrangement, the culture media would cost far more than the value of what could be expected to grow in them. It is safe to say that no

cheaper solution of the human food problem will ever be found than in the scientific control of the forces of growth of living organisms.

These are some of the ways in which the problem of growth is being attacked at the present day. The results may in some respects seem disappointing, and yet, if many of the facts that have been obtained appear to have no practical application, and even little connection with other scientific facts, we must remember the history of electricity and other similar branches of science in which the isolated, unpractical facts of one generation have made possible the theoretical generalizations of the next and have only begun to find their practical application in the third or fourth. The study of growth is still in its infancy. Who can predict to what discoveries it will lead us or what will be its final value to mankind?

LAW AND SOCIETY

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It is impossible in the scope of this brief address to trace the growth of law from its earliest appearance in primitive society to its present elaborate and complex form. All I can attempt to do is to consider what the ultimate object and purpose of law is in its relation to the social body and whether the time is not ripe to reduce to the field of law certain questions the solution of which are left for settlement by warfare or by its economic equivalent, destructive competition and strikes.

For the purpose of this address I shall use the term "Society" as including every group from the most primitive family or horde to the most highly organized nation or empire, and even to that larger and looser group of nations who recognize or profess to recognize the same system of international law.

I shall use the term "Law" as meaning the system by which a social group enforces its will upon the individual members. This differs from the compulsive force which lies behind the ethical code accepted by the group, in that this is enforced by social ostracism, a force which while undoubtedly strong is applied by the concurrent but unorganized action of the individual members of the group whose moral susceptibilities have been offended. Law, strictly speaking, requires some system or machinery of enforcement; some person or class of persons to whom Society has delegated its coercive power.

The desire for order is not confined to the human animal, but is most strongly exhibited in man. Even the members of the most primitive family submitted to the will of the father, mother or elders long after their superior age gave them the physical power over the younger and weaker members of the

group. The desire for peace and for some authority to control the actions of individuals, whose mutually conflicting desires would, if unrestrained, lead to constant conflict within the group is still strong, except among those, whose superior financial or political power, like superior physical strength in more primitive communities, would make the unrestrained pursuit of their desires advantageous to them.

The law first showed itself in two ways among primitive tribes. In the first place, the tribe itself directly punished offenses against itself, and in this were included offenses against what was conceived to be the will of the supernatural beings they worshiped. As mankind naturally ascribes to the divinities he worships his own feelings, primitive man believed that if a member of the tribe offended the Divine Law, the God would punish the whole tribe; therefore, an individual offense against Divine Law threatened to invoke the divine displeasure upon the entire group. In only these two fields was punishment meted out by the tribe or group itself; nor indeed are these two exhibitions of group power of great importance in the development of the law, the only modern survival of them being the punishment imposed for treason.

The beginning of municipal law, the law by which individual members of a group are required to conform to the group ideal of proper social conduct, was the restriction of reprisals, of feuds and warfares between the families composing the tribe, one of which had been offended by some act done to one of its members which he regarded as harmful to his interest and so constituting a grievance to the family or group of which he was a member. Not only did primitive sentiment approve of retaliation, but it actually regarded it as obligatory for the group, a member of which had been offended, to wipe out the grievance and even up the score by inflicting an equivalent harm upon the group of the offender. This naturally led to feuds. As the tribes themselves were fighting for their very existence against other tribes, it was necessary for them to suppress this internecine devastating warfare so they might

present a united front against the common enemy. There was at first no effort to prevent the original aggression. Group force was applied to discountenance a continuance of private vengeance and its resulting feuds, first by providing for money payments to satisfy the grievance of the offended family and finally by punishing through group action those families or individuals who refused to accept the money penalties and persisted in avenging their own grievances. It is to be noted that underlying the punishment of offenses against the group and the regulation and prohibition of private vengeance there was a more or less conscious effort to satisfy a present need of the group itself by preserving the discipline and unity necessary for its preservation. In its very inception, therefore, the law appears as an effort on the part of the group to enforce upon its members respect for the interests of the group itself. As the group or tribe widened, as it by conquest absorbed other tribes, as commercial relations with other groups were established, something more than mere self-preservation was necessary. There was need of expansion and of self-realization. The tribal laws and customs contained in the tribal code, whether orally transmitted from generation to generation or embodied in some written inscription or document, were found to be inadequate. Such codes embodied all of the tribal traditions and customs; they included their religious rituals, their sacred taboos and commandments as well as their purely legal system. They became a part of the very life of the tribe and that part of them which was legal acquired the sanctity which attached to the code as a whole. Such codes, as is well known, were supposed to have been dictated to the often mythical law-giver by the tribal or national God. These bodies of customs, religious and legal, continued to govern the relations of the members of the tribes among themselves, but they were clearly inadequate to form the basis of peaceful dealings with other tribes which had different traditions. Some common meeting ground had to be found. It was necessary to select between conflicting customs. Tradition alone was insufficient.

Reason was required. At this point we find the first pronounced impetus toward rationalized system of law. Similarly, other new situations have from time to time arisen which have required a change or modification in the traditional or their accepted law. Each substantial change in the law will, I think, be found on close analysis to have been due to one of certain things, *inter alia*, amalgamation or absorption of other nations with a different system of legal tradition, a change in the external civilization of the nation or group, and that most subtle thing, the change in the inherent conception of what will best serve the group interest, which occurs from time to time, itself probably determined or induced by altered economic conditions.

But we find each change retarded and deformed by that instinct of reverence for the sanctity of the existing legal code, which is a part of the archaic conception of law as a thing of divine origin, of form as being in itself authoritative apart from the substance which underlies it and of the sacred character of the written word. Such changes as have been made are often made surreptitiously, as by legal fictions, which assume that "black is white" in order that the legal consequence that previously attached to "white" alone should as fully attach to "black." The legal fictions enabled broad-minded judges to change the substance of the law "while" still appearing to show respect for its sacred form. In this they have been of real service to humanity, but on the other hand they have, like all compromises, an element of mental dishonesty and they have prevented a thorough scientific analysis of the real content of the law.

On the whole, it may be said without much fear of contradiction that Law is the creature of Society and is the instrument whereby it enforces upon the individual respect for the group ideal of proper social decorum. Its ultimate object is to enable the group to realize its ideal of self-expression; not merely to preserve its existence, but to attain to what is at the time regarded as its ideal development.

This conception of ideal development has often changed. Indeed, we are passing through a period of change in this respect. The English law down to the middle of the last century enforced an entirely individualistic conception which was itself the result of several factors. Up to the end of the eighteenth century England was a thoroughly conservative country, entirely satisfied with its social organization, quite content with its settled class distinctions, highly prosperous and isolated from foreign influence. The political power rested in the hands of the aristocracy and the higher bourgeoisie. Their system of law, like their social system, appeared to Englishmen final, complete and perfect. Each class was placed in its own pigeon hole, from which there was or theoretically should be no escape. Their idea of law was that which would allow the utmost freedom of action within those classes and there was no substantial conflict between the classes. With the growth of modern industrialism, the accepted theory was that the development of the country would best be promoted by unrestricted competition. From this dream of a completely adequate legal system and of the efficacy of unrestricted and undirected individual effort to attain the highest national development, England was rudely awakened by the discontent of the working classes. It is impossible here to analyze the cause of this discontent. It is enough that it existed. A new grouping has occurred. The English-speaking world is realizing that it is not enough for society to keep "hands off" in the contest between capital and labor, carrier and shipper, producer and consumer. A new thought is abroad. It is perhaps too much to say there is a new accepted conception of the ideal conditions under which England and America can realize their highest destiny. At most there is a rejection of the old concept of unrestricted individual effort. What is certainly with us now is a situation very closely analagous to that which confronted the primitive tribe. The contest between capital and labor, carrier and shipper and other new economic groups whose interests conflict with one another is causing social warfare.

The whole constitution of modern life is so complex that the success or failure of one of the two contenders is no longer a matter of moment only to themselves. The relations of all classes of the community to one another are too close for that. It is, therefore, impossible for Society to stand neutral in these conflicts. Not merely will these conflicts do injury to the participants themselves and cause general social unrest, but they will indirectly inflict serious injury upon the many other groups whose interests are more or less closely bound up with those of the contestants. It is impossible today to permit a general railway strike. The question of proper hours of pay and working conditions generally concern not only the railways and the workers; they concern less vitally but none the less very materially those to whom the railways give its services, the cost of which must depend upon the cost of supplying it, including the cost of labor. But even this interest in the proper solution of the difficulty is as nothing compared to the vital interest which every member of the civilized community has in keeping open the avenues of communication between locality and locality. A complete strike of all the railway systems of the United States would not merely paralyze business, but if continued for any substantial length of time would mean starvation to millions of our people who have congregated in cities into which the bare necessities of life must be brought by rail. So a strike among coal workers not only affects the price of that most useful commodity, but if persisted in so as to exhaust the available stock of coal, would mean distress and loss of life which no society could tolerate. These are striking instances, but they differ in degree only from the situation created by any serious conflict between capital and labor.

Just as primitive mankind was forced to prevent a fighting out of their differences between family group and family group, it seems certain that some way must be found to bring within the field of law those controversies between these new groups whose interests are as mutually conflicting as those of primitive

families. How far has our law dealt with the situation? It has not acted as an arbiter of the final dispute. It has not attempted to adjust the differences by any settled code by which the justice of the contention of the parties can be determined. In isolated instances particular strikes have been settled by legislation or by the more or less personal act of an executive. A system of arbitration has been provided to which the parties may, if they please, resort; but in America, at least, there has been no effort to provide a legal system for the adjudication of such disputes. Society regards these matters not as a justifiable question to be determined by our courts as judges, but rather as a contest between individuals in which our courts act as umpires to see that the contestants do not fight foul; that they do not use physical violence; that they do not tell lies about their competitors; in a word, that they shall not do what would be illegal in an individual. In one particular the majority of the courts go further. They act as a "concert of powers" and prohibit either of the two contending parties from using their economic power to enlist as allies persons or classes who have no immediate concern with the matter in dispute. Wherein lies the difficulty? It seems to me that it lies primarily in one thing. There is as yet no agreement of opinion, no definite settled group conviction as to what are proper working hours, what are proper working conditions, how much of the profit of an enterprise should go to the capital which supports it, how much to those who manage and direct it, and how much to those who share in the enterprise by the giving of their labor? Yet there is a growing conviction that all men are entitled to a living wage, not merely in justice to themselves but for the good of the community itself. We are coming to perceive that starvation wages and long hours are not only disagreeable to the worker himself, that they not only tend to discontent which in itself is a menace to the peace of the community, but, since the working class is the stock from which is bred the greater part of the future citizens of the country, they create a serious menace to the future of our race.

I do not say that there is as yet a settled conviction that every man is entitled to a wage sufficient to afford him reasonable decent nourishment for himself and children plus a margin for leisure and recreation which will tend to develop his own personality, but this conception is gaining advocates even in America. It has been accepted in Australia, where a most interesting experiment is being tried and is apparently successfully. In Australia under a recent act power has been given to the Federal Court to settle strikes. Two principles have been accepted as controlling:

1. That the employer must pay a living wage as above defined.
2. The workmen are not entitled to be paid a wage which will so increase the cost of production as to render the business unprofitable in competition with the outside world.

No strike will be allowed for a wage which will destroy the business, and the employer is forced to grant demands of the workmen if they ask no more than a living wage. Within these limits the employer and employee are free to fight the matter out for themselves.

This is but a beginning. Even under this scheme there remains a large field which the law confesses itself as yet unable to regulate, yet this seems to me a long step in the right direction. Certainly there is no problem more important, more worthy of serious and attentive study than that of reducing to the realm of Law the conflict between Capital and Labor.

THE DRAMA, THE PHOTO-PLAY AND EDUCATION

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This effort of mine to treat three subjects of the importance and extensiveness of the drama, the photo-play and education in one onset had better be called a sketch rather than a discourse. I named all three when asked for a title for my subject mainly because I thought that a consideration of the first two offered under the auspices of the University of Pennsylvania should extend itself to include the third if it hoped to be in keeping; but the amount of attention that I will attempt to give the specific subject of education will be very slight and more by way of suggestion than by direct treatment. My concern is not to show what the drama and the photo-play may do for education so much as it is to suggest what education should be doing for the drama if it is to lay hold, in a critical moment, of a powerful aid to its own well-being.

And as Philadelphia is, I take it, a representative city of the United States, and as the bulk of my acquaintance with the situation I am about to deal with was acquired here, I am going to use it as an adequate instance of what I conceive to be the general case of the drama in the United States. What I say of it must, of course, be modified to meet extraurban conditions, but on the whole I think a statement of the situation in Philadelphia will be a good working statement and generally representative, at least of the fortunes of the drama in the cities.

When I first knew Philadelphia, over twenty years ago, it was a force in the dramatic world. Not only had we an excellent school of acting in the old stock company at the

Girard Avenue Theater, but a man who felt disposed to go to a play for his evening's pleasure and profit might find in any week as varied a bill as the following at the local houses: At the old Chestnut Street Theater he might find Augustin Daly with a company of artists, including such eminent figures in one offering as Ada Rehan, James Lewis, Mrs. Gilbert, Henry Dixey, Tyrone Power. These and an excellent supporting cast would offer anything from a rarely good reproduction of a Mid-summer Night's Dream or The Tempest to a Night Off. At the Chestnut Street Opera House, let us say, one of Mr. Charles Frohman's companies, with Miss Effie Shannon, Mr. Barrymore, Mr. Herbert Kelcey, and maybe Mr. Boucicault and his mother, would be appearing in the same play, for those were the days when Mr. Frohman was still a gentleman producer and not a theatrical magnate grasping after his share of the syndicate spoils, and the star and the "run" had not yet arrived to a degree to displace the significance of the company and the piece. At the South Broad Street Theater perhaps the young Salvini would be playing in The Three Musketeers or some other such vein of romantic adventure; or Mr. John Drew, Miss Maude Adams and Miss Ethel Barrymore, in one company, would be offering one of their genre studies of perfect love, perfect ladies and perfect gentlemen. Across the way at the Academy of Music, Mr. Drew's venerable mother and Mr. Joseph Jefferson might be tempting the pursuers of delight with The School for Scandal or Rip Van Winkle. At the Grand Opera House on North Broad Street a good company, with capable artists, might be singing Martha or Maritana or La Sonnambula. Elsewhere, perhaps, Edward Harrigan would be offering his own raffish, but evidently attractive, studies of the East Side of New York (the theatrical East Side that never was on land or sea), or Mr. Creston Clarke or Miss Olga Nethersole in repertoire would be affording change from night to night in anything from the classic to the ultra-romantic (the bizarre had not yet broken into the fold). Indeed, repertoire was the rule. Not many companies came

to the city expecting to brazen out, so to speak, two to four weeks with one offering, though I think it occurred with such things as The Girl I Left Behind Me or Hoyt's half grotesque farces like a Texas Steer, or still again with such "rippers" as Charley's Aunt. But my recollection is that repertoire prevailed.

In all this I say nothing of the excellent weekly bills of opera at the Academy of Music, and the good fare of its kind offered in opera bouffe and musical comedy by Miss Lillian Russell, by Francis Wilson (with Jefferson D'Angelis and a strong female lead), or by Dan Daly and Miss Edna May in such things as The Belle of New York. Nor am I counting in the steady offering of syncopated entertainment in the shape of vaudeville (then variety) at Keith's old theater on Eighth Street in the days before the Rogers Brothers and Weber and Fields had not yet won their leaden spurs, and hence were under some necessity of trying to be as good as J. W. Kelly, the Rolling-Mill Man, elsewhere, or Tom Kelly the blackface star, or the members of the troupe mayhap with which Chevalier or Sandow had come surrounded for a two or three weeks' stay.

Such were the theatrical offerings of the time, not every week, of course, but in a steady representative stream throughout the winter, so that it was an ill-grained humor indeed that could not find satisfaction somewhere in a week's offering. But this is only mere gossip until we see the philosophy of it. First of all, business, to the best of my recollection, was in a state of more or less constant boom in the theater of that day. It may be that the companions and I who skimped our lunches by day to revel by evening always picked the theatrical winners; it may be that distance is lending its wanton enchantment to the view, but my recollection is that whether we went to see Francis Wilson in his grotesqueries or James Lewis and Mrs. Gilbert in their tender and delicate rendering of some fine comedy, or whether again we chose, for variety's sake, to see variety at the old Keith theater, or Creston Clarke in

The Merchant of Venice or young Sothern in Captain Letterblair, good houses, generally overflowing houses, were the rule. In this, I say, memory may be playing me a trick, but I do not think so. At least I cannot now recall a single instance of an engagement closing before its time because of neglect. In the face of this the claim of the theaters at present to be giving the public what it wants is ghastly farce. In those days the public had an opportunity to exercise its choice, and it exercised it to the profit of everybody concerned. There was always a satisfactory public so long as there was a satisfactory play, and stays of three, four and five weeks were not uncommon. Men like Mr. Augustin Daly were able to equip their plays with a cast of artists that today would furnish forth all the undertakings of such producers as the Shuberts, Mr. A. L. Woods, Cohan & Harris, or any house not putting on an Ibsen or Shaw play.

In the face of this I repeat (and I shall go on implying, if not actually repeating it) it is nothing short of preposterous for the theatrical producing world to claim that it is giving the public what it wants today. The public wants matter agreeable to its taste, and wants to be allowed to exercise its own choice in selecting it. If it can do this I think there is no more reason for saying that the fortunes of the theater are in the descendent than there is for saying that Christianity is discredited by the fact that a select body of hoodlums of various nationalities have chosen the beginning of the twentieth century to run amuck in Europe. The cases are pretty nearly parallel. For in the days I speak of the theater throve, and theater followers—in and out of the theater—were prosperous because there was a gentlemanly understanding in control on all hands. The producers met the situation on the supposition that the public they were dealing with had its rights. They used the theater as a means of livelihood, of course, but they wanted their living as gentlemen, not as hawks. I do not pretend that they were morally and ethically above smearing their nest, from time to time, with a concoction to

assail the nostrils of the prurient. Mr. Charles Frohman for years set himself no other task that I recall except to import Parisian and Viennese "triangles" of a questionable tone and note, and there were others no better than Mr. Frohman should have been. I only claim the gentlemanly relation on economic grounds. The producers dealt as much as they might, each in his vein, in a fair offering in order to win, rather than to bully favor, and each found ample favor to keep him in the theatrical producing business, I think, without feeling the pinch of want.

Then one day the whole thing changed so suddenly that the gentleman producer disappeared almost totally with the end of one season, except in the case of isolated men like Mr. David Belasco and the Shubert Brothers, who fought the new influence as malign. The event that effected this sudden violent change was the creation of a syndicate of eight men in New York City, with Mr. Charles Frohman and his brother, Daniel, at the head. It was not that the Frohman leopard had changed his spots, but, I think, he changed the grouping of them. I do not say that the men who formed this syndicate consciously foreswore the instincts or practices of the old gentleman producer as represented by such men as Augustin Daly. I do not say that they organized to grab all they could get from the theatrical situation. I do not know what their sentiments were exactly, as I have never seen the charter of their syndicate. I only know that they grabbed. They magnatised the old conception of dramatic production and the shock killed it at one application. Whether Mr. Belasco and the Shuberts fought the change at the time and later (the original syndicate soon was dissolved into other combinations), the melancholy fact remains that the old gentlemanly attitude of allowing the public a fair choice in procuring its theatrical entertainment has never been in existence since.

What is the result? Mr. Lee Shubert, I think it is, is authority for the statement that the result is a working condition in the theater of 40 per cent successes and 60 per cent

failures. If that proportion comes out in the year the theatrical business is a going concern, allowing its dictators and directors a return for their services that is satisfactory. And when we understand that the eight gentlemen who formed the original Frohman syndicate set $800,000 per year as the modest sum at which they would consider themselves requited for their services, one must feel that there is a resilience in theatrical finance that is not to be found in many forms of investment.

In other words, the better interests of the drama died of strangulation in the course of one year in the grip of money. I cannot think but that the better interests of the box-office likewise have suffered by the abominable pretence that the rights of the public shall be exercised exclusively by the magnate. In those old days perhaps income from any one play was not so violent, if I may put it that way, as it is today from the "run" production; but neither was it so precarious.

So that it must seem that plunging is more in accord with the spirit of the theatrical producers of the last two decades than satisfaction with a steady income. And looking at the situation from the point of view of finances alone, I am sure I do not see where the advantage is supposed to lie, for it required only the hardships in the theatrical situation that followed upon the outbreak of the European war in 1914 to show that the coffers of the plungers were not very deep or full. Producers that the public looked upon as being staunch as oaks, like the Lieblers, were snuffed out with painful suddenness, while in the old days managers like Augustin Daly and Sir Henry Irving died men of substance.

To be sure, there was a change in the content of the drama in the period we are considering. The murky sun of Ibsen cast a shadow on many old forms of dramatic belief and interest in a degree and way that, if it did not kill them, at least forced them into a state of suspended animation. His shafts fell almost balefully upon many old conventions of facile sentiment, and for the time being, at least, sent them down to earth. The sharp sun, again, of Mr. Bernard Shaw's satiric

wit withered the bulk of the forms of conventional heroics that twenty years ago delighted the heart of the average theater-goer. But I cannot afford to take those aspects of the situation into consideration. Neither man has had so general an influence that he may be said to have devastated the situation. For the debility that has fallen upon the drama we can find an adequate explanation only in the evil influence that money grabbing in the early years of this century came to exert upon the affairs of the theater. If it were not for that and the destructive change it wrought, people who went to see The Girl I Left Behind Me in 1895 would still be going, in 1915, to see such plays as Mr. Sheldon's Romance without the author being reduced to offer it under its half-apologetic title. It is not the unsympathetic eye of Ibsen or Shaw that killed that old, bland, ingenuous taste, but the starvation—the inanition to which the producers themselves reduced it. By driving with a high hand with their "runs" they put thousands of people, in whose life the drama was more or less of an institution, out of the way of going to the theater. At least that was the case with myself and my friends. Where once the play of the night before was a topic of conversation among the young men settling down to their office work, it came to be, even before I left an office fifteen years ago, almost a rarity.

So that if the case of the playhouse is hard today it is scarcely too much to say that the theater has largely made its own bed. Big business in the theater has overreached itself and come by a hard fall mainly of its own accord, for had the old even conditions prevailed ten years ago the moving picture would have taken its due place instead of so largely dominating the situation. The share that the war has played in breaking down the fortunes of the theater has not been a fraction of what the theater has done to invite its own downfall.

Of course there is an economic consideration present. I will touch upon it, however, briefly, by and by; at this point, before coming to the moving picture, I wish to raise the

question: What has education been doing in the last twenty years to succor this age-old ally of hers in its distress? What anxiety has she felt to see the school of vivid report and representation that the stage represents restored to its due place as an educative aid and influence? Has she bestirred herself to meet or improve the situation? On the whole, no. The drama is no more a concern of education today than it was in 1850—perhaps less; certainly it is less than it was in the days when English drama was forging its way to the front just before Elizabeth's reign in England. In those early days of growth in England the schools exerted an influence of the most energetic kind upon the fortunes of the theater. Their part in bringing about the great nationalization of the drama as an eminent, if not super-eminent, feature of English literature was as considerable as that of any other single influence of the time. Can the same be said of education among us today? No, our placid old dame sits wagging her toothless gums over the multiplication table, religiously persuaded to the core of her withered old system that if a child is to be equal to the demands of public life, the first care is to teach him the moral force of eight times eight and the passionate delights of the table of avoirdupois. With the insight into character and the habits of first-hand observation that these studies convey he will be duly equipped to meet the prime demands of life in the twentieth century, come what will. Not that I pretend to ridicule the importance of the multiplication table, but when it is religiously put to the front as the decalogue of social salvation it is allowed to usurp a place that is out of proportion. Not a year ago a course in dramatic construction was taken off the roster of an institution of learning of college rank because the services of the instructor giving the course were needed to teach the more necessary and important branches of the history of the English language and the history of English literature. Two years before that a student dramatic company of the same college was forced out of existence because there was no provision in the college charter that

would condone the enormity of male and female students playing together on the boards. So is Gran'dam Education faithful to her trust as keeper of the spiritual seals and as the fashioner of men's perceptions. So is she, sitting dotingly at the feet of Shakespeare, the "glass of fashion and the mould of form." When the fight has been fought and the issue decided, for better or worse (if it can be much worse), the enormously lady-like old lady will review the scene of conflict, find an adequately flowery phrase for the struggle, and talk of it with back-handed enthusiasm for a hundred or a hundred and fifty years to come as the epochal stage in the history of twentieth century drama. But that, I am afraid, will be the full share of her activity. At least I do not see her girding her loins for house-cleaning or for battle.

Meanwhile, what is going on all about her? In my estimation a deplorable demoralization of public taste, public sentiment and public discrimination. Wherever I look at the activities of the moving-picture world I see, with the rarest exceptions, lust, destruction (nowadays the surest of "laugh-getters"), vulgarity, distortion, grotesquerie, far-fetchedness and fundamental unreality offered, sometimes quite soberly, as a fair and just representation of the probity, decency and truth of existence, not to say its grace and happiness. I go to the highest priced moving-picture places in town—places that publish themselves abroad with half pages, sometimes pages, in the newspapers, as the guardians and agents of all that is best in the world of moving-picture art—and after I have been drugged with the ineptitudes of Jordan Is a Hard Road, I am offered, as an inducement to return next week, The Sins of Society, The Cheat, The Thief, The Galley Slave, or I may vary this happy fare with the hysterical scream of The Eagle's Mate, the cheap trickery of The Battle Cry of Peace or the cowardly innuendo of The Birth of a Nation. When the producer thinks he has sufficiently harrowed my feelings with such moral exercises to satisfy even the spirit of Aristotle himself, he offers me as a means of restoring myself

to a healthy, well-balanced sense of life the exquisite titillation of Saved by Wireless, Fatty and the Broadway Stars, or Fickle Fatty's Fall. And for the privilege of partaking of this dainty, happily blent dish I may pay, if I wish, as high as a dollar and a half or two dollars, a sum for which, twenty years ago, I could see in one week Hamlet or Othello, The Devil's Disciple or Beau Brummel (Richard Mansfield in the title rôle), and hear Don Giovanni or Siegfried. In short, I am permitted to deal once more with the theatrical promoter, as in the first decade of the century, on the assumption, agreeable to him but not to me, that I am too stupid to penetrate his vulgar masquerade as a public educator and benefactor (see the announcements of The Birth of a Nation and The Battle Cry of Peace), and too dull-witted generally to hope to cope with his business acumen.

To that reading of the situation I do not for a moment subscribe. I look upon the moving-picture activity of the day as in the bulk pestilential and extremely harmful. It is a fungoid life pushing into the limelight from the sick body of the theater and the drama, and like most fungoid growth it is prolific and audacious. It is pushing forward desperately, and perhaps, on the whole, to its own satisfaction, in order that it may enjoy its little hour while it offers. I think it knows its spurt will be short-lived, but it means it to be a true rake's progress while it is going. No audacity is beyond being dragged into its service; no fraudulent aspect of cheap heroics or cheap sentiment is too baleful to give it pause in its eagerness to gather its roses while it may. It is version number two in this history of ours of the way in which big business on its worst side is ready to demoralize the community in which it can run loose and to kill the goose that lays its golden eggs for it by sweating the bird to emaciation.

I am going to spend a few moments to show that this is so. For years after the invention of a motive machine capable of carrying a series of pictures so rapidly across the field of vision that the optical delusion of continuous action results,

the new industry spent its prentice days in marked neglect. It tried to bring itself into favor by exhibitions in country barns or other out-buildings. It lived what might be called a marginal, half Pariah-like existence, enjoying neither repute nor profit. But at last by dint of hard work, by spending energy, means and courage upon it, its obscure pioneers brought it to a point at which its use and popularity grew. At this point, per the modern economic formula, appeared the promoters, the men who, by debauching the purpose and opportunity of the drama, had acquired sufficient financial standing to step in and squeeze out the original pioneers. I do not know how the pioneers—the inventors and early promoters—fared at this juncture; I only know that the men who today have made billions out of the moving-picture industry are not the men who originally put either brains, on the side of invention, or courage and spirit, on the side of development, into the situation. They appeared after the venturesome stage was past, and the meantime they have employed in demoralizing the quality of their opportunity, so that it is high time that the thing was taken under some kind of drastic regulation. The Board of Censors that exists at present is only an evil. It would be a laughing stock if it were not that its existence serves the reverse purpose of giving authority and endorsement to scandalously distorted travesties upon life. I put it to any thinking man to deduct from the next attempt at a serious representation that he sees on "the screen" the presence and consequence of the following paraphernalia, and say what the remainder will be: Drugs, drink, tobacco, firearms, daggers, rapine, fraud, greasy-eyed animal passion, thievery, robbery, gambling, general licentiousness and cheap bravura. I think I may say beforehand what the remainder will be: First, exaggerated husks: either wealth raised to the nth power by means of limousines and costly-looking people in costly-looking clothing and surroundings, or poverty generally depressed to the sorriest nadir; for in the world of moving-picture fortune, life has no levels: it is either all

the lumpy mountain tops of cheap costliness of life, or the gulfs and the sloughs of desperate poverty. In the world of the screen moderation is death. In the second place, there will be left a half-rabble of grotesque figures to fill these husks, men and women, ill-conceived and ill-portrayed, living a life of frenetic passion, going and coming at all times at a degree of tension that would leave Solomon a lunatic and Sandow a wreck within a month.

That, I think, is what will remain. For of all that is subtly true or whimsically instructive and wise the moving-picture screen can make no use. The fine shades of true sentiment are impossible to it; you cannot differentiate Iago from Othello save by his color and the stock distortions that must serve next week for the diabolism of Lord Steyne in Vanity Fair or the machinations of Javert in Les Miserables, because—pun though it may seem—in the one-dimensional world of the shadowgraph there is no room for shading. Everything that is not physically demonstrable—and that in a smashing, lumpy fashion—is lost. The subtleties of anything approaching a truly humorous or satiric reading of life are forever beyond its reach. Think of putting Polonius on the screen as Shakespeare intended him. Think of showing Ann and Jack Tanner, or the distress of Nora Helmer. I once saw Mr. Cyril Maude in what was entitled Peer Gynt, but if a ploughman had painted The Angelus or The Gleaners he could not have moré thoroughly missed Millet's sentiment than Mr. Maude, by force of circumstances, was compelled to miss, the significance intended by Ibsen in his satire. I once saw Mrs. Fiske in an hour's set-to with Vanity Fair. The acting was dignified and restrained indeed, but the story was crushed out of existence by that single fact. There was no more reason in what was shown on the screen for believing Becky Sharpe a sharpstress than there was for believing Mr. Maude's Peer Gynt a kind of ferocious embodiment of unintelligent egoism.

That is what remains, then, when one takes away from the moving-picture world's confidences the crude, almost

mechanical implements of story. And that remainder (unfortunate as it is in its shallowness), is made still more dangerous to the understanding of young people and naïve people generally by the perfunctory nature of the character tags. The villain is never off sentry go. To smile and smile and still be a villain is as impossible to him as a hornpipe to an aviator. It would wreck his craft. The sentimental heroine, again, swallows her grief in physical lumps as a cobra swallows a rabbit. How false it all is and is understood to be by the people may be realized when one asks himself when he ever saw anybody weep, or, rather, heard a sob in the dark, in a moving-picture hall. At best one hears cries of facile dismay or surprise from women as this, that or the other castastrophe impends or comes off.

In short, the story of the moving-picture world is addressed today, and has been addressed from its early teens, not to the understanding or the sympathies, but to the nerves. Hence I think its influence, apart even from its perversely cheap and wrong presentation of character and personality, is almost totally pernicious. I will not say that under its influence we will grow into a nation of dastards or cut-throats or swashbucklers, but increasingly our popular reactions will require more and more hysterical stimuli to awake them.

The situation, however, is by no means all stygian blackness; not even the moving picture can practice its affairs without learning something about life. It has learned, amongst other things, that there is a quality of public interest that is not necessarily prurient or dense. It has found that it is possible to interest the populace in stirring events other than those promoted by the whiskey bottle, the hypodermic syringe, the cigarette case and the teapot. There is no doubt that the influence of scenes of stirring action, of highly accelerated motion (when it is not raised to the pitch of a "scream," as it prevailingly is), of pictures of vessels at sea and engines of all kinds in ingenious motion is tonic to the nervous system and to the blood. It is unquestionable that the public sense

of the look of the world in strange, little-visited quarters has been mildly educated; but I am afraid that the pedagogue inclines to overrate the beneficial influences of such glimpses of Pathé's weekly world as are granted us. Were a "palace" today to offer an unvaried bill of such pictures to its patrons I am afraid it would be out of favor by next week. The moving picture by its abuse of the hysterical and far-fetched in action, motive and sentiment has so debauched the popular interest that the people want only screamers and thrillers in the field of the tragic and the pathetic, and the grotesque in the field of the comic (which is, indeed, all that it is capable of handling). The public suffer the educative film rather than desire it. The bulk of the interest is of the "scream" order.

Now, I have set out the situation as it appears to me. Is it hopeless? No, there is nothing hopeless about the situation, but there is not a little that is serious and annoying. The annoying thing—I say it again—is that Great-grandmother Education sits on, mumbling by the old embers, and is not herself doing anything to help a situation that in any right sense of her duties should be among her first cares. We shall turn toward the old lady presently with the question what should she be doing. But first I want to state a remainder of the case that it strikes me is necessary if we are to be clear.

First, many people incline to see in the moving picture the art of the future—at least the popular art. They say that the cheapness of the fare is bound to keep it on the popular bill. I do not share this opinion. In point of fact, I think it can be entertained only in neglect of the history and character of popular interest. No doubt at the moment people go to the moving-picture hall as a way of escape from the humdrum character of their minds and lives. But nothing becomes so readily humdrum as the way of escape from the humdrum when it is much used. The delights of the moving picture are not Cleopatrian. Their variety is not so infinite that age cannot wither them nor custom stale them. Indeed, nothing is so clear an indication of the shallowness

and impermanence of the mind that lives by the extreme sense of life than the readiness with which the public tires of its favorites. John Bunny died auspiciously while his fame stood at pinnacle height; but what sense of loss did his decease create, and where today is even the redoubtable Charlie Chaplin? Only six months ago, so did our principal streets blaze with the refulgence of his name that I was disposed to suggest through the newspapers that Market Street be changed to Charlie Chaplin Row. Today my joke would be unfit for publication. True, his motley mantle is now being shared by Syd Chaplin (from his smile, I imagine a relative) and Mr. Conklin; but not even a distribution of its weight among many will avail, I think, to bear it up. The only thing that Mr. Syd Chaplin and Mr. Conklin seem capable of are the india-rubber grotesqueries and horse-collar funniosities that were the least of Mr. Charles Chaplin's abilities; for Mr. Charles Chaplin is the one instance of a moving-picture actor, that I am aware of, who was able, when he wished (or probably was allowed) to "put over" fine comedy on the screen. By virtue of a remarkable personal reserve in his acting Mr. Chaplin was always capable of keeping himself outside the grotesqueness of his story. But that I am confident is not what the public at large saw in him or wanted. They wanted only his grotesque farce and when they were laughed out on that score they saw Mr. Chaplin go without serious regret. If he is to come back it will have to be with a new set of contortions to catch the fickle fancy of the real patrons of the speechless drama—the people who, for one reason or another, cannot devise means of passing the time in their own or their fellows' company without boredom.

Meanwhile the popular taste is being stuffed like the goose that is being fed for pâte de fois gras. The public are getting stimulation without enough advancement or education to keep them ahead of the wearing-out process. My own belief is that it will all die out as suddenly as the bicycle craze or the roller-skating craze. Those were forms of popular amusement

that ran a dizzy course and then suddenly dropped out of being (as crazes). I do not see any other future for the moving-picture craze; all the more so since there is not in it the exhilaration of action that was associated with the bicycle and roller skates. There was variety of scene in the bicycle; there was variety of contact and adventure in the roller-skating rink; yet not even these elements of genuineness availed to keep the public interest in them going beyond the allotted nine days. To the retort that the bicycle and roller-skating crazes were costly relative to the moving picture, I can only answer that that is beside the mark. It is the suddenness of the disappearance of popular interests and activities that is significant. Having been pursued with headlong ardor, they are always abandoned with eagerness. It is hot come on, hot come off.

So the "movies" as a long-lived danger, not to say as the art of the future, do not seem to me to be a prospect greatly to be feared. The public will grow as desperately tired of them as it has of everything else that it has accepted or has had to accept as a makeshift. *And from first to last the moving picture is a makeshift.* In that fact alone seems to me to lie the canker at its root. It is not drama; it is not intercourse in anything but one pitiably thin and shallow aspect. It is not art; it is less than a tenth of the art it pretends to be. Lastly and supremely, it is not life, either as truth or criticism. Its domain is chiefly the domain of disease and extremity.

So much on the side of the public. As to the artist, both creative and reproductive: what inducement does it offer the creative artist to spend his ingenuity upon the making of a tale, only a disordered tenth of which he can communicate? What sincere artist, creative or interpretative, will wish to continue activity in a field in which he is robbed of man's highest faculty, speech, and in which he dare not consult his own sense of the decent behavior of passion or grief or shame or happiness, or anything else by which the world lives and moves and has its being? Were it possible for the thing to

go on it might all well come to a time when the moving-picture artist would live in a world of such gross unreality and remoteness that many nervous disorders, hallucinations and forms of dementia would grow out of it. So while the actor is turning —generally shamefacedly—at the moment in the direction of the higher pay and the greater security that the moving-picture world offers, I cannot think that any man or woman with any true regard for his art can so compound his conscience as to continue satisfied with the petty opportunities the "screened" drama offers.

Hence it seems to me the truest and most enduring weight of the situation must be on the side of a recovery of our dramatic sanity. The question is, what is being done on all hands to bring about a return to dignity in the matter? I look at my newspaper as I ask this question (the Sunday paper of December 19th) and I find to my considerable pleasure that the offerings for Christmas week are mainly in the nature of legitimate drama. The moving picture is very much less in evidence than usual. I hope this is not merely a holiday indication: that it has something permanent in it and that it presages better things. Still, even if the drama does come back, a vital question will be, what kind of drama? Are we simply to put away Tweedledum and take back Tweedledee? Shall it be in effect that plus ça change, plus c'est la même chose?

It certainly ought not be so if the best interests of art and the community are to be considered. And that is where I conceive that education is derelict. Her opportunity today is to be corrective in the condition of things that exists. How? Through the schools plays could be offered to the people who today solely frequent the "movie palace." These plays, if wisely chosen, could be an excellent means of correcting the evils that are running away with the best interests of the theater, whether in the palace or the "legitimate" theater of cheap farce and cheap sentimentality. If our schools were rightly equipped with good teachers of elocution and with

physical courses that would make the carriage of the children a beautiful thing instead of the brutal thing of the modern football arena, we might then have plays by young people that would bring parents and friends into the presence of better things. With this might be combined a play by ambitious young people of the neighborhood in which good local talent would find a representation, and the community would find interest and education. In this way the best ambitions of the stage might be revived, creative and reproductive talent encouraged, a helpful use made of our school buildings and a healthy counter influence exerted against the poor service of the moving-picture world. The cost would not be great; the profit in the circumstances, looking at profit in the larger sense of a care for what might be of benefit for us all, would be tremendous. I do not know whether the law forbids it or not, but if it were allowable to make a slight charge for such entertainment a goodly sum might be deflected in this way from the pockets of private free-booters into the none too thriving coffers of education. Even if the law forbids such a charge today—well, we are not Medes and Persians.

Is education doing anything like this? Is she thinking of doing it? No, indeed. She goes on in her old mumble-bumble way of telling what was done in the reign of Stephen to meet the popular demand for drama—one of the most vital demands in the nature of man—but doing nothing to meet or help the demand in her own day. I do not pretend to quarrel with the teller of the story of the drama in Stephen's day. It is excellent in its place, but it is by no means the whole story or the whole obligation. Goethe said that he abominated all teaching that merely informed him without stimulating him. Likewise to know what the natives of England did in the reigns of Stephen and Elizabeth to further their interest in the drama, and, at the same time, to hang back unable or unwilling to help ourselves in the same direction in our own day, argues an unquestionable miscarriage of interest and energy.

Meantime, outriders like the Society for the Extension of

University Teaching are in the saddle. They are trying to produce periodically (even if under crippling conditions) something that will exert a wholesome influence upon public taste. Such local organizations as our excellent Plays and Players and the Stage Society are doing what education neglects to do, and that without education's equipment by way of halls, platforms or stages, and without anything like the opportunity education enjoys in the way of a big field from which to draw its talent.

I am sufficiently interested in the fortunes of the drama to say that I hope most fervently that in this respect of keeping the public reminded that there are such things as graciousness of speech, of carriage and behavior, the outriders will beat education in her own field and put her to shame so badly that she will mend her ways for all time.

THE IMPORTANCE OF TUBERCULOSIS IN ITS RELATION TO PUBLIC HEALTH

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The effect of the tuberculosis campaign, which was launched a little over a decade ago, is subject to two interpretations. The pessimist holds that in spite of all that has been done there is little to show in the way of eradicating the disease. The optimist, on the other hand, asserts that a distinct advance has been accomplished in the control of tuberculosis, and that while the immediate results are not striking, the effects of the campaign will be more and more apparent as time goes on.

Any movement which can start with practically nothing and in ten years' time create an organization which at present includes 1,200 local anti-tuberculosis organizations, 575 hospitals and sanatoria, 450 special dispensaries, 1,000 dispensary physicians, 4,000 nurses and 400 open-air schools, is certain in the long run to accomplish its object.

Briefly stated, the results so far achieved are shown in "(1) the steadily growing enlightenment of the people on the subject of tuberculosis, its cause, methods of prevention and treatment; (2) the gradual falling mortality from the disease, and (3) the impetus given to the entire public health movement through concentration of public attention on a disease the gradual eradication of which, by virtue of its etiology, is dependent on the realization of higher general health standards." (Editorial, *Journal of the American Medical Association*, January 8, 1916.)

It is this last aspect of the subject that I wish to emphasize. As one surveys the various activities of preventive medicine

during the past few years, it is surprising to see how great has been the influence of the effort to control this one disease.

The campaign against tuberculosis had not advanced very far before it was apparent that a wide variety of conditions played a part in producing this disease. The result has been that there has been a country-wide interest aroused in regard to better housing, the condition of working places, the effect of particular occupations on the health of the worker and sanitation in general.

What may be termed the by-products of the tuberculosis crusade are the campaign for the reduction of infant mortality; measures directed towards the improvement in health of school children; the prevention of mental diseases, of alcoholism, of venereal diseases and of blindness. And to this list might be added the campaign against cancer, the hookworm infection and tropical diseases generally.

Furthermore the methods employed in the fight against this one disease have been employed in other diseases with such modifications as were necessary to adapt them to the special peculiarities of each.

"Fundamentally sanitation and health are economic problems." It was with this conception of the meaning of sanitation and health that the Department of Health of the City of New York adopted the following motto:

"Health is purchasable.—Within natural limitations a community can determine its own death-rate."

Such a statement is worthy of the most serious consideration. If it is true, or even but approximately true, it should be an incentive to every community to ascertain how much illness and how many deaths can be ascribed to faulty hygiene and to what extent unsanitary defects can be abolished or modified.

Generally speaking, the chief problem to be met by communities in the temperate and semi-tropical zones is the prevention of an excessive death-rate from the acute infections. The acute fevers occurring in early childhood, smallpox, typhoid fever, pneumonia and tuberculosis occur in all parts of the

United States. In addition to these diseases the Southern States have to deal with malaria, pellagra, hookworm and the special problem of tuberculosis among the negroes.

The diseases which I have mentioned are all preventable to a greater or lesser degree. The truth of this statement is as certain as any established fact in medicine. Preventive measures have made such tremendous strides during the past twenty years in the control of infectious diseases, that it is now possible to entirely eradicate some of them and to greatly reduce the incidence of others.

The best known example of a disease which can be suppressed entirely is smallpox. Furthermore, vaccination is the oldest preventive measure we have and at the same time the most efficient. A vaccinated population means a population immune of smallpox, and every time an epidemic of this disease occurs it is an evidence of inefficiency.

Typhoid fever is another disease, the occurrence of which is a reproach to any community except in the case of an occasional instance when the disease may be imported. We know the specific cause of the disease and we know also the manner of its transmission: A polluted water supply; the carrying by flies of infected fecal matter to articles of food; direct contact with an individual suffering from the disease, and lastly infection of foodstuffs by the so-called typhoid carriers. The mere mention of the various ways in which the disease is transmitted suggests at once the methods of prevention.

A pure water supply is the most certain way of entirely eradicating or at least reducing to a minimum typhoid fever as well as other intestinal infections; this applies to the isolated farmhouse as well as the town or city.

Since the Spanish-American war, in which an appalling number of our soldiers contracted typhoid fever, sanitarians have come to realize that in addition to polluted water, typhoid fever may be spread by means of flies having access to exposed fecal discharges and afterwards alighting on articles of food. The lesson has been well learned and now encampments of

troops are provided with properly constructed latrines, and in addition the breeding places of flies are destroyed.

Custom and long association have so familiarized us with the house fly that many fail to recognize how filthy it is in addition to being dangerous. I know of no description of the fly evil which equals that in Gulliver's Travels. You will recall that in the voyage to Brobdingnag the inhabitants of that place were described as being enormous and everything else was in proportion. Gulliver's account of the fly nuisance is given in the following passage:

"I was frequently rallied by the queen upon account of my fearfulness, and she used to ask me whether the people of my country were as great cowards as myself? The occasion was this: the kingdom is much pestered with flies in summer, and these odious insects, each of them as big as a Dunstable lark, hardly gave me any rest while I sat at dinner, with their continual humming and buzzing about mine ears. They would sometimes alight upon my victuals, and leave their loathsome excrement or spawn behind, which to me was very visible, though not to the natives of that country, whose large optics were not so acute as mine in viewing small objects. Sometimes they would fix upon my nose or forehead, where they stung me to the quick, smelling very offensively; and I could easily trace the viscous matter, which our naturalists tell us, enables those creatures to walk with their feet upwards upon a ceiling."

Among those who nurse typhoid patients the disease may be acquired if the attendant is careless and neglects to wash her hands whenever they become soiled with the discharges. Indeed, routine washing of the hands should be practiced every time any service is performed for the patient.

The typhoid carrier, by which I mean an individual who harbors virulent typhoid organisms but who is at the same time healthy, is a more difficult problem. In Manila no one can be employed in the handling of foodstuffs, except those in private houses, without submitting to an examination to deter-

mine whether their discharges contain typhoid or cholera germs or the sputum, tubercle bacilli.

Now over and above these preventive measures, all of which are feasible and can be applied practically, we have the additional safeguard of typhoid vaccination. The latter measure has so thoroughly demonstrated its value and efficiency that it is no longer a subject of debate.

Another disease which in its method of prevention bears a strong relationship to typhoid fever, is ankylostomiasis, or hookworm infection. Here, again, we know the specific cause, the method of transmission, the means to prevent its occurrence and the cure of the disease.

The work of the Hookworm Commission in Porto Rico has demonstrated clearly what can be done in the tropics where conditions are less favorable than here. In the Porto Rico campaign the dispensary was the center of activities. In a recent campaign in Guatemala the plantation was taken as the unit. The three essential features in dealing with this problem are: sanitary education, destruction of the adult worm by means of thymol or oil of chenopodium, and the removal of conditions which favor the growth of the embryos. Preventive measures consist in the proper disposal of the feces, obtaining a pure water supply, and the decreasing of chance infection by wearing shoes and stockings. At the present time the campaign against this disease is world wide, and is being conducted by the International Health Commission of the Rockefeller Foundation.

Whether an increase of 80 per cent in the appropriations of the eleven southern states for public health work can be attributed entirely or only in part to the hookworm campaign, I am in no position to state. It would seem, however, as though the campaign had been of considerable educational value.

It is well known that among the most potent causes of a high death-rate are the summer diarrheas of infants. Unquestionably most of these intestinal disorders of children can be pre-

vented. There is probably no better example of how a disease may be controlled through the application of easily followed rules. An abundance of fresh air, light clothing and absolute cleanliness in all that concerns the baby are essentials. Nursing bottles and nipples should be boiled every day and kept scrupulously clean. The milk should be pasteurized and kept in a cool place, and all water given the baby, either with the milk or between the nourishment, should be boiled. Even in infants who develop intestinal trouble much can be done to check the disorder by following the above rules.

We have next to consider a group of diseases, the prevention of which is largely a matter of an effective quarantine system. This group is commonly referred to as the diseases of childhood—scarlet fever, diphtheria, measles, chicken-pox, whooping-cough, epidemic meningitis and acute poliomyelitis or infantile paralysis. Our knowledge of this group of diseases has been greatly extended in recent years, and in three of them an efficient method of treatment has been obtained, namely: diphtheria, epidemic meningitis and, quite recently, whooping-cough. Furthermore, the specific cause is known in four instances—diphtheria, epidemic meningitis, acute poliomyelitis and whooping-cough. Whenever any of these diseases prevails in an epidemic form, it is almost a certainty that proper quarantine measures have been neglected. One of the most effective means of bringing about control of this group of diseases lies in an adequate system of school inspection.

About four years ago the Philadelphia Bureau of Health put into effect a very efficient system of school inspection, the effects of which are just becoming apparent. From an average death-rate of 125 the mortality from scarlet fever was reduced to 26 for the year 1915.

This has been accomplished by daily inspection of the schools and the prompt isolation of all suspicious cases. Mr. Vogelson, of the Philadelphia Bureau of Health, informs me that the same reduction could be obtained in the case of

diphtheria if sufficient money was forthcoming to provide the required assistants in the city laboratories.

During the periods when the schools are closed and among children under the school age and among adults efficient quarantining depends on prompt notification of the Health Department by the physicians in charge, and the removal to a hospital or the enforcement of isolation in the home by the health authorities.

Another way in which quarantine measures may be more effectively carried out is the education of the general public in regard to the danger of the so-called milder diseases of childhood. A fuller realization of the danger of measles and whooping-cough must be brought to the public mind in order that proper safeguards may be carried out in all cases. The idea unfortunately prevails that these diseases must be suffered by all children, and therefore many are thoughtlessly, or even purposely, exposed, thus needlessly contributing to the mortality of children.

Before leaving this subject some mention should be made of other results obtained by efficient school inspection work, namely: the detection of backward children, the presence of orthopedic and eye defects, bad teeth, etc.

We turn now to a disease—malaria—the eradication or control of which is largely dependent on the character of the country. Malaria, as you well know, is transmitted from person to person through one species of the mosquito, the anopheles. The cause of the disease is known, as is also its cure. Theoretically, malaria is preventable in all instances, namely: by protecting the individual from the bites of mosquitoes, by exterminating the insects and by carefully treating all patients so that no opportunity may be offered for the parasite to enter the mosquito. Practically our success in eradicating or reducing the incidence of the disease is dependent largely on the character of the environment. Given a town adjacent to which is a small swampy tract, and malaria may be prevented by drainage of the swamp and other simple procedures which

will destroy the breeding places of the mosquitoes. On the other hand, in a type of country such as that included in Canal Zone, the complete eradication of malaria is next to impossible. What can be done, and as a matter of fact what has been done, in the Canal Zone, is to control the situation to such an extent that both the incidence of the disease and the deaths resulting from it have been reduced to almost negligible numbers. This has been rendered possible only through the highest degree of efficiency on the part of the Sanitary Department. Owing to the wide distribution of the mosquitoes, and also illimitable breeding places and the large number of individuals harboring the parasite, the preventive measures must be carried out unremittingly, and the least relaxation of effort is certain to be followed by a corresponding increase in the number of individuals suffering from the disease.

A disease which, in times past, has been considered an unfit topic for discussion, except before medical audiences, is becoming more and more forced upon the attention of the general public. I refer to syphilis. The time has passed when we can afford to ignore the fact that this is an acute infection, the spread of which can be tremendously reduced by isolation and proper treatment instituted during the early stages of the disease. The almost universal attitude taken by hospital managers who, on the ground that they are unwilling to countenance immorality, refuse to allow the disease to be treated in their wards during the infectious stage, is difficult to understand, especially when, with a curious obliquity of vision, they allow their medical wards to be filled with cases of Bright's disease, diseases of the arteries, heart, liver and nervous system, many of which have their origin in an untreated attack of syphilis. The solution of this problem, because of the nature of the infection, is beset with difficulty. The first requisite is the education of the public, and the second is the providing of adequate facilities for treating the disease and seeing to it that treatment is continued until a cure is obtained. It is encouraging to note that quite recently some of the hospitals in

Massachusetts have made provision for cases of this type. Australia, which is far ahead of the rest of the world in many matters relating to sanitary science, has put into effect a campaign conducted on these lines.

Finally, there are to be considered two diseases in which the effects of bad hygiene and overcrowding have an important bearing. I refer to lobar pneumonia and tuberculosis. There is ample evidence to show that the incidence of pneumonia is distinctly higher in overcrowded and unhygienic areas. Some years ago the disease prevailed in an epidemic form among the negro laborers in the Canal Zone. Removing the men from overcrowded barracks and placing them in separate houses and bungalows resulted in the reduction of the incidence of the disease to a minimum.

The last disease to which I shall refer is not only the most widespread, but in many respects the most difficult to control. Tuberculosis, or consumption, as it is popularly known, has a world-wide distribution, and for centuries has been attended by a high mortality rate. The oft-quoted statement that consumption is the cause of one-seventh of all deaths is still not far from the truth.

When the present crusade against tuberculosis was launched a little over a decade ago, it was hoped that the time was not far distant when the disease would be under control. Indeed, there were a few optimists who confidently predicted that in ten years, or twenty years at the most, tuberculosis would be completely eradicated. Destroying the disease by a violent frontal attack has failed, and we have settled down to the drudgery of trench warfare. It is now fully realized that the fight is to be a long one and that even slight advantages are to be gained only through unremitting work. Until a specific cure is forthcoming there is no prospect that our method of attack will be altered. We can make our present methods more efficient, however, if we utilize properly certain well-known facts.

Lacking a specific cure for the disease, our great hope lies

in prevention, and a campaign based on this premise must take into consideration the following facts: The infection is widespread, and while due to a specific cause, the tubercle bacillus, the latter in order to become active usually needs the stimulus of some secondary factor. The immediate causes of the disease are varied, and from the standpoint of prevention we only need consider those which may be attributed to unsanitary conditions: (1) Bad housing conditions, using the term in its broadest sense. The house itself may be unfit for habitation or the immediate surrounding or the slovenly habits of the people may be responsible for unsanitary defects. Tuberculosis is essentially a house disease, and the worse the living conditions, the higher will be the incidence of the disease. Bad housing and the slums are associated in the minds of most people with the overcrowded and unsanitary portions of our large cities. A slum, however, may consist of no more than one house, and every town, village and rural district suffers from the evil. An isolated house in the country can be as much of a slum as that existing in a large city; the difference is quantitative and not qualitative. Not only does tuberculosis thrive under such conditions, but also nearly all the other infectious diseases, and in addition the incidence of crime is high in such localities. In several of the cities of Great Britain the municipal authorities have destroyed and rebuilt the worst portion of their slum district, with the result that the morbidity and death-rates have been greatly diminished. One of the most remarkable instances of the effect on the tuberculosis death-rate as the result of destroying a slum district occurred in San Francisco after the great fire in 1905. For the two years prior to the fire the tuberculosis death rate was 274.7 per 100,000. No records are available for the two years immediately following the fire, but in 1908 the rate had dropped from 274.7 to 179.7 per 100,000, and in 1913 had fallen to 153.9.

(2) In regard to the sources of infection it may be stated that about 90 per cent of all cases of tuberculosis are due to the human tubercle bacillus, and 10 per cent to the bovine

organism. This means that while we must use every endeavor to assure a pure milk supply, the real problem lies in limiting the spread of the human type of the infection. Adequate supervision of dairy herds, and more particularly the pasteurization of milk, should reduce the incidence of bovine tuberculosis to a minimum. The control of the human type of the disease offers greater difficulties. In spite of the great prevalence of pulmonary tuberculosis we have available, in lieu of a cure, a rational hypothesis on which to work. It is generally admitted that the sputum of the tuberculous patient must be the center of our preventive efforts. Among the rich and the moderately well-to-do this can be accomplished without interference by the state. But among the poor, and especially when the disease has reached the advanced stage, the infection is being spread constantly through ignorance of the ordinary laws of sanitation. For this class isolation is the only remedy. Arthur Newsholme, of England, has shown very clearly that the death-rate from tuberculosis declines in any community in direct proportion as the consumptives are segregated in hospitals for the care of advanced cases. While this principle has been recognized for years its practice has been avoided partly because of the expense and partly because of shrinking from forcible isolation. For those who believe the practice of isolation is not feasible, I will state briefly what has been accomplished in the State of Victoria, Australia. They attacked the problem by locating every case of tuberculosis. This was accomplished by paying a physician ten shillings ($2.50) for every case reported, thus reversing the usual procedure, which is to inflict a fine for not reporting cases. As soon as a case was reported it was investigated by the official inspector. If the individual was in comfortable circumstances he was told that if an outside sleeping porch was provided, if sputum cups were used and all the rules pertaining to the treatment of the disease were faithfully observed, he could remain at home. If, however, he was detected breaking the rules on two occasions, forcible isolation in a hospital would be

carried out. In the case of those unable to provide themselves with the proper means of preventing infection, isolation in a sanatorium or hospital was enforced. The government authorities have gone even farther. No one can become a resident of the State of Victoria who has tuberculosis. This may seem drastic, but how else are we to obtain control of this disease? Either we can go on as at present trusting in a gradual but very slow reduction in the incidence of the disease, or we can adopt measures which involve a wholesale clean-up of unsanitary conditions which foster infection and in addition isolate all those known to have tubercle bacilli in their sputum.

This rather sketchy review illustrates sufficiently clearly what is meant by health being purchasable. All the diseases I have mentioned belong to this class and it is by reducing the incidence of this group that a reduction in the mortality rate is going to be obtained. By its attack on the preventable diseases Australia has, in twenty-five years, reduced her death-rate from 17 or 18 per thousand to 8 per thousand. A rate of 10 to 11 per thousand may be a normal rate for old established communities, for it is obvious that the deaths incident to old age and which represent the wear and tear of life are inevitable. Hearts will eventually play out; arteries will lose their elasticity and kidneys finally are unable to perform their functions. Such things are to be expected, and while the general average of life may be increased, we must expect a reasonable death-rate. The real significance of a death-rate is to be determined by two factors: (1) the age period and (2) the causes which contribute to it. The majority of deaths over fifty are unavoidable, as they represent conditions incident to advancing years. A high death-rate under fifty represents, for the best part, conditions which are preventable. And this is what is meant by the statement—"Within natural limitations a community can determine its own death-rate."

It is obvious that nothing can be done towards eradicating or reducing the incidence of the preventable diseases without the expenditure of money, and for such a purpose it is not

unreasonable to advise extravagance. Fortunately, the appropriation of money for this purpose need not be made on an extravagant basis; a liberal expenditure, however, is absolutely essential in order to obtain results.

Let us take, for example, the most liberal budget for purposes of public sanitation that I know of, namely: the work on the Canal Zone. According to General Gorgas there was an average working population of 150,000. The annual budget of the Sanitary Department was $365,000, which represents one cent per capita per day. Considering the results obtained and the difficulties surrounding the work, the sanitation of Panama has not been costly, representing, as it does, less than one per cent of the total appropriation for all purposes. And when we consider further the low death-rate and take into account the fact that the canal could not have been built without the work of the Sanitary Department, the amount of money appropriated for this purpose was certainly well spent. Gorgas considers that a tax of one cent per capita per day, or $3.65 per capita per year, is well within the means of any tropical country.

Taking this rate as a standard, let us compare it with some of the budgets of our cities in the United States proper, all of which are financially able to afford a liberal health budget, and none of which have the difficulties which exist in Panama to contend against. New York, which is probably the most liberal city in the country in regard to the expenditure of money for health purposes, provides a budget which represents about sixty cents per capita per year. This represents 1½ per cent of the city's annual expenditure as compared to 5 per cent for fire protection and 9 per cent for the police.

In 1911 the Chicago Department of Health asked for $1,500,000 a year for health purposes, and received about $600,000. The following comment from an official authority of high standing is illuminating:

"Chicago now has a 21-cent per capita health department. A 21-cent health department for Chicago can hold the gross

death-rate under 16 per 1,000 for a few years. It can hold the number of deaths from diphtheria at about 800; scarlet fever at about 600; typhoid at about 300, and baby deaths from summer complaint at about 3,000. It can keep smallpox epidemics at about twelve years apart, and paralyzing epidemics of diphtheria or scarlet fever about four or six years apart.

"A health department spending fifty cents per capita should put diphtheria down to, say, 100 deaths per year; scarlet fever to about 500; typhoid to 120, and cut off 5 per cent from the consumption mortality. It should be able to add ten years to the smallpox intervals, and three or four years to the diphtheria and scarlet fever intervals.

"The final conclusion is that we can have freedom from preventable diseases in proportion as we are willing to pay for it. We cannot have something for nothing. A 21-cent health department means about 15,000 deaths from preventable diseases a year. If we pay more, we will have fewer. If we pay less, we shall have more.

"Which shall it be: dollars or deaths?" (Quoted by Veiller, *Annals of the American Academy of Political and Social Science*, March, 1911.)

The city of Philadelphia for some years has appropriated for health purposes about $550,000, $200,000 of which is expended in maintaining the Municipal Hospital for Contagious Diseases. This leaves about $350,000 for preventive work. This means that because of lack of funds the various activities of the department are hampered, and in some instances, such as the supervision of perishable foods, nothing is done. The citizens of Philadelphia, or rather their rulers, have provided a Health Department and a budget which represents an expenditure of about 23 per capita per year. If the tax for health purposes represented one-half a cent per day per capita ($1.70 per capita per year), a budget of $2,500,000 could be provided. This would furnish an efficient health department and permit of an expenditure of about $1,000,000 a year towards ridding the city of many unsanitary evils, such

as open privy vaults, surface drainage, blind alleys, interior courts, uninhabitable houses, etc. In ten years the tax could probably be reduced to one-quarter of a cent per capita per day.

The problem in rural communities is essentially the same as that of the cities. The whole question is largely one of money, and as I have already emphasized, the liberal, and not the extravagant use of money.

We of the medical profession have two facts to consider, the full significance of which must be grasped.

In the first place we have got to realize that sanitary science has become a distinct branch of medicine and requires special training, just as much as does any other specialty. The day has passed when a community can afford to tolerate health officers who are untrained for the task to which they are appointed.

The intelligent community is, in the near future, going to demand that the head of its health department be a man who knows what to do and how to do it. The old hit or miss policy that exists pretty generally throughout the country is already doomed. "Unless guidance of the public in this direction is to be left to sociologists, and among these, enthusiasts, faddists and blundering well-meaners, the medical profession must be not only better educated, but differently educated. Not only is the profession not well trained in sanitary science, but it is still less well trained in the philosophy and principles of hygiene." (Favill.)

In the second place the profession, as a whole, has got to take a more active interest in the development of sanitary science. At the present time the agitation for improvement in public health matters has been markedly an individual matter. As Favill has well said, the rank and file of physicians has exhibited the same indifference, a large measure of unintelligence and occasional misguided opposition to progress in this line. These facts are vital to the whole matter; until the profession as a whole can consider itself an instructor of the people, progress will be slow and fragmentary.

In strong contrast to the passive attitude of the medical profession is that of the nurses. More and more nurses are equipping themselves for public health work, and by so doing are rendering invaluable service both as educators and as demonstrators. No less an authority than Hermann M. Biggs, Commissioner of Health of the State of New York, has stated that "the rural and visiting nurse is the foundation of all constructive public health work and indispensable for its proper development."

Three years ago the Phipps Institute, in Philadelphia, opened an eight months' course for graduate nurses in public health work. The students are given practical experience in visiting nurse work, rural nursing, infant mortality problems, school inspection, housing, tuberculosis and other infectious diseases and hospital social service. The first year we had three students; the second year fourteen, and the present class numbers twenty, which is the maximum number we can handle. The demand for nurses with this training is far greater than the present supply, as more and more rural communities and small towns are seeking their services. I am reasonably certain that in many instances the public health nurse has a better knowledge of and keener insight into the problem than the average health officer of our smaller towns and cities. Sooner or later the demand for health officers, especially trained for the work, is going to become imperative. More and more we are veering towards governmental control of health problems, and the medical profession must prepare itself to meet this change.

The last aspect of the subject on which I wish to touch is the attitude of our legislators and public officials. Have you ever stopped to consider the vast amount of money which is annually appropriated for all sorts of public improvements? Millions and millions are expended for beautifying our cities, for improving roads and increasing and improving transit facilities. In many instances the charge of extravagance is well grounded. When we come to consider the amount of

money expended for improving the health of the community, however, not extravagance or even liberality is the rule, but almost invariably parsimoniousness. How are we to change this and bring about a more liberal expenditure of money for health purposes? Personally I do not think we can expect that our officials are apt to change their attitude. Everywhere throughout the country more money is being asked for, and everywhere the amount granted falls far below what is needed. The remedy lies in the education of the people, and this is properly the function of the medical profession. I am ashamed to say that in this regard the profession has neglected both its opportunity and its duty, and that the credit for many advances in the improvement of health conditions belongs to the lay sociologist. If the people were reliably informed as to the menace of certain unsanitary evils and if it was furthermore brought home to them that thousands of lives are annually sacrificed and even more rendered inefficient because of the lack of proper safeguards, I am certain they would demand the election of officials who would afford them adequate protection. It was once said by Disraeli, if I remember rightly, "that the first consideration of an enlightened statesman should be the health of the people." Let us see to it, therefore, that we all do our full share towards providing officials of this type, and let us lose no opportunity to emphasize the fact that "Health is purchasable. Within natural limitations a community can determine its own death-rate."

THE SEA AND THE SAILOR IN FICTION

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Those of us who have crossed the Atlantic in the great transatlantic steamers must undoubtedly feel that one of the great achievements of modern science is its victory over the brute force of wind and water. Danger, as far as human foresight goes, still exists in the shape of fogs, icebergs (and at times submarines), but the danger of the wind and heavy sea is scarcely apparent to the ordinary passenger, who walks a deck so high above the water and can find so many sheltered nooks on that deck, that he is often unaware whether a strong wind is blowing or whether it is the wind created by the motion of the mighty boat. He starts at a stated time, and fully expects to reach and does in general reach his destination at a time which mostly varies only by a matter of a few hours on each trip. He perhaps crosses the Atlantic many times without coming in contact with the force, majesty and, we might say, brute maliciousness of wind and water.

How much more was the passenger of the sailing ship or even of the earlier passenger steamer exposed to these forces. On unsheltered decks that seemed to him at least but a few feet above the water, he came in personal contact with these elements, and the uncertainty as to time of arrival was not a matter of a few hours, but of days, weeks, on longer voyages even of months.

And if this is true of the passenger who perhaps spends but a few days of his life on the ocean, how much more must it be so of the professional sailor, be he in the navy or merchant service, before the mast or on the quarterdeck (to use a modern expression, "on the bridge")! At present we live in a period

where the older sailors have had their early training on sailing ships, but the passing of the sailing ship is merely a question of time, and in a few years the sailor of the sailing ship will be a rarity, except, perhaps, here in the States, where the American coasting schooner seems for the present to be holding her own against steam. From a purely practical point of view this fact need not be deplored. Good steamship sailors can be trained on steamers, just as I have no doubt many of us can run a motorboat successfully and yet know next to nothing about sailing a boat. But with the passing of the sailing ship there passes also a certain romance which a seafaring life has always had for many of us, owing, no doubt, greatly to its very uncertainty; and there passes, above all, a type of men whose lives had been spent in such close contact with the forces of wind and water, with the endeavor to subdue these forces to their own purpose, sometimes with success, sometimes unsuccessfully, that their very character had been molded thereby—and they had certain characteristics peculiar to their profession. Some of these characteristics are well described by a modern writer, Mr. Conrad, in one of his earlier books, "The Nigger of the Narcissus": "They had been strong, as those are strong who know neither doubts nor hopes. They had been impatient and enduring, turbulent and devoted, unruly and faithful. Well-meaning people had tried to represent these men as whining over every mouthful of their food; as going about their work in fear of their lives. But in truth they had been men who knew toil, privation, violence, debauchery—but knew not fear, and had no desire of spite in their hearts. Men hard to manage, but easy to inspire; voiceless men—but men enough to scorn in their hearts the sentimental voices that bewailed the hardness of their fate. It was a fate unique and their own; the capacity to bear it appeared to them the privilege of the chosen! Their generation lived inarticulate and indispensable, without knowing the sweetness of affections or the refuge of a home—and died free from the dark menace of a narrow grave. They were the everlasting children of the mysterious sea. They

were strong and mute, they were effaced, bowing and enduring, like stone caryatides that hold up in the night the lighted halls of a resplendent and glorious edifice."

In another of his earlier works, "The Mirror of the Sea," the same writer sums up very clearly the difference between the sailor of a passing age and of the present and coming age in the following lines: "The sailing of any vessel afloat is an art whose fine form seems already receding from us on its way to the overshadowed Valley of Oblivion. The taking of a modern steamship about the world (though one would not minimize its responsibilities) has not the same quality of intimacy with nature, which, after all, is an indispensable condition to the building up of an art. It is less personal and a more exact calling; less arduous, but also less gratifying in the lack of close communion between the artist and the medium of his art. It is, in short, less a matter of love. Its effects are measured exactly in time and space as no effect of an art can be. It is an occupation which a man not desperately subject to seasickness can be imagined to follow with content, without enthusiasm, with industry, without affection. Punctuality is its watchword. The incertitude which attends closely every artistic endeavor is absent from its regulated enterprise. It has no great moments of self-confidence, or moments not less great of doubt and heart-searching. It is an industry which, like other industries, has its romance, its honor and its rewards, its bitter anxieties and its hours of ease. But such sea-going has not the artistic quality of a single-handed struggle with something much greater than yourself; it is not the laborious, absorbing practice of an art whose ultimate result remains on the knees of the gods. It is not an individual, temperamental achievement, but simply the skilled use of a captured force, merely another step forward upon the way of universal conquest." And then again:—"To the man of masts and sails the sea is not a navigable element, but an intimate companion. The length of passages, the growing sense of solitude, the close dependence upon the very forces that, friendly today, without changing their nature, by the

mere putting forth of their might, become dangerous tomorrow, make for that sense of fellowship which modern seamen, good men as they are, cannot hope to know. And, besides, your modern ship, which is a steamship, makes her passages on other principles than yielding to the weather and humoring the sea. She receives smashing blows, but she advances; it is a slugging fight and not a scientific campaign. The machinery, the steel, the fire, the steam have stepped in between the man and the sea. A modern fleet of ships does not so much make use of the sea as exploit a highway. The modern ship is not the sport of the waves. Let us say that each of her voyages is a triumphant progress; and yet it is a question whether it is not a more subtle and more human triumph, to be the sport of the waves and yet survive, achieving your end."

The finest and most modern sailing ship of the present day is, after all, but a lineal descendant of the caravel of ancient times or the Chinese junk; the sailing ship sailor is the direct professional descendant of the sailor who manned these ancient lumbering crafts. But the steamer is no lineal descendant of the sailing ship, but only its successor. So also the steamship seaman of the future (and we might almost say of the present) is not the descendant of the old-time sailor, but his successor. As Mr. Conrad says: "Our ships of yesterday will stand to the ship of the future as no lineal ancestors, but as mere predecessors whose course will have been run and the race extinct!"

We all know how the prophetic genius of the artist Turner immortalized, seventy-five years ago, this coming event in his noble old line of battleship "Temeraire" with the puffing tugboat and the setting sun.

Most remarkable it is that just at this epoch of almost complete transformation of navigation, the seafaring profession itself has produced two writers of note, who have immortalized, the one in verse, the other in prose, not only the romance, but also the realism of a passing age. I refer to Mr. John Masefield and Mr. Joseph Conrad. That England should have pro-

duced these writers is not so remarkable, for they are the successors of a goodly list of sea-writers in a country where, as Mr. Conrad says: "Men and sea interpenetrate, so to speak—the sea entering into the life of most men, and the men knowing something or everything about the sea, in the way of amusement, of travel, or of bread-winning."

However much we may dispute England's claim of Britannia ruling the waves, yet we cannot deny that in Britain, more than in any other country, the seafaring profession has been held in high regard and esteem and hence has been able to attract to its merchant service as officers men of a better class. If the Polish boy Korzeniowski (the native name of Mr. Conrad), born in the Ukraine, far from the sea, with no sea traditions in his surroundings or family, becomes one of the greatest sea novelists of English literature and thus contributes to the greatness of English letters, some credit may be attributed to the above fact. For it was not by the blind accident of birth, such as some Germans claim gave a Shakespeare to England, but by deliberate and voluntary selection of a nationality that Mr. Conrad came to write in English.

Mr. John Masefield could never have written his "Story of a Round House" unless he had followed the sea as a profession, and thus have come in close and intimate touch with the old-time sailing-ship sailor and the sea as seen and felt from the deck of a sailing ship. For a coming generation the "Story of a Round House" will be a poetic and yet realistic rendering of life on a sailing ship when the sailing ship and the men that manned her are extinct. And the same is true of Mr. Conrad's "The Nigger of the Narcissus." Both of these modern sea writers have achieved that great success which is, after all, the highest aim of modern art: to render the realties of the life they would portray in artistic garb. Their success lies perhaps in the very fact that they portray a life which they themselves lived at one time sympathetically. Just this quality seems to be lacking in two earlier writers of sea fiction whom I will briefly discuss, Daniel Defoe and Tobias Smollett. Neither of

these men was, however, a professional sailor, and, although they had been at sea themselves, yet evidently they had but little love for the fickle element.

"Robinson Crusoe," by Daniel Defoe, published in 1719, can, I think, be classed as the first classical sea-novel in English literature. And yet Defoe's attitude to the sea and a seafaring life is far from sympathetic. He shows a dislike or rather a dread of the sea and no high opinion of sailors. He describes the sea only in its grimmest aspects. In fact, all the trouble and misery which Robinson has later to endure is, according to Defoe's presentation, only a punishment brought upon the hero by his wicked waywardness in wanting to go to sea against his father's advice and wish. Robinson's desire for a seafaring life is described as a "fatal propension of nature, tending directly to the life of misery which was to befall him." When we consider that England, and in the last twenty years or so Germany likewise, owe their supremacy on the seas, partly at least to the fact that their merchant marine is manned to a great extent by officers coming from the respectable middle class, it sounds strange to us that Robinson's father tells his son "that the sea is only a career for men of desperate fortunes on one hand, or of superior fortunes on the other, who went abroad upon adventures, aspiring to rise by enterprise and make themselves famous in undertakings of a nature out of the common road; that these things were all either too far above him or too far below him." Nor does Robinson show himself very heroic on his first adventure at sea, where at the first storm he describes his feelings in the following words: "In this agony of mind I made many vows and resolutions, that if it would please God to spare my life this voyage, if ever I got my foot once on dry land, I would go directly home to my father and never set it into a ship again while I lived." However, by the help of drink he later forgets his repentance, but really never becomes a professional sailor, for, as he says: "It was my great misfortune that in all these adventures I did not ship myself as a sailor, whereby I might have learned the duty and

office of a foremast man, and in time might have qualified myself for a mate or lieutenant, if not a master. Instead of that I would always go on board in the habit of a gentleman, and so I neither had any business in the ship, nor learned to do any." In his description of the sea Defoe is as unsympathetic towards its moods as he is towards his sailors. Storms follow on storms, and although Defoe describes them and their effect realistically enough, yet we feel that the grandeur and the beauty of the sea are unknown to him. Of one of the first storms his hero encounters he only says: "Such a dismal sight I never saw, the sea went mountains high and broke on us every three or four minutes. When I could look about, I could see nothing but distress around me!"

In Defoe's other sea-novel, "The Life, Adventures and Piracies of the Famous Captain Singleton," the hero is altogether a worthless character, and the actions recounted of him are such as few readers would take delight in. From the nature of the story these, indeed, could not be much otherwise. Singleton is probably a faithful portrait of a numerous herd of rascally adventurers that swarmed upon the seas at that period. The events of his life are those of any other pirate, but diversified by some strange adventures, which owe their existence to the fertile brain of Defoe. The picture which Defoe makes his hero draw of the crew of a Portuguese vessel on which he makes his first adventure to sea, is certainly not flattering to the Portuguese nation, which he calls "the most perfidious and the most debauched, the most insolent and cruel, of any that pretend to call themselves Christians, in the world." The crew he describes in the following words: "Thieving, lying, swearing, forswearing, joined to the most abominable lewdness, was the stated practice of the ship's crew; adding to it that, with the most unsufferable boasts of their own courage, they were, generally speaking, the most complete cowards that I ever met." However, as Defoe shows no great esteem for the sailors of his own nationality, we are not surprised when he is so severe on foreign sailors, especially Portuguese, of whom he

later on says: "That it is natural to an Englishman to make the devil and a Portuguese equally his aversion."

Tobias Smollett, in "Roderick Random," his first novel, published 1748, which is partly at least autobiographical, among many other adventures, makes his hero go to sea first in the navy and later on a slaver. As "Roderick Random" belongs to that type of novel which leads the hero from adventure to adventure, the so-called "picaresque novel," not much description of scenery of any sort is to be expected, nor is it to be found. Thus, although we have a very realistic description of the disastrous Carthagena expedition and of a naval battle, nowhere do we find a sympathetic description of the sea, of storms, of impressions of the vast force of nature. In two sentences only does he describe a storm, viz: "The sea was swelled into billows mountains high, on the top of which our ship sometimes hung as if it was about to be precipitated to the abyss below. Sometimes we sunk between two waves that rose on each side higher than our topmast head, and threatened, by dashing together, to overwhelm us in a moment." But even if Smollett shows little interest in the poetry or grandeur of the sea, he is, on the other hand, the inventor of a type of eccentric sailor which many writers have used after him, though none, to my knowledge, had drawn the type before him. I refer to the hero's uncle, who bears the very suggestive name of "Tom Bowling," the bluff, brave seaman of nautical and profane, not to say obscene tongue, but of true, kindly heart. As Tom Bowling is the progenitor of countless sailors in English fiction, amongst whom I need but mention the Immortal Captain Cuttle and his friend, Captain Bunsby in Dickens' "Dombey and Son," Smollett's description of him may be of some interest: "Bowling was unacquainted with the ways of men in general, to which his education on board had kept him an utter stranger. He was a strong built man, somewhat bandy-legged, with a neck like that of a bull and a face which, you might easily perceive, had withstood the most obstinate assaults of the weather. His dress consisted of a soldier's coat, altered for him by the ship's

tailor, a striped flannel jacket, a pair of red breeches, japanned with pitch, clean, grey worsted stockings, large silver buckles, that covered three-fourths of his shoes, a silver-laced hat, whose crown overlooked the brims about an inch and a half, a black bag wig in buckle, a check shirt, a silk handkerchief, an hanger with a brass handle, girded to his thigh by a tarnished laced belt, and a good oak plant under his arm." Certainly a strange costume for an officer of the British navy! His speech evidently matched his strange costume. I give a few passages which show that Smollett's gallant sailor does not suffer from over-refinement of language: "Lookee, you lubber, if you come athwart me, ware your gingerbread work; I'll be foul of your quarter, d—n me!" "None of your jaw, you swab, else I'll trim your laced jacket for you. I shall rub you down with an oakum towel! Bear a hand, damme! must I bring to every minute for you, you lazy dog!" The other sailors to whom we are introduced by Smollett are the brutal and tyrannical Captain Oakum, who has undoubtedly served as a type of sea-tyrant for later writers, and the common sailor, Jack Rattlin; loyal, brave and honest, unable to read or write, in short a type of the man-before-the-mast whom we shall meet with again in Marryat's and Cooper's sea-novels. On the whole, Smollett's description of the life in the navy in his day is not flattering to that branch of the service; it shows plainly the author himself had no great love for the sea. But if, as already mentioned, Defoe and Smollett show little love for the sea and a tendency to portray sailors in no favorable light, owing probably partly to the fact that they were themselves not professional sailors and partly to a tradition in literature which, as Mr. Masefield says, "recognizes and makes significant only the grimmest aspects of the sea and of the life of its followers," this can not be said of a sea writer whose novels have inspired many a boy with a longing for the sea and to whom many of us older men owe many pleasant hours of innocent amusement in our younger days—Captain Frederick Marryat, born in 1792, and whose most popular novel, "Mr. Midshipman Easy,"

appeared in 1836. Marryat shows in his many novels plainly the influence of Smollett, but he is less coarse and has a higher sense of morality. In spite of a certain coarseness natural to the novel of that period, his "Peter Simple" can still rank today as a classic book for boys, to be safely recommended to every healthy boy fond of adventure. Marryat's books owe (or perhaps I should say "owed") their popularity to the fact that he is a born story-teller, and that his characters and the incidents he portrays seem real, owing to his drawing largely on his own experience in the navy for both incidents and character. No doubt one must attribute the life and vigor of his splendid stories of the sea partly to the autobiographical nature of his work, the result of twenty-four years in the navy in the days of privateering, slave-trading and smuggling. Although Marryat himself did not go to sea until 1806 (at the age of fourteen) and thus only saw the end of the Napoleonic wars, yet he undoubtedly had opportunity enough to hear the yarns of the older men who had fought under such men as Nelson, who, as Mr. Conrad says, had "breathed into the soul of the navy his own passion of honor and fame." A good deal of this spirit is reflected in Marryat's seamen, whether officers or before the mast, not men of high intellectuality, but men of an unswerving sense of duty and honor, who, going to sea at an early age, had been trained by that eternal struggle between man and the elements so keen in the days of sail. Like Smollett, however, Marryat is chiefly concerned with hurrying his hero from adventure to adventure, and thus descriptions of storms and of the sea in general rarely occur in his sea-novels. In description he is probably at his best in his lively and realistic portrayal of naval battles, generally encounters between frigates, where the skilful handling of the vessel is accurately told. In his "Midshipman Easy," for instance, there is only one short description of a storm in the Mediterranean, off the coast of Spain, as compared to numerous descriptions of naval engagements, prize-taking, etc. I quote this passage as an example of Marryat's style: "The sky, which had been clear

in the morning, was now overcast, the sun was obscured with opaque white clouds, and the sea was rising fast. Another ten minutes, and then they were under double-reefed topsails, and the squalls were accompanied with heavy rain. The frigate now dashed through the waves, foaming in her course and straining under the press of sail. The horizon was so thick that the vessels ahead were no longer to be seen. The mainsail was taken off, and the frigate appeared to be immediately relieved. She no longer jerked and plunged as before. . . . The sky now assumed a different appearance—the white clouds had been exchanged for others dark and murky, the wind roared at intervals, and the rain came down in torrents. Then the wind lulled—for a minute it was quite calm, and the frigate was on an even keel. Hardly were the braces stretched along in order to meet a change of wind before the wind flew round to the southwest with a loud roar. The yards being squared, the frigate flew before the gale under her foresail and topsails close reefed. The weather was now so thick that nothing could be observed twenty yards from the vessel; the thunder pealed and the lightning darted in every direction over the dark expanse. Suddenly a tremendous noise was heard, a shock was felt throughout the whole ship, which trembled fore and aft as if it was about to fall to pieces, and the frigate was down on her beam-ends. The foremast of the frigate had been struck by lightning, had been riven into several pieces, and had fallen over the larboard bow, carrying with it the main topmast and jib-boom. The jagged stump of the foremast was in flames and burnt brightly, notwithstanding the rain fell in torrents. The ship, as soon as the foremast and main topmast had gone overboard, broached to furiously, throwing the men over the wheel and dashing them senseless against the caronades; the forecastle, the fore part of the main deck, and even the lower deck, were spread with men either killed or seriously wounded, or insensible from the electric shock. The frigate was still on her beam-ends, and the sea broke furiously over her; all was dark as pitch, except the light from the blazing stump of the

foremast, appearing like a torch held up by wild demons of the storm, or when occasionally the gleaming lightning cast a momentary glare, threatening every moment to repeat its attack upon the vessel, while the deafening thunder burst almost on their devoted heads."

Unlike Defoe, Marryat believes that their very calling makes sailors at heart religious, when he says: "How wrong are those on shore who assert that sailors are not religious! How is it possible, supposing them to be possessed of feeling, to be otherwise? On shore, where you have nothing but the change of seasons, each in its own peculiar beauty—nothing but the blessings of the earth, its fruits, its flowers—nothing but the bounty, the comfort, the luxuries which have been invented, where you can rise in the morning in peace and lay down your head at night in security—God may be neglected and forgotten for a long time; but at sea, when each gale is a warning, each disaster acts as a check, each escape as a homily upon the forbearance of Providence, that man must be indeed brutalized who does not feel that God is there. On shore we seldom view Him but in all His beauty and kindness; but at sea we are as often reminded how terrible He is in His wrath. In their courage and activity sailors may appear reckless, but in their hearts they acknowledge and bow unto their God."

In Marryat's novel, "Percival Keene," the author gives us the following conversation between a boat-swain's mate and a fore-top man on the subject of heaven:

"I wonder, Bill, whether I shall ever go to heaven?"

"Why not?" replied the boatswain's mate.

"Why, the parson says it's good works; now, I certainly have been a pretty many times in action, and I have killed plenty of Frenchmen in my time."

"Well, that's sufficient, I should think; I hold my hopes upon just the same claims. I've cut down fifty Frenchmen in my life, and if that ain't good works, I don't know what is!"

"I suppose Nelson's in heaven?"

"Of course; if so be he wishes to be there, I should like to know who would keep him out, if he was determined on it; no, no; depend upon it he walked slap in."

A typical sailor of the old school is Marryat's Coxswain Swinburne, in "Peter Simple," a worthy lineal descendant of Chaucer's shipman or of Shakespeare's boatswain, but a little milder and gentler and hence more to our liking. As Mr. Masefield says: "The poetic, or sea-bear sailor, who bawls and drinks and raps you out oaths and bangs upon the tables with his cudgels, is always to be found even at the present day. One can find him on blue-water ships; and where he exists he is the best man in the vessel. He is not fitted to command, but he is excellent before the mast. He has hardly changed since Chaucer's time. One could find a dozen like Chaucer's shipman in any dock in Liverpool or New York, Sydney or San Francisco. He no longer wears 'faldying,' or rough Irish frieze, but he is never without a knife (as he will tell you himself in a coarse proverb), and he is tanned by the wind and the sun, and he is a good fellow, a good comrade, a standby in any sudden trouble. It is significant that Chaucer notes the goodness of his fellowship directly he has drawn his portrait. He describes him riding as he 'couthe' (as well, that is, as a sailor generally rides—something like a sack), and he tells us of his clothes, and knife, and tan. Directly the man has been defined for us, Chaucer points out his chief characteristic—

"And certainly he was a good felawe"

that being the one supremely attractive thing in all sailors. For the rest, he is a mere ruffian with a knavish trick of broaching the wine casks in the hold 'while that the chapman sleep.' 'Of nyce conscience,' or tenderness or ordinary human mercy, he is careless. But with all brutality and cunning he is a craftsman and a knowledgeable fellow. He can reckon the tides, he knows the currents, he is a good pilot of the Channel and its ports of call, while he can stow a ship's hold like an

artist. With all this, he is weather-beaten and toughened by the sea. He is hardy and 'wise to undertake'; not reckless, but valiant and trusty. On the whole Chaucer's shipman is the most perfect sailor in creative writing." Marryat's Swinburne has most of these characteristics in milder form; he is a good type of many of the sailors in Marryat's and Cooper's novels.

One of the most original characters of Marryat's creation is, however, the boatswain Chucks in "Peter Simple," like Swinburne, a typical sailor as handed down in literature, but having in addition an inborn desire to conform his speech and manners to those of a gentleman. For those unacquainted with Marryat's "Peter Simple," the following may serve as a specimen of his way of reprimanding a sailor: "Allow me to observe, my dear man, in the most delicate way in the world, that you are spilling that tar upon the deck—a deck, sir, if I may venture to make the observation, I had the duty of seeing holystoned this morning. You understand me, sir, you have defiled his majesty's forecastle. I must do my duty, sir, if you neglect yours; so take that—and that—and that—(thrashing the man with a rattan), you damned hay-making son of a sea-cook. Do it again, damn your eyes, and I'll cut your liver out." Mr. Chucks excuses his bad language as follows: "Swearing is absolutely requisite, and not at all sinful for a boatswain. There is one language for the pulpit, and another for on board ship, and, in either situation, a man must make use of those terms most likely to produce the necessary effect upon his listener. Whether it is from long custom in the service, or from the indifference of a sailor to all common things and language, perhaps constant excitement may do, and therefore he requires more 'stimilis,' as they call it, to make him move. Certain it is, that common parlancy won't do with a common seaman. It is not here as in the scriptures, 'Do this, and he doeth it (by the bye, that chap must have had his soldiers in tight order), but it is 'Do this, damn your eyes,' and then it is done directly. The order to do just carries the weight of a cannon shot, but it

wants the propelling power—the damn—is the gunpowder which sets it flying in the execution of duty."

Although this lecture is confined to the Sea and the Sailor in prose-writers, I may mention that Marryat wrote several sea-ballads which have more of the true flavor of the forecastle and the sailor of the eighteenth century than the more popular, but somewhat mawkish ballads of Dibdin and others. They will be found interspersed in his novels and, as Mr. Masefield observes of most sea-ballads, to be appreciated must be sung by men with voices like a gale of wind. Here is one entitled "Port Admiral":

'Twas at the landing-place that's just below Mount Wyse,
Poll lean'd against the sentry's box, a tear in both her eyes;
Her apron twisted round her arms, all for to keep them warm,
Being a windy Christmas Day, and also a snow-storm.

And Bet and Sue
Both stood there, too,
A-shivering by her side;
They both were dumb,
And both look'd glum,
As they watch'd the ebbing tide.

Poll put her arms a-kimbo,
At the admiral's house look'd she,
To thoughts before in limbo
She now a vent gave free:
"You have sent the ship in a gale to work
On a lee shore to be jamm'd,
I'll give you a piece of my mind, old Turk,
Port Admiral, you be damned."

Who ever heard in the service of a frigate made to sail
On Christmas Day, it blowing hard, with sleet, and snow, and hail?
I wish I had the fishing of your back that is so bent,
I'd use the galley poker hot unto your heart's content.

Here Bet and Sue
Are with me too,
A-shivering by my side;
They both are dumb,
And both look glum,
And watch the ebbing tide.

Poll put her arms a-kimbo,
At the admiral's house look'd she,
To thoughts that were in limbo
She now a vent gave free:
"You've got a roaring fire, I'll bet,
In it your toes are jamm'd;
Let's give him a piece of our mind, my Bet,
Port Admiral, you be damned."

Another one breathes the spirit of a navy flushed and inspired by Nelson's victories:

The Captain stood on the carronade—"First lieutenant," says he,
"Send all my merry men aft here, for they must list to me;
I haven't the gift of the gab, my sons, because I'm bred to the sea;
That ship there is a Frenchman, who means to fight with we.
Odds blood, hammer and tongs, long as I've been to sea,
I've fought 'gainst every odds—but I've gained the victory."

"That ship there is a Frenchman, and if we don't take she,
'Tis a thousand bullets to one, that she will capture we;
I haven't the gift of the gab, my boys; so each man to his gun;
If she's not mine in half an hour, I'll flog each mother's son.
Odds bobs, hammer and tongs, long as I've been to sea,
I've fought 'gainst every odds—and I've gained the victory."

We fought for twenty minutes, when the Frenchman had enough;
"I little thought," said he, "that your men were of such stuff;"
The captain took the Frenchman's sword, a low bow made to he;
"I haven't the gift of the gab, monsieur, but polite I wish to be.
Odds bobs, hammer and tongs, long as I've been to sea,
I've fought 'gainst every odds—and I've gained the victory."

Our captain sent for all of us: "My merry men," said he,
"I haven't the gift of the gab, my lads, but yet I thankful be;
You've done your duty handsomely, each man stood to his gun;
If you hadn't, you villains, as sure as day, I'd have flogged each mother's son.
Odds bobs, hammer and tongs, as long as I'm at sea,
I'll fight 'gainst every odds—and I'll gain the victory."

An almost forgotten sea-novelist of the first half of the nineteenth century is Michael Scott, the author of "Tom Cringle's

Log" and other sea-novels. Michael Scott has considerable merit as a sea-writer, his style is breezy and entertaining, he keeps up the interest by hurrying his hero through sea-battles, storms, adventures and sprees on shore, etc.; in fact the life of a naval officer in the days of fighting the French, Spanish, Americans, slavers and smugglers. "Tom Cringle's Log" is written in the form of a log kept by the hero, a young naval officer. It has considerable humor in it, although at times somewhat forced, like so many novels of that period. For our present taste, it suffers from its length. It contains besides naval life, however, some very good descriptions of life in the British West Indies in the days of slavery, the author himself is evidently opposed to Canning and the liberation of the slave. For young America it should have some interest, as it contains accounts of one or two engagements with American ships in the War of 1812. Written by a man who is evidently otherwise firmly persuaded that Providence meant the British sailor to rule the ocean, the following passages may be considered of interest to us here in America, and highly complimentary to the small American navy of that day: "I don't like Americans; I never did, and never shall like them. I have seldom met with an American gentleman in the large and complete sense of the term. I have no wish to eat with them, drink with them, deal with them, or consort with them in any way; but let me tell the whole truth, nor fight with them, were it not for the laurels to be acquired, by overcoming an enemy so brave, determined, and alert, and every way so worthy of one's steel, as they have always proved. One used to fight with a Frenchman, as a matter of course, and for the fun of the thing, as it were, never dreaming of the possibility of Johnny Crapeau beating us, where there was anything approaching to an equality of force; but say as much as we please about larger ships and more men, and a variety of excuses which proud John Bull, with some truth very often I will admit, has thrust forward to palliate his losses during the short war, a regard for truth and fair dealing, which I hope are no scarce qualities among British seamen, compels

me to admit, that although I would of course peril my life and credit more readily with an English crew, yet I believe a feather would turn the scale between the countries, so far as courage and seamanship goes; and let it not be forgotten, although we have now regained our superiority in this respect, yet, in gunnery and smallarms practice, we were as thoroughly weathered on by the Americans during the war, as we overtopped them in the bull-dog courage with which our boarders handled those genuine English weapons, the cutlass and the pike."

In another passage in this book the author says: "Grappling in mortal combat on the blood-slippery quarterdeck of an enemy's vessel, a British sailor is the bravest of the brave. No sailor of any other country, saving and excepting those damned Yankees, can stand against him."

In accuracy of detail in seamanship, Fenimore Cooper's sea-stories are unsurpassed, but he lacks the vivacity and humor of Marryat. He seems at home in vessels of every rig, from the sloop to the line-of-battle ship, merchantman or man-of-war, and in description of the handling of vessels in difficult positions he can hold the interest of any nautical man. His accurate description of repairs to the rigging or hull of a vessel are most instructive. His ships and their doings are truer to life than their crews, for his sailors are often not very convincing. This is, however, probably more due to the school of writers to which he belongs than to lack of knowledge, for in the "Sea Lions" he gives us a very convincing picture of the sea-faring men, half agriculturists, half seamen, such as are still to be found among the older inhabitants of Martha's Vineyard and Cape Cod. His seamen are seldom profane or brutal, but many are religious, God-fearing men, such as undoubtedly are still to be found among the sea-faring class of Puritan descent of New England. He shows a high esteem and sympathy for the sailor, whether in the navy or merchant service, officer or common seaman. Descriptions of the sea in its various moods are not so frequent with Cooper. When, however, he does give them he is as successful as with his ships. He seems at home

on the sea in all climes, from the calms and hurricanes of the tropics to the icy gales of the Antarctic seas. His intimate knowledge of the American coast shows careful study and practical experience. One feels that in Cooper's hands any vessel will be well handled, his seamen may make mistakes, but the master-hand that guides them will not.

A novelist who has very truthfully and faithfully portrayed life in the merchant service in sailing ships is W. Clark Russell. Of the numerous sea-novels he wrote, "The Wreck of the Grosvenor" is undoubtedly the best. The book is, however, rather one-sided, as Russell wrote his sea-novels (besides contributions to the daily papers) with the purpose of interesting the public in the betterment of the life of sailors in the merchant service. It can be truthfully said that, even if Clark Russell's merits as a novelist are not of the highest order, the sailor of the British Merchant Service owes him a debt of gratitude for the interest he aroused in England in the condition of that service. As Clark Russell had been to sea in the merchant service in his younger days, his description of ships and sailors, whether before or abaft the mast, is realistic and shows that the author has entirely freed himself from the old traditional book-sailor. As he wrote many of his books for a definite purpose, he can very well be forgiven for a tendency to make (in some of his books, at least) his captains, mates and owners less humane and his crew more ignorant and mutinous through bad food, leaky ships and bad treatment, than was really the case even at the time of his writing. Of his descriptive powers, I will leave you to judge by giving a passage describing a vessel outward bound at the mouth of the channel, from "The Wreck of the Grosvenor:" "The vessel was rushing through the water at a great pace. I felt as exhilarated, as one new to the life, when I looked astern and saw the broad path of foam churned by the ship rising and falling and fading upon the desolate gloom of the hilly horizon. Blue fires burned in the water; but by and by, when by stretching out we had got into the broader sea and the vessel plunged to the heavier waves which

were running, big flakes of phosphorescent light were hurled up with the water every time the ship pitched, and for twenty fathoms astern the water was as luminous as the Milky Way. The roaring of the wind on high, the creaking of the spars, the clanking and grinding of the chain-sheets, the squeal of sheaves working on rusty pins, the hissing and spitting of the seething foam, and ever and anon the sullen thunder of a sea striking the ship, filled the ear with a wonderful volume of sound."

Or this brief description of a vessel running down a fishing smack: "In a second I had bounded to the weather side of the poop and looked over, and what I saw sliding rapidly past was a mast and a dark-colored sail, which in the daylight would probably be red, stretched flat upon the wilderness of foam which our ship was sweeping off her sides. Upon this ghastly white ground sail and mast were distinctly outlined—for a brief moment only; they vanished even as I watched, swallowed up in the seething water."

Although Clark Russell's novels suffer from the necessity, which he evidently felt, of catering to the tastes of the reading public by weaving into his sea-story a love affair, which could often only be done by making the hero save some young lady, who of course is a paragon of beauty and virtue, from some sinking wreck, considerable merit is due to him for having successfully portrayed life in the merchant service, his predecessors being mostly concerned with the navy.

R. H. Dana's "Two Years Before the Mast" gives us a faithful picture of life in the American merchant service in former years, but, as it is a recital of actual facts, it does not come within the domain of fiction.

Mr. Jack London, in his "Sea Wolf," shows a thorough knowledge of seamanship, but the novel is unpleasant reading on account of the unnecessary brutality and profanity portrayed therein. His Captain Wolf Larsen, of the sealer "Ghost," is neither a very convincing nor, let us hope, possible character of a sealing captain. One cannot help feeling that Mr. London

has attempted to personify a Nietzschian superman in this brutal skipper, whose brutality has a philosophy of life back of it. The whole book certainly is not an attractive picture of life on a sealing vessel. Even if it is only half-way true, let us hope it is an exception and not a rule.

It would be impossible, of course, to mention all the writers of good sea fiction and discuss their treatment of the sea and the sailor in this brief paper.

The sailor ashore, for instance, from a humorous point of view, has been wittily exploited by Mr. W. W. Jacobs, whose dignified captains and love-sick mates have given many of us some cheerful reading, and of whom Mr. J. Conrad says: "However extravagant his invention may be, it is always artistically adjusted to observed truth." Robert L. Stevenson has furnished us with excellent descriptions of the trading trade in the South Sea Islands, besides his classical pirate book, "Treasure Island." Mr. Kipling, in "Captains Courageous," shows how the sea made a man of a spoiled boy. The Australian, Mr. Louis Beck, has written many short stories on the old days of ships in the South Sea Island trade, let us hope they were not manned by sailors as murderous and villainous as many that he portrays.

Of contemporaneous writers of sea fiction, Mr. Joseph Conrad has won for himself a reputation far wider than that of a sea-novelist. Mr. Curle, in his book, "Joseph Conrad," comments on the astonishing series of events that led a Polish boy to enter the British merchant marine service and a master mariner to become one of England's greatest living novelists. He says: "It seems quite incomprehensible—one of these marvelous 'flukes' that fate keeps up its sleeve for a hundred years and then flings in our face." Equally marvelous, however, is the fact that Mr. Conrad should have entered the merchant service in the transition period from sail to steam, just in time to receive his early training in a sailing ship at the most impressionable age. Gifted with a genius of the highest order for reproducing his own experiences and feelings

realistically in the most artistic manner, and imbued with an inborn love of ships, Mr. Conrad has immortalized in such stories as "The Nigger of the Narcissus," "The Mirror of the Sea," "Youth," "The Brute," "Freya of the Seven Islands," "The Secret Sharer," all the realities and romance of the sailing ship and its crew of a passing age. But he has been just as successful in reproducing in fiction the present age of steam in such stories as "Lord Jim," "Typhoon," "The End of the Tether."

It would be interesting to know if Mr. Conrad's determination to make the sea his profession was inspired by the reading of English sea-novels. In his book, "A Personal Record," he makes no mention of such inspiration, but only mentions Victor Hugo's "Toilers of the Sea" as his first introduction to the sea in literature. He mentions, however, that the determined resolve "if a seaman, then an English seaman," was formulated in his head, of course in the Polish language, as he did not know six words of English, at the age of fifteen or sixteen. Against the wishes and advice of his family, contrary to all traditions of his native land and race, he starts his seafaring career in the Mediterranean, in the French merchant service, but with the fixed purpose still in mind of becoming an English seaman. How vividly he describes his first sight of the "Red Ensign." "Her head swung a little to the west, pointing toward the miniature lighthouse of the Jolliette breakwater, far away there, hardly distinguishable against the land. The dingy danced a squashy, splashy jig in the wash of the wake; and turning in my seat, I followed the 'James Westall' with my eyes. Before she had gone a quarter of a mile she hoisted her flag, as the harbor regulations prescribe for arriving and departing ships. I saw it suddenly flicker and stream out on the flagstaff. The Red Ensign! In the pellucid, colorless atmosphere bathing the drab and gray masses of that southern land, the livid islets, the sea of pale, glassy blue under the pale, glassy sky of that cold sunrise, it was, as far as the eye could reach, the only spot of ardent color—flame-like, intense, and pres-

ently as minute as the tiny red spark the concentrated reflection of a great fire kindles in the clear heart of a globe of crystal. The Red Ensign—the symbolic, protecting, warm bit of bunting flung wide upon the seas, and destined for so many years to be the only roof over my head."

In justice to Mr. Conrad, I must mention that I am discussing him as a sea-novelist only, and as this may deter many from reading his books, I merely mention that, in the opinion of competent critics, he is just as great a writer on subjects which from all ages have chiefly interested the reading public, for instance: women and love. But whereas many an otherwise good sea-story has been spoiled by the dragging in of these two subjects, this is never the case with Mr. Conrad. In fact, in his sea-novels we never have the feeling that even shipwrecks, storms, etc., occur for the purpose of keeping up the interest, events take place in a manner that all who have ever followed the sea as a profession would naturally expect. In reading his books we lose all feeling of reading fiction; we seem to meet sailors, officers, ship agents and captains whom we have met before in the course of our profession; we see and feel the influence of the ocean as we saw and felt it ourselves; ships cease to be inanimate objects, but become living and animate creatures, as they should be to every true sailor; we live ourselves in the atmosphere his wonderful genius has created, and it is only when we pause to reflect that we feel that here articulate genius has expressed what inarticulate sailors of all ages and countries have experienced, felt and seen. And his characters are often not even men who would be interesting for a moment in real life if taken off their ships. What makes a hero of the stupid, unimaginative Captain MacWhirr of the steamer Nan-Shan, who is too dense even to grasp the sailing directions for skirting a typhoon in the China Seas, and therefore takes his steamer through the heart of a typhoon? Whoever has had anything to do with captains of ships has perhaps met the counterpart of Captain MacWhirr, as Mr. Conrad describes him:

"Captain MacWhirr, of the S. S. Nan-Shan, had a physiognomy that, in the order of material appearances, was the exact counterpart of his mind; it presented no marked characteristics of firmness or stupidity; it had no pronounced characteristics whatever; it was simply ordinary, irresponsible and unruffled. The only thing his aspect might have been said to suggest, at times, was bashfulness; because he would sit, in business offices ashore, sunburnt and smiling faintly, with downcast eyes. When he raised them they were perceived to be direct in their glance and blue of color. His hair was fair and extremely fine, clasping from temple to temple the bald dome of his skull in a clamp as of fluffy silk. The hair of his face, on the contrary, carroty and flaming, resembled a growth of copper wire clipped short to the line of the lip; while, no matter how close he shaved, metallic gleams passed over the surface of his cheeks when he moved his head. He was rather below medium height, a bit round-shouldered, and so sturdy of limb that his clothes always looked a shade too tight for his arms and legs. And as if unable to grasp what is due to the difference of latitude, he wore a brown bowler hat, a complete suit of a brownish hue, and clumsy black boots. These harbor togs gave to his figure an air of stiff and uncouth smartness. A thin silver watch-chain looped his waistcoat, and he never left his ship for the shore without clutching in his powerful hairy fist an elegant umbrella of the very best quality, but generally unrolled. Having just enough imagination to carry him through each successive day and no more, he was tranquilly sure of himself, and from the very same cause he was not in the least conceited. It is your imaginative superior who is touchy, overbearing and difficult to please; but every ship Captain MacWhirr commanded was the floating abode of harmony and peace. It was, in truth, as impossible for him to take a flight of fancy as it would be for a watchmaker to put together a chronometer with nothing except a two-pound hammer and a whip-saw in the way of tools. Yet the uninteresting lives of men so entirely given to the actuality of the bare

existence have their mysterious side. It was impossible in Captain MacWhirr's case, for instance, to understand what under heaven could have induced that perfectly satisfactory son of a petty grocer in Belfast to run away to sea. And yet he had done that very thing at the age of fifteen. It was enough, when you thought it over, to give you the idea of an immense, potent and invisible hand thrust into the ant-heap of the earth, laying hold of shoulders, knocking heads together, and setting the unconscious faces of the multitude towards inconceivable goals and in undreamt-of directions."

Yet this dull, unimaginative Captain MacWhirr, by the sheer force of his sense of duty and perseverance, and by allowing his officers no shirking of their duty even when all seems lost, brings his ship with her cargo of two hundred Chinamen safely into port. The story is a magnificent description of the fury of the sea and wind as opposed to the efforts of simple men battling not for their lives, but in simple fulfilment of their duty. Whoever has stood on the bridge of a deeply-laden small steamer in a heavy head gale will recognize the reality of Mr. Conrad's description:

"Both ends of the Nan-Shan were under water, as though she had no more free-board than a raft. The sea, flattened down in the heavier gusts, would uprise and overwhelm them in snowy rushes of foam expanding wide, beyond both rails, into the night. And on this dazzling sheet, spread under the blackness of the clouds and emitting a bluish glow, Captain MacWhirr could catch a desolate glimpse of a few tiny specks black as ebony, the tops of the hatches, the battened companions, the heads of the covered winches, the foot of a mast. This was all he could see of his ship. Her middle structure—covered by the bridge which bore him, his mate, the dark wheelhouse where a man was steering, shut up with the fear of being swept overboard together with the whole thing in one great crash—her middle structure was like a half-tide rock awash upon a coast. It was like an outlying rock in the night, with the water boiling up, streaming over, pouring off, beating

round—like a rock in the surf to which shipwrecked people cling before they let go—only it rose, it sank, it rolled continuously, without respite and rest, like a rock that had miraculously struck adrift from a coast and gone wallowing upon the sea."

Anybody who knows and has experienced the force of fury of a storm at sea will feel after reading "Typhoon" as if he had passed through the storm himself. Just as masterly as the scene seen from the bridge is described, is his description of the engine-room during the typhoon.

But Mr. Conrad's genius in describing the sea is as great in calm as in storm. Take this description of a steamer in the Arabian Sea from his novel "Lord Jim:"

"A marvelous stillness pervaded the world, and the stars, together with the serenity of their rays, seemed to shed upon the earth the assurance of everlasting security. The young moon, recurved and shining low in the west, was like a slender shaving thrown up from a bar of gold, and the Arabian sea, smooth and cool to the eye like a sheet of ice, extended its perfect level to the perfect circle of a dark horizon. The propeller turned without a check, as though its beat had been part of the scheme of a safe universe; and on each side of the 'Tatna' two deep folds of water, permanent and sombre on the unwrinkled shimmer, enclosed within their straight and diverging ridges a few white swirls of foam bursting in a low hiss, a few wavelets, a few ripples, a few undulations that, left behind, agitated the surface of the sea for an instant after the passage of the ship, subsided splashing gently, calmed down at last into the circular stillness of water and sky with the black speck of the moving hull remaining everlastingly in its center."

Or this description of a sailing ship in the Indian Ocean (taken from "The Nigger of the Narcissus"): "The passage had begun; and the ship, a fragment detached from the earth, went on lonely and swift like a small planet. Round her the abysses of sky and sea met in an unattainable frontier. A great circular solitude moved with her, ever changing and ever

the same, always monotonous and always imposing. Now and then another wandering white speck, burdened with life, appeared far off—disappeared, intent on its own destiny. The sun looked upon her all day, and every morning rose with a burning, round stare of undying curiosity. She had her own future; she was alive with the lives of those beings who trod her decks; like that earth which had given her up to the sea, she had an intolerable load of regrets and hopes. The august loneliness of her path lent dignity to the sordid inspiration of her pilgrimage. She drove foaming to the southward, as if guided by the courage of a high endeavor. The smiling greatness of the sea dwarfed the extent of time. The days raced after one another, brilliant and quick like the flashes of a lighthouse, and the nights, eventful and short, resembled fleeting dreams."

As Mr. Curle says in his book on Joseph Conrad: "The sea has been the most powerful, the most urgent influence in Conrad's life. It has tinged his art with the brilliance, with the sombre glory of its moods; it has fired his imagination with its fickle repose and mighty upheavals." In Conrad's book, "Mirror of the Sea," there are passages which show the author's deep understanding of the ocean's moods. It is an understanding to be gained only by following the sea as a profession, when man is forced to study all its moods and whims and caprices, as he would of a woman with whom he wishes to live in safety, even if not always in peace. I take the following passage from his chapter "Initiation" to illustrate this: "For all that has been said of the love that certain natures (on shore) have professed to feel for the sea, for all the celebrations it has been the object of in prose and song, the sea has never been friendly to man. At most it has been the accomplice of human restlessness, and playing the part of dangerous abettor of world-wide ambitions. Faithful to no race, after the manner of the kindly earth, receiving no impress from valor and toil and self-sacrifice, recognizing no finality of domain, the sea has never adopted the cause of its masters.

He—man or people—who, putting his trust in the friendship of the sea, neglects the strength and cunning of his right hand, is a fool! As if it were too great, too mighty for common virtues, the ocean has no compassion, no faith, no law, no memory. Its fickleness is to be held true to man's purposes only by an undaunted resolution, and by a sleepless, armed, jealous vigilance in which, perhaps, there has always been more hate than love. Impenetrable and heartless, the sea has given nothing of itself to the suitors for its precarious favors. For all its fascination that has lured so many to a violent death, its immensity has never been loved as the mountains, the plains, the desert itself, have been loved. Indeed, I suspect that, leaving aside the protestations and tributes of writers who, one is safe in saying, care for little else in the world than the rhythm of their lines and the cadence of their phrase, the love of the sea, to which some men and nations confess so readily, is a complex sentiment wherein pride enters for much, necessity for not a little, and the love of ships—the untiring servants of our hopes and our self-esteem—for the best and most genuine part. For the hundreds who have reviled the sea, beginning with Shakespeare in the line—

'More fell than hunger, anguish, or the sea,'

down to the last obscure sea-dog of the 'old model,' having but few words and still fewer thoughts, there could not be found, I believe, one sailor who has ever coupled a curse with the good or bad name of a ship. If ever his profanity, provoked by the hardships of the sea, went so far as to touch his ship, it would be lightly, as a hand may, without sin, be laid in the way of kindness on a woman."

I know of no writer who has so imbued his ships with real life as Mr. Conrad. In his short story, "The Brute," the villain of the story "The Brute" is a ship that kills a man every voyage, and finally a woman. It is written so convincingly that you feel relieved when "The Brute" is run ashore on the rocks and ceases to exist. Most touching in his story,

"The End of the Tether," is the way in which Mr. Conrad describes the parting of Captain Whalley from his beloved ship "Fair Maid." Even the dirty, unseaworthy old hooker "Judea," in "Youth," with her faded motto, "Do or Die," on her big square stern becomes dear to us as she was to her old captain, and we can share his feelings as he sees her take her last plunge into the Indian Ocean. In "Freya of the Seven Islands" occurs one of his most poetic passages on ships:

"The brig's business was on uncivilized coasts. Alone, far from the beaten tracks, she glided, all white, round dark, frowning headlands, stole out, silent like a ghost, from behind points of land stretching out all black in the moonlight; or lay hove-to, like a sleeping sea-bird, under the shadow of some nameless mountain waiting for a signal. She would be glimpsed suddenly on misty, squally days dashing disdainfully aside the short, aggressive waves of the Java Sea; or be seen far, far away a tiny, dazzling white speck flying across the brooding purple masses of thunder-clouds piled up on the horizon."

In his "Mirror of the Sea," Conrad even asserts that the art of handling ships is finer, perhaps, than the art of handling men. "For men," he says, "professors or coal-heavers, are easily deceived; they even have an extraordinary knack of lending themselves to deception, a sort of curious and inexplicable propensity to allow themselves to be led by the nose with their eyes open. But a ship is a creature which we have brought into this world, as it were, on purpose to keep us up to the mark. In her handling, a ship will not put up with a mere pretender, as, for instance, the public will do with Mr. X, the popular statesman; Mr. Y, the popular scientist; or Mr. Z, the popular—what shall I say? anything from a teacher of high morality to a bagman—who have run their little race. But with ships, to be a humbug is too difficult. The difficulty arises from the fact that one does not deal with ships in a mob, but with a ship as an individual. For in each of us lurks some particle of the mob spirit, of the mob temperament. With ships it is not so. Much as they are to us, they are

nothing to each other. Those sensitive creatures have no ears for our blandishments. It takes something more than words to cajole them to do our will, to cover us with glory. It is not what your ship will not do that you want to know to get on terms of successful partnership with her; it is, rather, that you ought to have a precise knowledge of what she will do for you when called upon to put forth what is in her by a sympathetic touch."

And lastly, I must speak of Conrad's sailors. As I have already mentioned, in speaking of his sailors one seems to be speaking of men we have met, of old shipmates, of forms long forgotten, but suddenly brought vividly before our eyes. Our own fading reminiscences of seafaring men, most of whom have probably long since gone to Davy Jones' locker, blend with Conrad's creations, so that we can scarcely distinguish between the two. I know of no other way in which to express the success of Conrad's art. His are no book-sailors, caricatures or great heroes, like our good old friends Captain Cuttle and his friend Bunsby, or such as we meet in boys' books, or in the writings of that wittiest of sea-writers, Jacobs. Conrad's sailors are real flesh and blood, often childish, generally stupid in a worldly sense, and invariably artless; men to whom the work of each day is the main problem of their lives. As Mr. Curle remarks in his book on Conrad: "It is to them that Conrad turned joyfully from the feverish complexities of more intellectual types." But I do not wish to convey by this that Mr. Conrad has a set type for his sailors, like Cooper or Marryat. Take the crew and officers of the ship "Narcissus" in his "Nigger of the Narcissus," how clearly each member of that crew, fore and aft, stands out as men each stamped with his own individuality, but all bearing the imprint of the sea. His bad seamen one is made to feel are really not seamen at heart, but worthless men who by chance have drifted to sea. And yet in what a masterly manner are they also portrayed. One feels that Donkin, in his "Nigger of the Narcissus," is a cockney gutter-snipe, that the cowardly second

mate of the "Nan-Shan" in "Typhoon" is really nothing but a hopeless beach-comber, that even the stern taskmaster, "the sea," cannot change these useless members of society into decent sailors. And we know such men exist in every crew. What different types of men are Captain MacWhirr of the "Nan-Shan" and that perfect type of the gentleman-sailor, Captain Anthony of the "Ferndale" in "Chance," the inarticulate son of a poet, perhaps the most lovable of Conrad's sailors. Many readers may think the character of Captain Anthony an impossibility, but he, too, is a product of the sea, the sea that can train a man in many things, but leave him in such absolute ignorance of woman's nature as the chivalrous but passionate Captain Anthony.

What high sense of duty is personified in old Captain Beard of the "Judea" in "Youth," who is described as: "A little man, with a broad, not very straight back, with bowed shoulders and one leg more bandy than the other, with that queer twisted-about appearance you see so often in men who work in the fields. He had a nut-cracker face—chin and nose trying to come together over a sunken mouth—and it was framed in iron-grey fluffy hair, that looked like a chin strap of cotton-wool sprinkled with coal-dust. And he had blue eyes in that old face of his, which were amazingly like a boy's, with that candid expression some quite common men preserve to the end of their days by a rare internal gift of simplicity of heart and rectitude of soul."

Whoever has traveled much on ships has encountered the type of sailor to whom command and responsibility have given an innate dignity of bearing as portrayed by Mr. Conrad in Captain Whalley in "The End of the Tether," one of Conrad's most pathetic characters.

In "An Outcast of the Islands" we meet with a different type of seaman in Captain Tom Lingard, trader and adventurer. But here again it is best to let Mr. Conrad describe: "Tom Lingard was a master, a lover, a servant of the sea. The sea took him young, fashioned him body and soul; gave

him his fierce aspect, his loud voice, his fearless eye, his stupidly guileless heart. Generously it gave him his absurd faith in himself, his universal love of creation, his wide indulgence, his contemptuous severity, his straightforward simplicity of motive and honesty of aim. Having made him what he was, womanlike, the sea served him humbly and let him bask unharmed in the sunshine of its terribly uncertain favor. Tom Lingard grew rich on the sea and by the sea. He loved it with the ardent affection of a lover; he made light of it with the assurance of perfect mastery; he feared it with the wise fear of a brave man, and he took liberties with it as a spoiled child might do with a paternal and good-natured ogre. He was grateful to it, with the gratitude of an honest heart. His greatest pride lay in his profound conviction of its faithfulness —in the deep sense of his unerring knowledge of its treachery."

Even the sailors who play but minor parts in Mr. Conrad's novels are as carefully outlined. The first mate, Franklin, and the young second mate, Powell, of the ship "Ferndale," in "Chance"; the mate and engineer of the steamer "Nan-Shan" in "Typhoon"—and countless other minor characters, all children of the sea, stand before us in clear outlines. What a masterpiece is his brief scene in "Lord Jim," where he introduces the French naval officer, the little prosy figure with the keen sense of honor. The pompous Captain Brierly, the cowardly, bullying captain of the "Tatna," in the above-mentioned book, the Serang, in "The End of the Tether," we feel we have met these men before in real life. What a picturesque figure he has made of that true son of sunny Italy, that sailor of the Mediterranean, Nostromo. But over the sea and the sailors Mr. Conrad has cast a romantic glamor, the web of romance and realism so closely interwoven that one can scarcely distinguish one from the other.

With man's victory over the sea, with the passing of the sailing ship, the shortening of all sea voyages, the opening of the Panama Canal, Mr. Joseph Conrad may be the last of the great sea writers who were able to sincerely look upon the sea

as our forefathers for generations have regarded it. The character of the sailor, too, is changing, or has already changed. Less dependent on the elements, but depending more on human contrivances, better educated in worldly wisdom, more scientific, but less closely intimate with every mood of wind and water, less the servants of a fickle mistress, but more the ruler of a sullen and untrustworthy servant, the sailor of the present and coming generation is a product of man's own training. For the sea enslaved can no longer train. No professional sailor of the future will be able to look upon the sea as Mr. Conrad saw it when he wrote: "The sea, perhaps because of its saltness, roughens the outside but keeps sweet the kernel of its servant's soul. The old sea; the sea of many years ago, whose servants were devoted slaves and went from youth to age or to a sudden grave without needing to open the book of life, because they could look at eternity reflected on the element that gave the life and dealt the blow. Like a beautiful and unscrupulous woman, the sea of the past was glorious in its smiles, irresistible in its anger, capricious, enticing, illogical, irresponsible; a thing to love, a thing to fear. It cast a spell, it gave joy, it lulled gently into boundless faith; then with quick and ceaseless anger it killed. But its cruelty was redeemed by the charm of its inscrutable mystery, by the immensity of its promise, by the supreme witchery of its possible favor. Strong men with childish hearts were faithful to it, were content to live by its grace, to die by its will. That was the sea before the time when the French mind set the Egyptian muscle in motion and produced a dismal but profitable ditch. Then a great pall of smoke sent out by countless steamboats was spread over the restless mirror of the Infinite. The hand of the engineer tore down the veil of the terrible beauty in order that greedy and faithless land-lubbers might pocket dividends. The mystery was destroyed. Like all mysteries, it lived only in the hearts of its worshipers. The hearts changed; the men changed. The once loving and devoted servants went out armed with fire and iron, and conquering the fear of their own heart became

a calculating crowd of cold and exacting masters. The sea of the past was an incomparably beautiful mistress, with inscrutable face, with cruel and promising eyes. The sea of today is a used-up drudge, wrinkled and defaced by the churned-up wakes of brutal propellers, robbed of the enslaving charm of its vastness, stripped of its beauty, of its mystery and of its promise."

ALESSANDRO BOTTICELLI

By Herbert E. Everett
Professor of History of Art

Botticelli was a painter who gained great fame during his lifetime, but as the ideals of the early Renaissance disappeared and the artistic sense of Italy and Europe declined or took other directions, his work sank into complete neglect. In the early part of the seventeenth century the Grand Duke Ferdinand I of Tuscany issued a decree giving a list of artists whose works were forbidden to be removed from Florence, but Botticelli's name is not included, though the list enumerates many minor artists whose work no one cares for now.

The modern appreciation of early Italian art began in England in the early nineteenth century and it was greatly stimulated there by the rise of the so-called pre-Raphaelite Brotherhood in 1847. This whole movement was an outcome of the Oxford revival, which led so many Englishmen to a closer sympathy with the Roman Catholic Church. A group of artists, of whom the leader was Dante Gabriel Rossetti, became imbued with enthusiasm for early Italian art and drew their inspiration from it. In 1849 Rossetti wrote to his brother from Paris that the Madonna and Child, by Botticelli, was one of the finest pictures in the Louvre. This seems to be about the earliest modern appreciation of the artist. For in 1847 Ruskin wrote to the trustees of the National Gallery, urging them to purchase some representative works of the early Italian masters, but he does not mention Botticelli, and confesses in his autobiography, written in his old age, that Lippi and Botticelli were at that time still far beyond him. In 1867 Rossetti bought the "Smeralda Bandinelli," now in the Wallace Collection and generally admitted to be an excellent production of Botticelli's

school rather than by the hand of the master. Inspired by a photograph of the "Spring," the original of which he never saw, Rossetti wrote the sonnet, "For Spring," in 1880. Meanwhile, Walter Pater had published his famous essay, entitled "A Fragment on Botticelli," still considered the most suggestive and subtle appreciation of the master. Towards the close he asks the question, "Is a painter like Botticelli, a secondary painter, a subject for general criticism?" Thus, serving to remind us how much we owe to this very essay in our modern estimates of the unique position of Botticelli among the great masters of the Renaissance.

Ruskin's first public mention of our artist occurs in "Ariadne Florentina" of 1873, and this was followed two years later by "Mornings in Florence," where he again returns to Botticelli. These books were widely read and quite without the author's intention contributed largely to the peculiarly English cult of Botticelli which became one phase of the "Æsthetic Movement" of 1880, with which the name of Oscar Wilde first came into prominence. By that time the name of Botticelli had become so well known that Du Maurier could publish his famous joke in *Punch* where a young man of fashion on announcing that he preferred Chianti to Botticelli is reproved and told that Botticelli isn't a wine but a cheese. Today every cultivated person accepts Botticelli as a great master, though it may be doubted whether his real qualities are even yet revealed to a very great number of people.

The painter's life offers very little that is picturesque or interesting in its outer history. His father was a man in comfortable circumstances, a tanner named Filipepi. As the word Botticelli calls up for us visions of tall, slender, willowy figures in light, floating garments, it is somewhat disconcerting to be told by modern investigators that Vasari's story that he took the name from his first master, a goldsmith named Botticelli, is hypothetical; that Botticelli, which means a little tub, was a nickname first given to the painter's older brother on account of his tub-like proportions. This brother was a broker and the

mainstay of the family. From him the painter inherited the name which he was to make so famous.

About 1460 he became an apprentice of Fra Filippo Lippi, at that time engaged on the well-known frescoes in the choir of the duomo at Prato. Lippi, whose influence was most favorable to the development of much that was characteristic in the genius of Botticelli, was the last of the older generation of devotional painters. Although he introduced many innovations into his treatment of religious subjects, humanizing types and sentiment, yet in the main he belonged to the Idealistic as opposed to the Naturalistic school and was almost untouched by the prevailing passion for scientific research. Under him Sandro was, no doubt, confirmed in the idealistic bend of his own nature and so was enabled to resist the naturalistic influences by which he was later surrounded.

There is, however, very little evidence of the direct influence of the master over the pupil. Like Lippi, Botticelli gave preponderance to the emotional over the physical aspects of human energy, but the grandeur and breadth and simplicity of the Prato frescoes are qualities conspicuously lacking in Botticelli. Lippi was direct, natural and concrete; Botticelli was abstract, visionary and elaborate. His art, in both its perfections and imperfections, shows that he was one of the strongest and most independent personalities of the early Renaissance.

After his apprenticeship to Fra Filippo he came under the influence of several strong painters, but his own personality was so powerful that no one influence became permanent. Although he absorbed much, he was by nature a leader and not a follower, the founder of a school and the inventor of a style rather than the continuator or developer of any existing style.

We know that Lippi left Tuscany for Spoleto in 1468 and that Botticelli did not accompany him, and there is reason to suppose that he then became an assistant of Antonio Pollaiuolo, for we recognize Botticelli as the author of our picture "Fortitude" in a set of panels illustrating the Virtues, the commis-

sion for which was given to Pollaiuolo, who executed the remainder. There are marked indications of Pollaiuolo's influence in all of Botticelli's early works. This influence was of great advantage to him, as he needed, for the completion of his education, to devote himself to the nude and to anatomical and technical studies in which Pollaiuolo was specially strong.

It was partly by means of this scientific knowledge that he was able to accomplish those versions of the body in movement which are among his greatest achievements. The atmosphere of uncompromising naturalism of Pollaiuolo supplied much that was wanting in the influence of Fra Filippo and by modifying that, prepared the way for the development of his own individuality.

In 1472 Botticelli was commissioned to take charge of Fra Filippo's young son, Fillippino, who was then fourteen years of age. Under Sandro's tutelage Filippino Lippi developed into one of the most charming and distinguished painters of the last quarter of the fifteenth century. His early style so much resembles that of his master that Filippino's works of that period are not infrequently attributed to Botticelli.

Botticelli's first important commission was the St. Sebastian now in the Berlin Gallery. The next few years, up to 1480, were passed largely in the service of the Medici family and during this time Botticelli was evidently brought into close contact with the ruler of Florence and the illustrious group by which he was surrounded. Outside of his genius for statecraft, Lorenzo was gifted with a fine taste for letters and the fine arts. He took a scholarly interest in ancient philosophies and had a poetic gift amounting almost to genius. Gay and lavish, he entertained his friends with banquets modeled on those of ancient Rome and took part in gorgeous masques and pageants for the diversion of the people. His court was a center of learning and culture, which attracted the most brilliant poets, artists and thinkers.

The classic revival was then at its height. It dominated all the habits of thought and penetrated into the life of the period,

bringing an element of splendor and refinement and also of affectation into the taste and manners of the cultivated classes. The antique became a fashion as well as a high ideal. Poetry, literature and painting were overlaid with classic imagery and illusions, strangely blended with much that was still medieval. These were the influences under which Botticelli lived and worked and these influences permeated his art. Gifted with a keenly analytical and responsive mind, he, more than any other artist of the period, entered into the spirit of early Renaissance culture and his art became a mirror reflecting all the tendencies of the age.

In 1480 Botticelli's fame was at its height and he was summoned to Rome by Pope Sixtus IV to collaborate with the most distinguished artists of the day in decorating with frescoes the walls of the newly constructed Sistine Chapel. Botticelli seems to have had the general direction of the entire work, but his own contribution consists of three frescoes. Vasari tells us that he gained great renown and much money in Rome and after squandering the money returned to Florence, where he wasted much time in studying and commentating the Divine Comedy of Dante. How true this may be we do not know. He certainly spent some time at a later period in making line drawings to illustrate the Divine Comedy, and between 1480 and 1490 some of his greatest masterpieces and most important commissions were executed. Botticelli's artistic life was ended early in the nineties, when he became a devoted adherent of Savonarola, who made his first great success as a preacher in 1489. For eight years Savonarola ruled the conscience of Florence and Botticelli adopted his rule so rigidly that he gave up painting entirely and Vasari says he would have died from starvation but for the support given him by Lorenzo and other generous friends. The latter statement is probably not exact, but we may assume that he gave up most of his personal work then, though he evidently retained supervision over his workshops from which issued a great number of Botticellesque works, which are no longer distinguished by the fine artistic feeling of

the master and in which the emotional quality has become strained and overwrought.

In 1500 Sandro's genius asserts itself for the last time in a beautiful little picture of the Nativity in the National Gallery, London, apparently the only work the artist signed and dated. From 1500 until his death in 1510 we find no notice of importance.

According to his biographers he was a man of pleasing personality, with a fondness for practical jokes. When Vasari wrote he was still remembered as a reckless, headstrong personality, with eccentric habits and tastes and a confirmed horror of matrimony.

In considering Botticelli's art it is important to bear in mind that he was a man who was singularly modern in the complexity of his temperament and gifted with a keen intellect, a poetic and visionary mind, a profound imagination. In the works of certain periods of his life the quality of intense idealism has attracted one group of critics who look at his work entirely from the literary standpoint and see in it only the poetry and the deep thoughtfulness. But there are other periods of his career when his purely artistic gifts overpower the poet and thinker and all his creative energies are brought to bear on the pictorial elements, producing an art that is more independent of representative or expressive intention than anything which had been seen in Italy before him, or than most works produced in Europe since his day. This phase of Botticelli's art has also its exclusive admirers, who neglect the interest his pictures have for us as expressions of early Renaissance thought and feeling.

It is Botticelli's greatest distinction that he is the first painter who valued painting for its abstract decorative qualities rather than for what he could represent with it. Now the painter works with line, light and shade, color and form and, broadly speaking, he can use these elements for three distinct purposes: 1, for the expression of ideas or sentiments; 2, for the imitative representation of actual objects; 3, for their intrinsic deco-

rative value only; that is, for the beauty that exists in line, light and shade, or color, apart from anything that they may express or represent.

Naturally, in the best art, these three aims are never wholly separated, but the predominance of one or another gives a definite character to particular periods and schools of art.

In its early development, Italian painting was merely an instrument in the hands of the church. Continuing the work begun by the mosaics on Early Christian basilicas, painting supplied the church with a set of visual symbols which stood for religious ideas. Its subject matter was exclusively religious and ideal and as artists were hampered with technical shortcomings after the decline of Roman civilization, and as the church was satisfied with an easily understood symbol, painting consisted for a long time of a series of conventions, as no fresh observation was demanded of artists. It was the painters themselves who, as they exercised their art, worked gradually, for their own satisfaction, to make their imagery more lifelike and more real. While still treating exclusively sacred themes, they sought to emphasize the human rather than the divine. Sentiments within the ordinary range of human experience were gradually introduced with increasing intimacy until we find Fra Filippo, in the middle of the fifteenth century, devoting himself particularly to the expression of human sorrow and joy and the happiness of human childhood. While remaining ideal and imaginative in character, art abandoned symbolism for expression and the expression is of earthly sentiments rather than the heavenly ones. Side by side with this, there was rising in the first half of the fifteenth century another school, which substituted observation for imagination, which was occupied with purely physical rather than spiritual effects. To represent the real appearance of objects, regardless of their spiritual meaning, was aim enough for them. So we have first, the expression of religious contemplation giving way to the expression of human sympathy; this was succeeded in its turn by accurate observation of material forms. With the naturalists

the external world obscured the world of ideals within and poetry made way for science.

In the midst of this naturalism Botticelli took a different attitude. For him the imitative and representative powers of art were not an aim in themselves. The expressive powers he does make his goal at certain periods of his career, when he was dominated by humanistic culture in his mature life and when religious fervor took possession of him in his old age. But when Botticelli is in his most inspired moments he is preoccupied with painting solely as a form of decoration.

Painting is valuable to him then not for any moral of spiritual significance which it can convey, but for the purely æsthetic effect—for its abstract beauty. And out of the constituent elements of painting, line, light and shade, and color, Botticelli selects line as being the most abstract, as possessing the least representative value, and he becomes a consummate master of line, the first great decorative painter of Italy and the father of the æsthetic schools as distinguished from the devotional or scientific schools of art.

As his art progressed he became more and more ready to sacrifice all story-telling elements to the expression of movement by means of line. Take, for example, the "Allegory of Spring" or the "Birth of Venus." Some of Botticelli's literary critics have been puzzled as to the artist's meaning and have attempted to explain these pictures as illustrations to poems by Lorenzo or Poliziano, and they try to read into them hidden allegorical meanings. But they miss the obvious in seeking for the abstruse. It is pretty evident that Botticelli meant primarily to produce a piece of fine lineal decoration and that he was indifferent to the subject matter except so far as it lent itself to the decorative development of his picture.

Botticelli was closely in touch with the great humanist poets and his pictures reflect the ornate imagery of this new school which was rising in Italy. It was very decorative poetry, a poetry of form rather than of sentiment, the charm of which lies in the style rather than in the meaning. There is certainly

a great general resemblance between much of this verse and Botticelli's masterpieces.

Although none of his pictures can be identified with any particular poem, there is no doubt that many of his motives were suggested by poetic images. In transferring the image from poetry to painting, however, Botticelli develops it with reference to its pictorial possibilities instead of carrying its verbal meaning out literally.

For the sake of clearness I have said that Botticelli is preoccupied with two different phases of art in different periods: expression and decoration. But there is no hard and fast line, for in the "Madonna of the Magnificat" the religious sentiment exists, though dominated by the feeling for beauty of line, and, on the other hand, in the "Birth of Venus," a most decorative work, a vein of deeper meaning steals in by means of the sad, strangely spiritualized Madonna type which he has bestowed upon the face of Venus. It is so that Botticelli shows himself the chief exponent of what Symonds has termed the double-mind of the Renaissance which was divided between the conflicting ideals of Christianity and of Hellenism; many of the most brilliant scholars spending their lives trying to reconcile the religion and philosophy of Greece with that of Christianity. In this attitude of mind Botticelli conceived many of his pictures, but he reflects the spirit of the age and is always irresolute. On the one hand the religion of beauty, of natural happiness and of free expansion attracts him, while on the other he seems to struggle to eliminate everything which does not contribute to the idea of asceticism and renunciation.

Botticelli never attains any true conception of the antique. The serenity and blitheness of the Greek spirit were beyond him, and his gods and goddesses are always troubled and wistful. Yet it is only in one or two of his latest pictures that he achieves the full expression of Christian faith and fervor. There is so much distress in his conceptions, his Madonnas are so plaintive, his angels so pitying, that he appears to portray the Christian characters as burdened rather than exalted by their beliefs.

In all of his more thoughtful work figures are felt to be the personification of ideas, moods or emotions rather than individualized conceptions of real persons. Whatever the ostensible subject is, he rarely tries to represent it, but uses it merely as a means of expressing some peculiar mood of his own.

Botticelli has been accused of a lack of virility, and there may be some truth in the accusation. Every artist has his own ideal, and Botticelli's ideal of grace is excessive slenderness and alertness is more to him than strength. His art is nervous, swift and delicate; never majestic or grand. In action his figures are often too vehement, especially in his later work, and in repose they are sometimes too languorous. In its dainty grace and inimitable charm his conceptions are always elaborate and complex, almost never simple. He is often inaccurate in drawing and careless about proportions. Figures are often too slim, hands and feet too large, and heads abnormally small are set on slender stem-like necks.

As a painter of light swift movement, Botticelli has rarely been equaled. This was the great problem which engrossed the Naturalists, like Pollaiuolo; but with Botticelli the representation of movement seems to be more a matter of artistic perception than of scientific study, and while the naturalists make movement an occasion for the display of anatomical knowledge often unlovely in effect, Botticelli values movement as the supreme manifestation of living grace, and therefore avoids all action which requires great bodily exertion.

He was curiously oblivious of the chief tendencies of painting in his later life; tendencies which produced the great art of the sixteenth century. His own latest works seem to have so completely exhausted the resources of his manner, which was delineation by line, that without the discoveries of Michel Angelo and of Leonardo, no further development seems possible for the art of painting. Michel Angelo discovered the possibilities for psychological expression inherent in the nude, and gave a new direction to pictorial art. The nude studies of Pollaiuolo and of the naturalists were mere drawing based on

anatomy. Leonardo's innovations are more original and far-reaching than those of Michel Angelo. In the works of Leonardo's predecessors light and shade was considered as pertaining to each object separately. In Leonardo's own work objects are considered as bathed in a homogeneous play of light and shade into which outlines as such melt and are softened. He first discovered that objects are not bounded by hard, definite outlines, but that all nature is made up of patches of color and light and dark, whose edges tend to fuse and dissolve into each other instead of stopping at a boundary line. Botticelli was only interested in light and shade as a means of expressing relief. He never loses contours or fuses masses. As the art of the succeeding century was largely devoted to the development of chiaroscuro as a means of emotional expression, the complete indifference of Botticelli to effects of light and shade probably explains why his works were so completely forgotten within a century after his death.

FOLK-TALES OF INDIA

By Roland G. Kent

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Nowadays we are likely to hear much of that branch of human experience which is designated as folklore, a term invented as a name for "the traditional learning of the uncultured classes of civilized nations," as one authority* puts it, and may be divided into (1) beliefs and customs, (2) narratives and sayings, (3) art. But against this definition a protest should be made: the emphasis is on the words "traditional learning," not on "uncultured classes," nor on "civilized nations;" for there is the greatest abundance of Folklore among uncivilized nations, and, on the other hand, the cultured classes are not free from it in civilized nations, so long as thirteen at table, or the dropping of a knife to the floor, or the picking up of a blackheaded pin has with some cultured members of society a reputed meaning and influence. The essential point in the definition of Folklore, I would repeat, is that it is the traditional learning of the people, not produced by the investigations of science, nor consciously invented for the purpose, like the rather recent flood of animal tales, now receding, but that learning which rises up spontaneously, so to speak, in the consciousness of the people, and is handed down from person to person by word of mouth, kept alive by the appeal which it makes to the emotions and to the imagination. Some of it incidentally finds its way into literature; some of it is gathered for the express purpose of permanent preservation in printed form. Professed collections of this nature seem to have begun in the seventeenth century. But collections of stories exist in the form of works of literature at an earlier date, such as the "Thousand and One Nights of the Arabs," and the "Jatakas"

*Encyclopædia Britannica, eleventh edition, under the caption "Folklore" (vol. X, page 601).

or "Birth-Tales" of the Buddhists; and Folk-tales are found interwoven in the Homeric poems of almost three thousand years ago, nay even in Egyptian texts of nearly two thousand years' greater antiquity than Homer. Yet with all this, the word Folklore was invented only seventy years ago, in 1846.

Even the Folk-tale as a province of Folklore is a tremendous theme; I crave your attention for but a tiny subdivision of it, the Animal Fable—a form of popular story found everywhere in the world, in the Old World and in the New, in the Tropics and within the Arctic Circle, for it makes its appeal to the experience of all men who have wild or tame animals before their eyes; the stories in which the actors are animals endowed with the mental powers of men, including the ability to use articulate speech, yet retain their normal characteristics as animals, cruelty, timidity, shrewdness and the like.

Surely you have already recalled to mind the Br'er Rabbit stories of our own Southland, and perhaps also old Aesop and his familiar tales, such as that of the Jackdaw and the Doves:

The Jackdaw and the Doves[1]

A Jackdaw, seeing Doves well fed in a certain dovecote, whitened himself and came to have a share in their sustenance. And they thought that he was a Dove, and admitted him among them as long as he kept quiet; but when he forgot himself and cawed, they recognized what he really was and drove him away. So he, having failed in getting his food there, went back again to the Jackdaws. And they, not recognizing him because of his color, kept him away from their food, so that by desiring two things he got neither. The story teaches us to stick to what is our own, realizing that greed does us no good and often takes from us what we have.

But it is not my intention to relate to you a series of Aesop's Fables. This one is introduced merely for comparison with a

[1] Fabulae Aesopicae, No. 201 b, edited by Halm.

Hindu story of a similar motif. Yet let not the inference be drawn, from this purposed comparison, that the Greeks got their animal fables from the Hindus, nor that the Hindus got theirs from the Greeks. The comparison which is here to be made between the Greek fable of Aesop and the Hindu fable written in Sanskrit, is one of style and of logical structure merely, and has nothing to do with their origins, whether independent or derived one from the other.

Recall then the simplicity of the Aesopic fable which you have just heard, and before a sample of the Sanskrit story is recounted, let me give you the difference in style: The Aesopic fable is short, unelaborated, lacking details; the Sanskrit fable is elaborate, full of details, absolutely logical from beginning to end. The Aesopic fable is plain to the point of barrenness; the Sanskrit fable is intricate, like one of the later wall paintings at Pompeii, with its wealth of architectural details, or like one of the paintings of the old masters, with hundreds of figures in the background.

I want to put before you, in what I conceive to be the correct and logical version, one of the Sanskrit stories in which the motif is similar to that of the Jackdaw and the Doves. An occasional explanatory remark inserted in the midst of the tale will aid the understanding. This story is "The Blue Jackal." The jackal is a small animal not unlike a fox, and plays in Hindu fable the part played by the fox in western fable, that is, the part of the clever animal which outwits the others. But his wit is not always triumphant; let us not forget the Fox and the Grapes.[2]

The Blue Jackal.[3]

In a certain forest region (*no matter where, according to the story, except that it was in India*) there dwelt a Jackal named Chandarava (*which means* "Harsh-howl." *Such names are given to the personages merely to show their characters, and often do*

[2] Fabulae Aesopicae, No. 33, edited by Halm.
[3] Hitopadeça III, 6; Panchatantra I, 10; Tantrākhyāyika I, 8.

not appear again in the course of the story). A famine came on, and he was unable to find food in his accustomed haunts, so that he was driven to seek something to eat in the outskirts of a city. (*Famine is in Hindu story the commonest cause for the characters to leave their homes for other places where they meet with adventures.*) As he was roaming around near the city a pack of dogs belonging to the residents caught sight of him, and started after him, with a continual barking. The poor Jackal was presently almost surrounded; he seemed to feel his pursuers' sharp teeth sinking into him. In despair he rushed into a house nearby. As luck would have it, this was a Dyer's house, and our Jackal, running at top speed, plunged head over heels into a vat for preparing the indigo dye!

From this point there are two versions of the story; one runs thus: When the Jackal clambered out of the vat, he was dyed perfectly blue; the dogs, which meantime had run into the Dyer's house, failed to recognize the strange creature, and dispersed to their several homes. And the Jackal, perhaps sadder and wiser, returned to his own native haunts. *The other version seems somewhat better:* The poor Jackal, fallen into the vat, was unable to climb out, and remained floating in the liquid, half dead; the dogs, mystified by their quarry's sudden and complete disappearance, presently departed for their homes. When the Dyer entered in the morning (*for of course it was night when the Jackal came prowling about the village for food*), he found the apparently lifeless Jackal floating in the vat; he picked him out and threw the body away outside. (*The original text represents the seeming lifelessness of the Jackal as assumed for the purpose of deceiving the Dyer, that the latter might throw the body away without first killing the animal, as he would surely have done if the Jackal showed signs of life; and since such pretence of death is a very common motif in these stories, it is quite probable that this is the true form of the tale.*)

But by whichever method the Jackal eluded the dogs and escaped from the Dyer and his vat of indigo, he succeeded in returning to

his native forests. Safe back in the forest (*what became of his hunger the story fails to tell*), he sought out his own kith and kin; but to his amazement they fled from him as fast as their feet could carry them—and of course, he after them, which scared them all the more; for (*in the words of the Sanskrit*) he shone with a splendid blue like the blue of the neck of the God Çiva after drinking the poison, virulent as that of the Tamala tree. (*Of this I must say a word presently.*) Not only did the Jackals flee him, but even Lions, Tigers, Panthers, Wolves and other Forest-Dwellers fled, filled with fear, reflecting,

> Whose conduct, family, and strength one does not know,
> Him let a wise man trust not, would he caution show.

(*These moral maxims, in verse, are inserted into the stories at every possible place; for the story is really told for the sake of the moral maxims, and the more that can be interpolated, the better, from the Hindu viewpoint.*) Our Blue Jackal's amazement at this behavior of the animals soon turned to a realization that they were acting under the impulse of terror, and then he understood: "Why, I am now of the most excellent color (*which means also*, of the highest caste; *blue is in India the royal color*). Therefore I may attain to any high position whatsoever!" So he called after the fleeing animals, "Oho, ye Flesh-Eaters, why do you run away in terror at the sight of me? There is no occasion for fear. Just today Brahma created me, and said to me, 'Inasmuch as the Flesh-Eaters have no king, I appoint (*properly* sprinkle with water *as a ceremony of consecration*) thee King of all the Flesh-Eaters, and give thee the name Kakuddruma (*which means, approximately*, Tiptop). Go down now to the earth and rule protectingly over them all.' Therefore I am come hither from heaven. Henceforth you must all dwell in the shadow of my parasol (*in India the parasol is one of the most significant emblems of sovereignty*); and in this forest obedience must be yielded to our command." (*Note the plural of majesty in the* "our," *at once assumed by the*

Jackal in his new capacity of King; this is not an embellishment of the translator.)

On hearing these words, the Forest-Dwellers stopped their flight and surrounded the Blue Jackal with obeisances, saying humbly, "Lord and Master, issue your commands, that we may perform them." In this way the Blue Jackal became King of the Beasts, and as he looked around upon his retinue, especially at the Lions and the Tigers, he was filled with pride. Forthwith he appointed his court officials: he made the Lion his Prime Minister, the Tiger the Protector of his Bedchamber, the Panther the Overseer of the Betel (*the betel leaf and nut, with a little shell lime, are chewed in the Orient like tobacco in some other lands not so far away; betel turns the teeth black and the saliva blood-red*[4]), the Wolf the Guardian of the Palace Door. But as for his own kin, the Jackals, he could not bear the sight of them, for they reminded him of what he really was; so he refused to speak to them, and even had them seized by the neck (*this touch is in the Sanskrit*) and driven away.

For a time the Blue Jackal ruled prosperously. The Lions and others went hunting for him, slew the Gazelles, and brought the prey before him and laid it at his feet. He took his dues as King and divided the rest among his subjects. But his unjust treatment of his kinsmen was destined to bring his downfall (*there is no hint that the outrageous lie by which he established his kingship had any part in the matter*).

For the Jackals, living as outcasts, were sorrowful and resentful, and presently one wise old Jackal worked out a scheme and said to them, "Do not be despondent, though this puffed-up fellow scorns us, for we know his weak spots. (*This statement implies that the Jackals had by this time come to know that the Blue Jackal was really a Jackal, though they could not explain his peculiar color.*) I have devised a plan for his destruction: The Tigers and so on regard him as their King, because his color deceives them and prevents them from seeing that he is only a Jackal; we must make him show them what he really is.

[4] On the therapeutic effect of the betel, see *Old Penn*, XIII, No. 16, p. 490.

Therefore in the evening we will all go to a place not far from him and give a great howl together, and then his inborn nature will impel him to howl in reply. For (*and here comes another of our moral couplets*)

"The nature of a man is hard
To overcome, 'tis said;
A dog will nibble at a shoe,
E'en though he be well fed.

Then a Tiger will know him by his voice, and will kill him." And (*the Sanskrit, to avoid a repetition, uses a stock phrase to indicate the successful accomplishment of a scheme in which all works out as it was planned*) this being done, this happened.

Another version represents these events differently and to some extent more naturally. In this, the exiled Jackals do not recognize the Blue Jackal as one of their kind, but bring about his end by mere accident: After the Blue Jackal had ruled as King for some time, he was holding an assembly of his subjects one evening, when from the far distance there came to his ears the howling of a pack of Jackals, those whom he had driven away. At the old familiar sound his true nature was revived; his hair stood on end (*to the Hindus, a phenomenon produced by extreme joy, as well as by several other emotions*), his eyes filled with tears, and he jumped to his feet and uttered a loud and piercing howl in reply. But the Lions and his other subjects heard and understood; for a moment they remained with faces cast down from shame, as they exclaimed, "To think that we have let this low-caste Jackal rule us as our King!" And though the Blue Jackal tried to dart away and escape, they fell upon him and tore him to pieces. And therefore I say,

Who leaves his friends and cultivates his foes,
Like King Kakuddruma, to death he goes!

I would explain the "And therefore I say," just before the final moralizing stanza. In these collections of Sanskrit stories, most frequently a story is brought in by a character in the

dialogue who utters a moral couplet like the one just given; the other speaker asks, "How is that?" The one who spoke the couplet tells the story to which it applies, and concludes by saying, "And therefore I say," and repeating the couplet.

Now as for this story of the Blue Jackal, those of you who have read it in the original, for it is one of the stories given in the excellent "Sanskrit Reader" of Professor Lanman, or in translation, will say that it does not contain all that has been set before you. Just here is the discouraging feature in the reading, for pleasure, of the Sanskrit fable literature. Many of the tales are incomplete. The collections of stories, as they come down to us, are adaptations, usually abridgments, of older collections, and omit some of the steps by which the action proceeds logically to its inevitable conclusion. Other stories have suffered by expansion; doubtless some of the details in that of the Blue Jackal are not very old, as compared with the framework of the tale; but every step in it is, as it has just been presented, motivated. I assure you that there is nothing in my version of it which is not taken direct from one Sanskrit version or another. To understand properly one of these stories, therefore, it may be necessary to read the tale in two or more of the forms in which it appears in different collections.

The strange simile which was applied to the Blue Jackal, of a blueness as "blue as the neck of the God Çiva after drinking the poison," needs an explanation, as has been hinted. The story is found in the Ramayana, the great Hindu epic which relates the adventures of the hero Rama, an epic still told and retold in India, and even now exercising a powerful influence upon the mind and character of the Hindus.

Why Çiva's Neck is Blue.[5]

Long ago the Gods desired to become exempt from age and disease and death, and the thought came to them that by churning the Ocean they might recover the Ambrosia or drink

[5] Rāmāyana I, Chapter 45; also Mahābhrāata I, Chapter 18.

of immortality, which had, along with other precious possessions, been lost at the time of the Deluge. So they took Vasuki, King of all Serpents, and wrapped him around Mount Mandara, and with these as churning stick and cord (*the process is not difficult to understand; a rope passed once or twice around a stick, if pulled first at one end and then at the other, will cause the stick to rotate rapidly, so as to churn the liquid in which it stands*) they began to churn the deep. With the recovery of the Ambrosia and the other treasures we are not here concerned; but after one thousand years of churning,[6] the Serpent Vasuki became resentful of this employment of his person, and struck at the hills and crags as he was drawn past them. The venom dripped from his fangs upon the earth, and soon the whole world, Gods and men included, began to burn. Then they took refuge to the great God Çiva, singing praises of his power, and crying, "Save us, save us!" And the God Indra, a blusterer somewhat after the fashion of the Greek Hercules, stood forth and said to Çiva, "O thou Chief of the Celestials, since the Gods are churning the ocean, the first product of this churning belongs to thee as foremost of the Gods. Therefore do thou take to thyself this poison as the first fruits of the churning!" At this, the God Çiva, to relieve the distress of the world, drank down the poison as though it were nectar; and lo! it had no effect upon him, except that his throat was turned to a bright blue color. (*Even today, when colored prints are made of the God, his neck is portrayed as of a brilliant blue.*)

I cannot refrain from telling at this point the story of what happened when the Gods had recovered the Ambrosia from the Ocean, and were about to drink it. The tale is short:

[6] The Hindu imagination runs to the large and not to the minute. For example, the original version of the Kathāsaritsāgara contained according to its own statement (Kathāsaritsāgara I, Chapter 8), 700,000 couplets, or over fifty times as much as the Iliad and the Odyssey together; 295 times as many lines are there in the six books of Vergil's Aeneid which are read in school in preparation for college. One year of the God Brahma is as long as 3,110,400 million years of men (Mānavadharmaçāstra I, 65–72).

THE ORIGIN OF ECLIPSES.[7]

After long churning the Gods regained the Ambrosia, or drink of immortality, but the Demons sought to steal it from them for themselves. They did indeed get it away from the Gods, but by a stratagem the Gods got it back again and started to drink it, that they might be free from old age and from death. Observing this, one of the Demons, named Rahu, assumed the form of a heavenly being, and mingling with the Gods, secured a portion of the Ambrosia for himself, and began to drink. But the precious potion had just reached his throat, when the Moon-God and the Sun-Goddess recognized Rahu for the Demon that he was, and told the divinities what was taking place. Instantly the God Vishnu seized his sharp-edged discus, and hurled it at the Demon Rahu, severing his neck below the point which the Ambrosia had reached. Down fell his headless body to the earth, shaking mountains, forests and islands, and lay quiet in death; but the huge head had been made immortal by the draft, and soared away into the sky, where it still floats and roves about. Never forgetting the ill turn which the Moon and the Sun had done it, Rahu's head wages eternal warfare against them, and from time to time seeks to devour them; then for a little while, the Moon or the Sun disappears partly or wholly, in what we know as eclipses.

But let us turn a step farther back, to the story of the Deluge. Almost every nation has its own version of this tale, in all parts of the world. One of the Hindu versions, for it is told in more than one place, is entitled "The Fish Story." This name has quite a different significance in modern English, and yet that meaning also would not be so very inappropriate to the Hindu tale, as will appear.

[7] Mahābhārata I, Chapters 18 and 19.

The Story of the Deluge.[8]

Long, long ago there was a mighty Sage, Manu, the Son of Vivasvant, who, by his austerities, had attained great powers. Many years he stood on one leg with arms uplifted; for ten thousand years he hung himself head downwards and with unwinking eyes.[9] One day, while he was practicing austerities, with his garments soaked by the rains and his hair matted upon his head, he stood by the bank of a stream, when a tiny Fish spoke to him with human voice, "Protect me, mighty Sage, performer of vows of penance; I am a helpless little fish, ever in terror of the larger fish, for they continually devour the smaller fish. Help me, and I will requite thee." Manu was filled with pity, and took the Fish into his hands. "What wilt thou do for me?" he asked. The Fish replied, "A great flood will sweep away all creatures on earth, but I will save thee from that fate." So Manu put the Fish into an earthen water-jar.

Here the Fish grew in size, cared for by Manu as though a child. Presently the Fish addressed Manu, "O Exalted One, the jar is no longer large enough for me. Grant me a better dwelling place." Then Manu took it from that jar, and carried it carefully to a large pond, where he put it into the water. There the Fish continued to grow for a long time, until finally that pond, though twenty-seven miles long and nine miles wide, became too small for it. So it again addressed Manu, and besought him to take it to the Ganges River, where it might have room. This Manu did, but even the great and holy stream became too small, and Manu was again appealed to, and asked to put the Fish into the Ocean. Despite its enormous size, the Sage lifted it easily, and carried it without trouble to the Ocean; and to him, as he carried it, it was, marvelous to relate, pleasant to the touch and to the smell.

Manu put the Fish down into the waters of the Ocean, and

[8] Mahābhārata III, 187; Çatapatha Brāhmana I, 8, 1.

[9] Except for the length of time, these penances are not exaggerated; see the article by W. M. Zumbro in *The National Geographic Magazine* for December, 1913, especially the photographs on pages 1290, 1295, 1306.

then the Fish once more addressed him: "O Exalted One, the time has almost come when the Earth shall be purged of all that lives upon it, both plants and animals, by a great deluge of the waters. But do thou build a stanch seaworthy ship, and equip it with a long cable. Then, O Great Sage, enter it with the Seven Rishis. (*These Seven Rishis, or Wise Men, were those whose souls afterwards became the stars of the Dipper.*) Take with you the seeds of all useful plants, and preserve them carefully. Then when you are on the ship I will come to you, with a horn upon my head; by this I shall be recognized. Now I must leave thee; but do as I have said, or thou canst not be saved from the flood."

Manu built his ship, gathered the seeds, and took aboard the Seven Wise Men. When the flood came, he set sail upon the raging sea. To him came the mighty Fish, easily known by its great size and by the horn upon its head. Manu made a noose with his long cable which he had been directed to provide and cast it upon the horn. At once the Fish began to tow the ship speedily over the salt water, rocking and pitching with the waves and winds. There was no land to be seen; the points of the compass were not to be made out. All was water, air and sky; in their midst, the Fish and the ship with Manu and the Seven Rishis.

Many years the Fish unwearied drew the ship, until it brought it to the highest peak of the Himalayas; there stopped and said to Manu and his companions, "Bind the ship to the mountain-top, but not too tightly; as the flood subsides, shift the mooring, that the ship be not left stranded." So they made fast the ship, and that peak was known thereafter as the Ship-Mooring. But the Fish, freed from the noose, spoke once more: "I am Brahma, Lord of Creatures; there is none greater than I. By assuming the form of a fish I have saved you from destruction. Manu will create again men, and animals, and plants, by the practice of austerities, and by my favor." With that the Fish vanished, and Manu took up the task of repopulating the world by the powers gained through the practice of ascetic penances.

But one story has suggested another, until we have drifted away from our main theme, the Animal Fable. It would seem unfair to the clever Jackal to leave him merely the victim of his own ingenuity, as he was in the story which we have given. Let us consider another story in which his cleverness comes out triumphant, that of the Jackal and the Dead Elephant:

The Jackal and the Dead Elephant.[10]

Once upon a time a hungry Jackal happened upon the carcass of an Elephant which seemed to have died of natural causes, for the skin was unbroken. This was unfortunate for the Jackal, for try as he might he could not bite through the thick, tough hide. While he lingered there a Lion came strolling along. The sight was unwelcome, but the Jackal made a virtue of necessity, and addressed him, "Master, as thy Club-Bearer, I am guarding the Elephant. Graciously partake of it." The Lion gazed fixedly at him, and replied, "I never eat a beast slain by another, and therefore leave thee the Elephant out of consideration for thy politeness." The Jackal cried out in joy, "That is truly worthy of your Lordship. Is there not the saying:

> "The Mighty, for he's noble, doth remain
> True to his virtues, e'en in greatest pain.
> Though oyster-shells be burned within the flame,
> When cooled again, their color is the same."

And the Lion, having heard this bit of flattery, passed on and out of sight.

But when he was gone, there came a Tiger. The Jackal, on seeing him, reflected, "Here is a pretty state of things. No sooner am I rid of one enemy, than another comes along, another enemy of heroic strength. I can free myself of him only if I stir up hostility between the two of them. For it is said,

> "When gifts and friendship will not serve thine end,
> Then discord sow, and it may victory lend."

[10] Panchatantra IV, 10.

Even the most virtuous is subject to sundering and division.

> "The pearl so round and fair, the precious thing,
> May be bored though and strung upon a string."

The Jackal accordingly, without the fear or humility due to superior strength, advanced to meet the Tiger, and said, "Uncle, thou art running straight into the jaws of death. The Lion has just slain the Elephant lying here, and has gone away to bathe (*the Hindu performs religious bathing before every significant act of his life, and the habit is here transferred to the Lion*); he installed me here as his guardsman until his return, with the injunction: 'If the Tiger comes, inform me secretly, that I may rid the forest of him. Once a Tiger stealthily devoured an Elephant which I had slain, and left nothing but a bone or two. Since then I have been unceasingly at war with the Tigers.'" At this the Tiger was terrified, and said imploringly, "Nephew, spare my life by saying nothing of me to the Lion." And he fled at the top of his speed.

Next a Monkey came along. On seeing him the Jackal thought, "This fellow has strong, sharp teeth; he will be able to gnaw through the skin of the Elephant." So he called out to the Monkey, "Nephew, I have not seen thee for a long time, and thou comest at a lucky moment to be my guest. See, this Elephant has been killed by the Lion, and it has been left in my charge. Now I tell thee, eat of it as much as thou wilt, and then be off before the Lion comes back." But the Monkey replied, in frightened tones, "Uncle, in that case I will have nothing to do with the eating of its meat; for he who takes care of his life, enjoys hundreds of pleasures. I do not care to be caught by the Lion." But the Jackal said, "Be free from anxiety. I will tell thee when the Lion is coming, while he is still far off." So the Monkey proceeded to gnaw at the hide of the Elephant, and when he had fairly made an opening, the Jackal cried out, "Nephew, run, run; the Lion is coming!" And the Monkey was off like a flash.

Through the hole in the hide made by the Monkey, the

Jackal began to eat his fill. But he had hardly begun when another Jackal appeared, looking hungrily for something to eat. The first Jackal said to himself,

> "To mighty foes obeisance humble make;
> By sowing discord, foes' alliance break;
> To lowly foes grant worthless gifts and slight;
> And 'gainst thine equals wage courageous fight."

Whereupon he assailed the newcomer, overpowered him, and drove him away with blood streaming from his wounds.

After this, the Jackal for a long time devoured, undisturbed, the flesh of the Elephant which he had secured for himself by these various devices.

I have already said that in order properly to appreciate a Sanskrit story, we may have to read more than one version. How essential this is, will appear in the next story, that of the Elephants and the Hares. I first give you a fairly literal translation of the tale as it appears in the Hitopadeça, keeping the word-order and the syntax so far as is consistent with intelligibility in English, and in utter defiance of the demands of English style. The purpose of this is to give a slight idea of the peculiar idiom of the Sanskrit language.

The Elephants and the Hares.[11]

(Literal Version.)

Once upon a time an elephant-herd was distressed from lack of rain, though it was in the rainy season, and addressed the herd-leader: "Lord, is there no means for our existence? There is here a bathing-place for small creatures only. But we, almost blind from lack of bathing, whither shall we go, or what shall we do?" Then the elephant-king, having gone not far, showed them a clear pool. Then the hares dwelling

[11] Hitopadeça III, 3. Other versions are Panchatantra III, 1; Tantrākhyāyika III, 3; Kathāsaritsāgara X, Chapter 62, Story 4.

on the bank were crushed in numbers by the blows of the feet of the elephant-herd. At once a Hare, Square-Nose by name, summoning them all together, sadly reflected, "This elephant-herd, crazy with desire for drinking, will surely come hither daily. From this will perish our family." Then an aged Hare, Victory by name, said, "Do not despond. A remedy must be found by me." Promising with these words, he went away.

And as he went he reflected: "How must I speak when I go into the presence of the elephant-herd leader? For

> "The Elephant slays by a mere touch,
> the Serpent by merely sniffing;
> The Lord of Men slays even while laughing,
> the Hypocrite even while showing honor.

Therefore I, ascending a hill-top, will from it address the herd-leader." This being done, the herd-leader said, "Who art thou? Whence hast thou come?" He says, "I am a messenger sent by the blessed Moon-God." The herd-leader said, "Let his orders be spoken." Victory says, "Hear, O Mightiest of Elephants:

> "Even amidst raised weapons a messenger speaks not falsely;
> For always by his inviolability he is a speaker of the pure truth.

Therefore I, by the Moon's command, say: 'Hear! That these hares, the guardians of the shining pool (*which means also* Moon Pool), have been driven away by you; this has not been done rightly; since these hares are my protectors, from this indeed in the world I am known as the Rabbit-Marked.' "

The messenger having spoken thus, the herd-lord from fear said this: "This was done from ignorance; I will not come again." The messenger said, "Therefore in this pool, bow down and propitiate the blessed Moon trembling with anger, and then depart."

Therefore he went in the night and pointed out the quivering reflection of the Moon in the water, and caused the herd-lord to do obeisance. "O Deity! through ignorance merely

was the sin committed by him; let it be forgiven!" When the Hare had spoken thus, he dismissed the herd-lord. Therefore I say,

> By unauthorized reference to the great,
> the highest prosperity is produced;
> By unauthorized reference to the Moon,
> the hares dwell in peace.

Two questions will, I think, intrude themselves upon you. How did the leader of the herd know where there was a pond of water to which they might go? How did the aged hare Victory succeed in imposing upon the elephant-king so grossly? The answer to the first and easier question appears in another version of the story; the second question is more puzzling, but may also be solved in a similar way.

You will see that the moral of this tale is an Immoral: the Hare gained his point by recourse to an out-and-out lie. Sad to say, many of these Sanskrit stories imply that the end justifies the means; and not infrequently the teaching is rather dishonest, as in the Lion and the Cat.[12] In brief, the story is that the Lion kept in his cave a Cat to guard him against the Mouse which once had nibbled his mane, and fed the Cat well to make sure that it would stay there in the cave. Presently the Mouse ventured out of its hole, and the Cat pounced upon it; but the Lion had no further use for the Cat after the death of the Mouse, and ceased to feed it. And therefore

> Don't ever let your master feel
> His servant has no work;
> Or like the Lion with the Cat,
> His keeping he will shirk.

And that is certainly a most immoral moral.

But to come back to the Elephants and the Hares, let us give you what appears to me the complete and logical version of the story:

[12] Hitopadeça II, 3.

The Elephants and the Hares.

(*Composite Version.*)

In a certain forest dwelt a herd of Elephants, ruled over by their King Chaturdanta (*which means* "Four-Tooth." *A four-tusked elephant is, as a matter of fact, occasionally found.*) But now there came a drought lasting twelve years (*a favorite length for a drought in Sanskrit literature*), and ponds and lakes everywhere were dried up. Then the Elephants spoke to their King, "Lord, we suffer from thirst. Some are already dead; we who survive are half blind from lack of bathing (*bathing is the Elephant's refuge both from heat and from the myriads of insects*). Find us a means of relief from our misery!" At this the Elephant-King sent to all eight points of the compass (*the Hindu counts eight by including the intermediate points, northeast, southeast, etc.*) swift couriers to seek water. Those sent eastward came after some time to a lake called Chandrasaras, which means both Shining-Pool and Moon-Pool, a pond abounding in waterfowl and bordered by cool and shady woods where fragrant flowers were blooming in profusion. (*I omit a long description of its idyllic beauties.*) The Elephants returned to their King and reported their find. The King led the herd by easy marches to the lake, into which they plunged, and drank and bathed to their hearts' content; then they withdrew into the neighboring forests.

But as they came down into the lake, and when they left it also, they had trampled and mangled or slain many of the Hares who dwelt peaceably upon its banks. After the return of the Elephants into the forest, the surviving Hares ran together in wild excitement, to take counsel. Their King, Square-Nose, voiced the feelings of all, saying, "What must we do? These Elephants have found their way to the lake, and will come hither again. Before they return, we must devise some means of protection." Another said, "Let us leave our homes, and settle elsewhere, that we may save our lives." But others cried out, "We cannot so suddenly abandon the

dwelling-place of our ancestors. Let us see if we cannot frighten away the Elephants."

The device which was employed, you already know. But how and why could it be put through successfully? The explanation is in another story, how the Hare offered his life for the God Çakra, or Indra, and was duly honored for the service. The feeding of a beggar is to the Hindu a paramount duty; on this is based the tale:

The Hare and the Begging Brahmin.[13]

Four friends dwelt as neighbors, following the way of righteousness, a Hare, a Monkey, a Jackal and an Otter. One evening, when they were gathered together for conversation, the Hare said to his friends, "Tomorrow is a fast day, and we must observe it ourselves and be ready at its close to feed any beggars who may come our way." They all assented.

Then the problem was, what to have on hand to offer to the beggars who might appear. The Otter went down to the river bank and found a string of fish buried in the sand by a fisherman for safe-keeping. He called, "Does anyone own these fish?" No answer came, for the fisherman was too far away to hear the call, and the Otter took the string home for his own use and for that of strangers at the end of the fasting period.

The Jackal, on a like excursion, found a jar of curds, a lizard and spits for roasting the lizard; he received no reply to his call, "To whom do these belong?" and carried them home.

The Monkey, for his part, laid up a store of mango fruits. But the poor Hare said to himself, "I cannot offer my own food, mere grass, to a beggar who may appeal to me. I shall have to give him of my own flesh!"

This intention of self-sacrifice roused the curiosity of the God Indra, who determined to put the Hare to the test. He came down upon earth in the guise of a Beggar. He took his

[13] Jātaka 316.

stand first at the door of the Otter's home, and being asked why he stood there, he said, "Wise sir, if I could get something to eat, after keeping my fast, I would be about the performance of my priestly duties." (*For these beggars are, to speak strictly, Brahmin priests, and might fairly be called mendicant friars.*) The Otter at once offered him of his store, but the supposed Beggar thanked him and said that he would return on the morrow, when his fast was over. Similar offers and replies took place at the homes of the Jackal and of the Monkey.

But when the Beggar told the Hare why he stood at his door, the Hare said, "Brahmin, thou hast done well in coming to me for food. This day will I grant thee a boon that I have never granted before, but thou shalt not break the moral law by taking animal life. Go, friend, and when thou hast piled together logs of wood, and kindled a fire, come and let me know, and I will sacrifice myself by falling into the midst of the flames; then when my body is roasted, thou shalt eat my flesh and have strength to perform thy priestly duties." Straightway the God Indra, by his divine power, caused a heap of burning coals to appear, and went and told the Hare. The latter came to the place of the fire, and thrice shook himself that he might not incur guilt by carrying with him to death any insects within his coat of hair; then he sprang upon the heap of live coals in an ecstasy of self-sacrificing joy. But virtue was rewarded; the flames failed to heat even the pores of the hair on his body. And when he inquired of the Beggar the meaning of this strange phenomenon, the Beggar replied, "I am no Brahmin; I am Indra, come to put thee to the test. Thy virtue shall be known forever." And the God seized a mountain and squeezed it, and with its essence painted upon the Moon the figure of the Hare, for all to behold for all time.

So it is, even unto this day; when a Hindu gazes upon the full moon, he sees not a Man, nor a Lady, as we Occidentals do, but a Rabbit. You may see it for yourselves; what you

take to be the pure white expanse of the Lady's cheek and brow and neck, is really a seated rabbit, all shining white, facing to your left. So now you may understand what happened in the story of the Elephants and the Hares:

The Elephants and the Hares.

(*Concluded.*)

One of the older and wiser Hares spoke up: "To frighten away the Elephants, we must have a clever messenger. Now the King of all of us, the Hare Vijayadatta, dwells on the disk of the Moon, and one of us shall go as a false messenger, to say to the King of the Elephants, 'The Moon forbids you to enter this lake, for here dwell my subjects.' "

For this service, old Lambakarna, which means Long-Ears, was chosen, for his readiness in deed and in word was well known; but yet he went off with misgivings, for the Elephant was a formidable enemy. As he pondered, an idea came to him which would make the imposture credible: he took his place on a rock at one side of the path which the Elephants would follow on their return to the lake for bathing and drinking the next night. Then just as the Elephant King came to the proper place, the Hare stood forth in the moonlight and cried, "Ho, thou King of Elephants!" To the startled Elephant, he seemed to be the Rabbit in the Moon, stepping right out of the luminary down upon the earth; and he called back, "Ho, who art thou?" The Hare replied, "I am a messenger sent by the blessed Moon-God." The Elephant said, "Tell me then what commands the God has."

The Hare said, "Hear, O Indra of Elephants! (*And next he indulged in a series of moral stanzas to befuddle further the Elephant:*)

> "Though thousands fall within the fray,
> A prince may not a herald slay!

"And again,

"E'en midst drawn swords a herald doth not falsity devise,
For since he never may be harmed he hath no need of lies!

"And also,

"Who does not first test out his strength
And eke that of his foe,
But blindly starts to do some deed,
He meets with naught but woe!

"And so remember, in thy comings to the lake, what the great Moon-God says to thee: 'Hear! Thou hast violated my pool, which bears my name, and hast slain my Hares, the protectors of my pool! Dost thou forget that I am known in the world as the Rabbit-Marked? Avoid the pool, and leave my Hares in peace, and great good fortune will come upon thee and thy followers. Thine are the woods to roam in, and my cooling rays (*the Hindu regards the rays of the moon as positively cooling, not merely as lacking in heating power*) will refresh your heated bodies. But seek again the lake, and my rays shall never more cool you, and you shall perish by the heat of the sun.' "

(*This threat seems weak to us, but it had the desired effect.*) The Elephant was terrified, and hastened to say, "Dear friend, I meant no harm. I would not have hostility with the Moon; tell me how I may appease the blessed God." "Come alone with me then, that I may show thee," replied the Hare. So he led the Elephant to the edge of the lake, and showed him the full orb of the Moon, mirrored in the quiet waters: convincing evidence that this was really a Moon-Pool, under the special protection of the Moon-God. "Bow thyself down now, and do homage," said the Hare. The Elephant did as he was ordered; but he was standing close to the edge of the lake, and as he bowed down, his huge trunk struck the water, making a thousand ripples. Instantly the image of the Moon was seen tremulously reflected in a thousand spots. The Hare said, "Alas, O King of Elephants, what hast thou done? Thou hast doubled the anger of the God." The Elephant asked in

consternation, "How have I done this?" The Hare replied, "By disturbing the water. Dost thou not see how his image everywhere quivers with wrath?" And the Elephant humbly said, "Good Sir, implore the God to be gracious toward me, and I will come here no more!" Then the Hare said, "Blessed Moon-God, it was in ignorance that this one sinned against thee; graciously pardon him!" And when the water ceased to ripple, and the Moon's image again became placid, the Hare bade the Elephant go in peace.

Thus did the Hares free themselves of the Elephants, and thereafter they lived undisturbed. And therefore I say,

> If you will call the great your friends,
> Prosperity comes soon;
> The Hares have peace, because they claimed
> To serve the blessed Moon.

You have, I trust, noticed the difference between the unadorned style of Aesop, and the highly embellished Hindu tale. Both were aimed to amuse and to instruct; but the function of instruction was kept more in the foreground with the Sanskrit stories, for they are not isolated tales, but are grouped together in a setting, of which this is a type:[14] A King has some worthless young sons, whose reform is undertaken by a Sage. The Sage brings about their reform by narrating to them a series of tales, mostly animal fables, every one of them illustrating some point of wise and proper conduct. All the tales are set in a framework story, the characters of which tell stories to one another to illustrate the points which they wish to make; the characters in these included stories tell stories to each other, until you may have four or five, one within the other like the parts of a Chinese puzzle. It was for this reason that I felt no compunction at telling the tale of how the Hare came to be set in the Moon, in the very middle of the story of the Elephants and the Hares. Hindu procedure is all in favor of such interpolations.

[14] **Hitopadeça, Introduction; Panchatantra, Introduction.**

The Hindu tale may be interrupted also by unnecessary descriptions, heaping epithet upon epithet, to the utter weariness of the Occidental reader. In the story of the Elephants and the Hares, a part of the account of the pool to which the herd of Elephants came runs somewhat as follows:[15] "A pool named Chandrasaras, adorned with geese, water-hens, sea-eagles, ducks, and other water-fowl; encircled with the boughs and branches of trees of various sorts, weighed down with flowers and fruits; made beautiful on every side by trees; with its shores spattered with an abundance of foam caused by the prattling waves which the wind drove on the shore; where the heat of the sun was kept off by the hundreds of parasols formed by the twigs of the trees growing by the shore; where a deep melody was produced by the striking of the waves against the bodies of the bathers; filled with pure water; protected from the heat by a thicket of lotuses in bloom; a veritable little piece of heaven"—but enough; and this is only typical.

The specifically Hindu doctrine of Non-Injury, or the avoidance of doing physical harm to living creatures, appeared in the story of how the Hare came to be in the Moon. There the self-sacrificing Hare threw himself into the fire, not allowing the supposed Beggar to put him on the coals; for in that case the Beggar would have incurred guilt. For the same reason the Hare shook himself thrice before the leap into the fire, that he might not carry any insects with him and be responsible for their death. This doctrine of Non-Injury is found in most of the Hindu religions, but especially in Buddhism; in fact, the story of the Hare and the Moon, which you have heard, is taken from a Buddhistic text, written in the Pali language, and is not found in Sanskrit at all, so far as I know. The Hindu carries this Non-Injury to great lengths; he is led to complete avoidance of animal food, excepting milk, and members of the sect known as the Jains actually sweep the path before them with a whisk-broom lest they trample on an insect, and breathe through a veil that they may not

[15] Panchatantra III, 1, in the Textus Ornatior, translated by R. Schmidt.

incontinently swallow and drown a gnat or a fly. Should a mosquito sting them, it must be allowed to finish its meal undisturbed.

Oddly, this has a philosophical and etymological basis in the meaning of the word for "meat" in Sanskrit, which is related in one of the oldest law-books of the Hindus. Now the Hindu philosophers were very strong on punning etymologies, almost all of which, including the present one, are utterly preposterous. Yet this one, unlike most puns, is perfectly translatable into English, so that it may be given without a single Sanskrit word:

The Me-it-ness of Meat.[16]

One should not at any time slay a beast to please his appetite; for he who does so will be born again upon earth and suffer death again, as many times as are the hairs upon the body of that beast, before he may be everlastingly freed from the fetters of the body and attain to heaven. Further, me-it shall eat in the other world, whose meat I eat in this; this the Sages declare the reason why meat is called meat, or (*as the Sanskrit puts it*) the me-it-ness of meat.

These are a few samples from the Folklore of India, with some characteristically Hindu features. They are not dead stories, buried in the oblivion of palm-leaf manuscripts, but still live in the consciousness of the people. In all the myriad dialects of India they are still told and retold, and are a great influence in shaping the character of the nation. They may seem strange to us, yet we ought to realize the fundamental resemblances to the Folklore of other and nearer lands; then by an understanding of the differences, the specifically Indian traits, we may come to a better and more sympathetic comprehension of that vast land where nearly one-quarter of the human race are born, live and die.

[16] Mānavadharmaçāstra V, 37–55.

UNPROVED PROPOSITIONS AND UNDEFINED RELATIONS

By George H. Hallett
Professor of Mathematics

The programme of modern science comprehends no less than the reduction of all phenomena to the operation of the law of necessity and its object is the removal of all contingent matter from the universe.

The scientist is not dogmatic in regard to the possibility or impossibility of the ultimate attainment of this object, he simply points to the achievements of science as showing clearly that what at one time may be regarded as contingent matter, at a later period can be proven to be necessary.

Even though modern science has constantly extended and broadened its field of research, and though the scientist recognizes no limits to this field save those which are artificial and self-imposed, yet it is regarded by some to be an open question whether real limits exist or not; but we shall return to this point.

The growth of science has been stimulated in the past by the active opposition of powerful organizations, the members of which were actuated by motives which proceeded from upright and laudable causes. But modern science takes no account of opposition of any sort whatsoever; it assumes that in the face of truth all opposition will vanish precisely as the morning mists vanish in the rays of the rising sun.

The method of modern science is mathematics and the constant aim of the scientist is to crystallize truth in a mathematical formula. Mathematics, therefore, in that it is the method of modern science, is of supreme importance. Its value can only be estimated when we consider the primary and fundamental

position which it holds and when we recognize the essential connection which it has with all the work of science.

The high position thus given to mathematics is conceded to it by scientists the world over, but there are many to whom the announcement would come as a distinct surprise.

Mathematics, in fact, is without interest to the majority of people, even to students. This lack of interest is due to causes which are well recognized, and through the operation of these causes the work of science has been seriously interfered with. As an illustration of this condition we may cite a statement of a professor in the Medical School of this University, in which he says that certain of the investigations which have been conducted in his own laboratory cannot be completed until a pathologist is found who is possessed of sufficient mathematical knowledge and initiative to carry them to their completion.

Mathematics as an existent something about which we talk and of which we constantly strive to know more is, we believe, not without elements of intrinsic interest to all.

A duty which the pure scientist owes to society is to share his knowledge with all who desire the same. And in this day, more than ever before, the scientist is recognizing this duty.

The terms "unproved propositions" and "undefined relations" which form the subject of my few remarks this afternoon have a purely logical content. They refer to those elements which stand at the very beginning of those logical systems which, when taken as a whole body of doctrine, form that part of mathematical science which is known as pure science.

The processes of many of those special sciences which rest entirely on empirical foundations are mathematical in character, and for this reason and not unnaturally these sciences have come to be classed among the mathematical. Pure science, therefore, is of necessity a mathematical science, but the converse statement that a mathematical science is pure science is not necessarily true.

It is sometimes stated that in pure science (mathematics) nothing is taken as granted, that all things are proved. No

statement could be farther from the truth, as it is evident that no thought, be it rational or irrational, is possible without having something to think about; this point, however, will be considered later.

The pure scientist, therefore, in order to have something to think about, *i. e.*, on which to base his science and knowing full well that a direct appeal to experience is denied to him, makes use of the simple expedient of introducing a set of symbols which shall combine according to certain arbitrarily assumed rules.

We shall return to a somewhat detailed consideration of the utility of this method of procedure.

For the moment we wish to discuss a few very simple questions which are connected with our subject and which may be of interest in themselves.

Pure science as such has for many years been subject to the serious criticism that it lacked the human element. Undoubtedly the criticism has assumed its present form by a transfer to the science of what was originally intended for the scientist.

The pure scientist, absorbed in work which requires always many hours and often even a life-time of continuous application and self-sacrificing endeavor, sometimes thinks that he has not time in which to live the life of the average or normal man. He voluntarily denies to himself many of the purely social and human elements of life in order that he may devote himself wholly to his science.

He is not in touch with the vital human interests of his day and is often helpless under the stress of circumstances which, though not out of the ordinary for the average man, are new and unfamiliar to him.

Standards of life and living are for him of secondary or even of little importance, owing to the simple reason that he has no opportunity for the consideration of such things.

Such is the traditional estimate of the pure scientist. There exists, however, no such man and the picture we have drawn represents no living scientist.

The man of science of the present day is a man among men, willing to assume the responsibilities which belong to all, interested in the affairs of life, and determined to avoid a one-sided development.

And this leads us to the principal consideration: the pure scientist has always been the product of the schools. In past ages the students of the universities were drawn from a comparatively small class of society, and the universities themselves sanctioned an academic life and academic ideals far removed from the life and ideals of the great majority of people.

Notwithstanding this, these universities were the homes of pure science in its existent forms, and it is to them that the world and hence all classes of people owe primarily all of modern science.

Universities in this day, however, are close to all the people and intimate relationships exist between the academic world of the schools and the business world of commerce and industry which are to the advantage of both.

The university still continues to be the home of science and society comes constantly to it for that science. More important, however, and in marked contrast to the practice of the past, the university now sends the scientist to the people.

That the schools of the past have been and the universities of to-day are the promoters of pure science is a fact the significance of which cannot be overlooked in any discussion relating to that science. It will suffice here to simply notice that the pure scientist to-day finds his proper place to be in the college and the university for two reasons: first, the long preparation required before he is equipped to enter upon his investigations, which preparation cannot be adequately obtained anywhere outside the school; and second, the inspiration that comes from the close union of men engaged in the same work.

The length of time required for his preparation, in that it is necessary, is of course not in itself a disadvantage; that it should come to be regarded as one is due to a condition which is characteristic of our day and nation. It is no less than that

the dominant ideals of the present require of any form of endeavor that important results be shown. When applied to matters of education, these ideals accord to any course of study a value which lies in and varies directly with its immediate applicability to the affairs of everyday life. Whether or not this standard of values is the best for mankind in general is here irrelevant. Standards of measurement are not fixed; some vary with time. The important consideration is that it now prevails and that the student of pure science is compelled to measure his own accomplishments in terms of units which are so different from those in ordinary use that the real value of these accomplishments cannot be estimated by those who are unaccustomed to the use of any other system of units than that employed by men of affairs in measuring the accomplishments of those who are engaged in the ordinary business of the world.

This difference in ideals and standards of measurement is the principal cause for what at times seems to be a lack of appreciation of the real value of the work of the pure scientist and of the results of pure science.

Contrary to the general opinion, it is nevertheless a fact which is of great importance to the student of pure science that pure science as such is not taught in our schools and undergraduate colleges. Before the average student enters the lecture room of the pure scientist he has received his bachelor's degree and has obtained the maturity of mind which belongs to a college graduate. When once within this room, however, he openly expresses regret that he had not been able to enter it at a much earlier period.

In order to avoid misunderstanding it should be clearly stated that the several mathematical sciences which are or which may be taken by the undergraduate in a school and college course are not, strictly speaking, pure sciences. Moreover, no serious attempt has ever been made and proved successful to introduce courses in pure science for the undergraduate. These things come, as indicated above, much later in the scholastic work.

In both algebra and geometry, which are the fundamental subjects in school mathematics, constant appeal is made to intuition and experience. The methods of empirical sciences are called upon to do service in the presentation of these subjects, and even laboratory courses in mathematics have been extensively introduced and put into successful operation. How far removed such methods are from the domain of the pure scientist may be appreciated when it is recognized that the great pedagogic advantages which these laboratory methods possess lie in the fact that the student uses his mathematics only when it is needed in the solution of some concrete problem. He soon comes to believe that the importance of mathematics lies in its immediate applicability to the particular problem at hand.

For those who are to use certain elementary facts and processes in the work of life and whose sole purpose in studying mathematics is merely to acquire a knowledge of these facts and processes, the empirical methods of presentation are entirely satisfactory. There is, however, a general impression among educators that it is desirable for all to have an understanding of at least the elements of pure science, since the methods of investigation which are characteristic of this science can be carried over to many other fields of research.

The fact to be emphasized is simply that pure science is not a secondary but a primary science. It requires nothing but a certain maturity of mind. Many other sciences, however, are derived from and depend on pure science, and a knowledge of the principles of pure science is a necessary part of the equipment of all who work in these secondary sciences.

It may be thought that what we have just said is of the nature of special pleading and that society at large is not interested whether the college student works in pure science or does not so work.

The simple statement that we have been speaking of that class of students from which all the scientists of the world are drawn will be sufficient to show that the question is an important one.

An additional circumstance is of significance in this same connection. A pure science is in its very essence a logical science and therein the concepts of formal logic are in constant evidence. Elementary geometry is without doubt the most logical of the subjects taught in the schools. By means of it the student is rendered familiar with not only the facts of the science, but also—and of far greater value to him—with those purely logical principles upon which all its developments depend. This sort of empirical logic which one absorbs unconsciously from the study of elementary geometry is the one great reason why the subject of geometry is regarded so highly by many of the leading educators. Without attempting to minimize the value of this logical training for the student it should be stated that not logical training merely but training in formal logic also is a pre-requisite for work in pure science. The laws of thought upon which all reasoning must ultimately depend are of sufficient importance in themselves to receive careful attention. For example, the Laws of Identity, Contradiction and Excluded Middle are unknown to most students of elementary mathematics.

As just stated, no better example of a purely deductive science can be taken than the elementary geometry of the schools. In this geometry it will be generally conceded that there is no more important concept than that of a straight line. Let us consider for a moment the definition of a straight line which is often given by the student and accepted by the teacher. That such a line is one which has the same direction throughout its whole extent. This definition or one similar to it is now given in the texts in use. Moreover, it is not here claimed that for the beginner and for the texts any other definition will serve as well. It is clear, however, that this is not really a definition as used by the mathematician, but is merely an equivalent of some such statement as "the student knows from experience what is meant by the term straight line and that the concept of direction resulting from his experience is 'direction in a straight line.'" In other words, the term straight line is not really

defined except by an appeal to experience and is therefore actually in the mathematical sense an undefined term in our elementary geometry. It is true that according to dictionary uses this definition is perfectly valid. A corresponding example is afforded by the definition of horse found in Webster's International Dictionary where the reader is informed that the animal is "a well-known hoofed quadruped."

A glance will show, then, that the term straight line was not devoid of content when we met it first in geometry. Before beginning that study we often used the term in many different connections and what we called a straight line was a particular element which was common in consciousness to all the objects which appeared in these different connections. A straight line in elementary geometry, therefore, is defined in the sense that Pascal used the term as being clear and understood by all persons. Modern geometry as a purely deductive science does not and cannot appeal directly to experience. Its undefined terms must have no other logical content than that implied by the unproved propositions.

Suppose for the moment we assume the existence of two classes of elements which we shall call A elements and B elements respectively, and also let us suppose that there is a certain transitive relation between A elements and B elements by which any two A elements are united with only one B element and any two B elements are united with only one A element. There are here two propositions: A elements exist, B elements exist. There are two relations of: "being united with." There are two terms: "element" and "being united with." Undoubtedly the logical implications of these undefined terms, unproved propositions and undefined relations are not many. But if we suppose the A elements to represent points and the B elements to represent straight lines, the relations cited may be expressed in well-known form that two distinct points determine one and only one straight line and two straight lines determine one and only one point. This is not the time or place to go into detailed account of the terms, relations and propositions or the

fundamental assumptions for different geometries, but it is of importance that such abstract geometries do exist and that our knowledge of these geometries has led to a broader view and a clearer appreciation of the concrete geometry with which we are familiar in our daily experience.

The ever-recurring appeal to intuition and experience in the earlier mathematics of the school to which reference has been made, although it removes these subjects in a degree from the realm of pure science, is a matter of necessity. The mind of a child or a young man does not engage readily and naturally in the purely deductive processes. It reasons from actually observed causes and deals with the phenomena of an objective world. The mind that can turn its attention away from that of the senses and focus it on an ideal world peopled with abstractions is not the mind of the youth. The same idea may be expressed by the statement that syllogistic reasoning and mathematical induction are at first unnatural and artificial processes. Such reasoning is essentially symbolic in its nature and the very symbols are ultimately entirely without content and therefore completely artificial. The world of pure science is a very different world from the world of experience. In the former there is no contingent matter, necessity rules supreme, determinism is the universal law, freedom of thought, will and action is impossible; in the latter approximations and probabilities alone are possible.

Now it will be granted that to predicate exactness or necessity of any course of reasoning which is founded on approximations and probabilities is absurd. Hence there arises the particular necessity of a pure science and the assumption of a definite correspondence between the abstract and the concrete. The pure scientist is led by experience in making his assumptions so that these assumptions may stand as abstractions which have a definite correspondence with certain phenomena of the world of the senses. But even if he were not so led and should by any possibility build up a science with no reference to a concrete representation, it would follow—we firmly be-

lieve—that a concrete representation would exist and could, if deemed advisable, be found. Were it not found, the scientist would forever be ignorant of the fact that he had a science. It is from this last consideration that the pure scientist can well be satisfied with science for science's sake.

A prevailing opinion is that the scientist is of necessity a firm believer in determinism. In justice, however, it should be borne in mind that necessity is at the very basis of all science and that no science as such can possibly exist without determinism. For example, the science of psychology is possible only to the extent and in the degree to which the facts of that science can be brought under the operations of a universal law. The scientist is, therefore, in relation to his science a firm believer in determinism. But no universal science exists and the very idea of a single science which shall embrace all things involves contradiction. It follows, therefore, that science does not embrace within its scope the consideration of all the possible elements of thought, and hence in reference to those elements which are not so included there is no reason to suppose that the determinism of science should exist. As a matter of fact, only in so far as the world of the senses corresponds to the world of science is the determinism of the latter to be carried over to the former. And it is only by an appeal to some such principle as the harmony which is postulated as existing between nature and science that any connection whatsoever between these two worlds can be established.

In order to illustrate the methods adopted by the pure scientist and the mathematician and to furnish the basis of certain remarks in reference to these methods, we shall consider a simple example of a miniature mathematical science which is taken from a well-known treatise on projective geometry.

Let S be a class, the elements of which we will denote by A, B, C . . . . . Further, let there be certain undefined subclasses of S, any one of which we will call m-class. Concerning the elements of S and m-class we make the following assumptions:

I. If A and B are distinct elements of S, there is at least one m-class containing both A and B.

II. If A and B are distinct elements of S, there is not more than one m-class containing both A and B.

III. Any two m-classes have at least one element of S in common.

IV. There exists at least one m-class.

V. Every m-class contains at least three elements of S.

VI. All the elements of S do not belong to the same m-class.

VII. No m-class contains more than three elements of S.

There are here just two undefined terms, elements of S and m-class and one undefined relation "belonging to a class." The undefined terms are devoid of content except such as is implied in the assumptions.

Certain questions in reference to these assumptions and terms will naturally occur to anyone who reads them. The first undoubtedly is in regard to the particular form of the assumptions themselves. What guides the scientist in assuming one thing instead of another or has he made many different sets of assumptions and the one actually given has been the one which, in the end, he preferred to all others? If many different sets of assumptions have been made, why is one set to be preferred to another?

Other questions of a different sort but entirely relevent may be asked. How is the serious work of the world advanced by a set of gratuitous assumptions made in reference to certain undefined symbols? Is not the whole thing a kind of intellectual game?

The answer to these questions may be given in reference to the above set of assumptions without difficulty, but its importance lies in the fact that a corresponding answer may be given in every case.

Consider for the moment the following rows of integers:

0	1	2	3	4	5	6
1	2	3	4	5	6	0
3	4	5	6	0	1	2

The foregoing assumptions were made as the result of a careful study of the properties of these three rows of integers. A glance will show that these rows and columns give us a concrete representation of the assumptions.

Moreover, the existence of this concrete representation establishes the fact that the assumptions are logical and consistent.

It is to be noted that many different concrete representations may exist for the above set of assumptions, and the great advantage which the abstract form of these assumptions has is that any theorems which are derived as a logical consequence of these assumptions are true for any and all concrete representations. The full significance of this last remark cannot be over-estimated.

As an example of a theorem which may be derived we take the following: Any two distinct elements of S determine one and only one m-class containing both these elements. This follows directly from assumptions I and II. From the example of the particular mathematical science just cited, the method which is distinctive of such a science may be seen in its actual operation. This method, in its form of application at least, is comparatively new in the world of science and it is only in very recent years that it has taken its proper place and supplanted all others. It is now the method universally adopted by all those engaged in serious scientific investigations.

It has been necessary to examine carefully the foundations of all the exact sciences and to recast our ideas in reference to many things in which there was formerly considered to be no element of uncertainty. A most conspicuous example is that of the number system of ordinary arithmetic. It was found that the theory of rational numbers, that is, of ordinary integers and fractions, rested on no secure foundation; that our fundamental ideas in regard to these concepts had been borrowed from the world of experience, and, therefore, that the fundamental elements of the science had not received precise definition. Modern pure arithmetic as presented differs so radically from that of the past that it would be with difficulty recog-

nized by those who were formerly regarded as masters of the subject.

It is the province of science to explain things according to a method peculiarly its own; that is, scientifically. It is only within very recent times that exactness has been given to the term "scientific explanation." The older methods were well exemplified by the philosopher and mathematician, Pascal, who was born in 1623. Professor Jevons says of him that it may be doubted whether any man ever possessed a more acute and perfect intellect. The words of Pascal, as given by Jevons, are as follows:

"The true method which would furnish demonstrations of the highest excellence, if it were possible to employ the method fully, consists in observing two principal rules. The first rule is not to employ any term of which we have not clearly explained the meaning; the second rule is never to put forward any proposition which we cannot demonstrate by truths already known; that is to say, in a word, to define all terms, and to prove all propositions. But in order that I may observe the rules of the method which I am explaining, it is necessary that I declare what is to be understood by definition.

"We recognize in geometry only those definitions which logicians call nominal definitions; that is to say, those definitions which impose a name upon things clearly designated in terms perfectly known, and I speak only of those definitions.

"These things being well understood, I return to my explanation of the true method, which consists, as I said, in defining everything and proving everything.

"Certainly this method would be an excellent one were it not absolutely impossible. It is evident that the first terms we wished to define would require previous terms to serve for their explanation, and similarly the first proposition we wished to prove would presuppose other propositions preceding them in our knowledge; and thus it is clear that we should never arrive at the first terms or first propositions.

"Accordingly in pushing our researches further and further

we arrive, necessarily, at primitive words which we cannot define, and at principles so clear that we cannot find any principles more clear to prove them by. Thus it appears that men are naturally and inevitably incapable of treating any science whatever in a perfect method; but it does not thence follow that we ought to abandon every kind of method. . . . . The most perfect method available to men consists not in defining everything and demonstrating everything, nor in defining nothing and demonstrating nothing, but in pursuing the middle course of not defining things which are clear and understood by all persons, but of defining all others; and of not proving truths known to all persons, but of proving all others. From this method they equally err who undertake to define and prove everything, and they who neglect to do it in things which are not self-evident."

Modern pure science does not differ in its method so much as might be supposed from that outlined by Pascal. The difference may be said to be principally in the application of the method. The older science started with experimental facts which were known to all men and applied the processes of deduction and induction to these.

The pure science of to-day at first makes no appeal to experience, but it does not thereby escape the necessity of such an appeal. Otherwise there could be nothing in common between the old science and the new. As has been stated, the scientist is guided by the existence in experience of concrete representations of his science, and his activity is conditioned by this existence.

In other words and in the form of question, what is done by the pure scientist after he has introduced his undefined terms, propositions and relations? How does he prove that his system has no contradictory elements in it? The answer to these questions is significant: there is no known way except by a direct appeal to experience. He seeks a concrete representation of his system, and when found the existence of such a representation proves for him that in fact his system is a logical system.

Now it will be agreed that the modern method is not only more rational than the old, but also that it admits of possibilities of extension which were explicitly denied to the old. Modern pure science nowhere in its fundamental ideas and elements mars the harmony of its developments by going outside of itself. The fact that it is necessary to appeal to the objective world in order to assure us that our system does not contain contradictory elements seems to be a matter of accident. But it is no accident, and the time will never come when it is possible to test an abstract system as to its logical validity without departing from the world of abstractions. If this be so, the fundamental differences between the methods of Pascal and those of to-day to a great extent disappear. And the advantage which we now enjoy is due primarily to a feeling that the modern application of the scientific method is in reality superior to that formerly in vogue, in that it makes but a single appeal to experience.

LIFE INSURANCE AS AN ECONOMIC FORCE IN THE COMMUNITY

By Solomon S. Huebner

Professor of Insurance and Commerce

Life insurance is the rich man's opportunity and the poor man's necessity. My purpose today is not to emphasize the family and business uses of life insurance as they benefit the middle and wealthy classes, alhough these are very important. Instead, I have in mind the great mass of this nation's wage and salary earners—some thirty-six millions in number—and the relation of life insurance to their welfare. Through the persistency of life insurance salesmen, the middle and wealthy classes have been pretty thoroughly canvassed, with the result that the face value of policies carried by the regular companies aggregates today $22,000,000,000 (equal to about one-seventh of the total wealth of the country), and the assets of these companies amount to nearly $5,000,000,000 (a sum approximately equal to all the savings deposits in all of the nation's savings banks). But to the great mass of wage-earners it cannot be said that the beneficent influence of life insurance has yet been applied to an extent at all worthy of this noble institution. Here the present agency system has admittedly failed, and through no fault of the agent. The circumstances confronting him—ignorance, improvident habits and, above all, an average income too small to purchase adequate family protection—have proven insuperable obstacles. Investigations among wage-earning families in this country show that only about one-fourth are protected with life insurance of $500 or less, representing an annual income of $25 at the most. Only about one-third possess some sort of a saving fund, and this in most instances is small. Between two-thirds and three-fourths

of American working families possess neither insurance nor a saving fund, and are just able to make ends meet, *i. e.*, just able to take care of the present without making any provision for the uncertain future.

Aside from the danger of unemployment, the great mass of the nation's toilers are ever confronted by four great risks, viz.: illness, accident, premature death and dependent old age. While I have hopes that the hardships resulting from honest unemployment will ultimately be lessened through some plan of unemployment insurance, I am certain that insurance is the only sure method of providing against the loss of income through illness, accident and premature death, and the failure to have a reasonable competency for decent support in old age. Life insurance is especially designed to protect against the risks of premature death and dependency in old age; and when supplemented with a reasonable and broadly interpreted "disability clause," can also be made to protect against loss resulting from total disability through accident and ill health.

Time does not permit a recounting and explanation of the manifold advantages of life insurance to the business man, although in their combined effect they are a powerful economic force in the community. For our purpose, since we are concerned today with life insurance in its relation to those who are dependent upon wages and salary, it is best to have clearly in mind the benefits which life insurance bestows upon this, by far the most important, class in our economic life. Briefly outlined, these benefits are the following:

(1) Life insurance furnishes the only certain method of capitalizing the income-producing value of the life of the breadwinner, and of indemnifying the loss of that value to the dependent family in case of premature death or (what is equally if not more serious) total permanent disability through accident or disease. A life insurance contract is simply a promise on the part of the insurer to pay the insured (or his beneficiary) a stipulated sum upon the happening of death or some other expressed contingency. Its great and fundamental purpose is to enable

a person to assign a value to himself *i. e.*, to capitalize his value as an income producer in the community, and then to have that value paid to his dependents whenever death may deprive them of the income which this person earned while living. Life insurance, in other words, is a "hedge" against the loss of income; it furnishes a fund which, when safely invested at the current rate of interest, will yield an income for the benefit of dependents as a substitute for the income made by the insured while living. Its purpose is to change uncertainty into certainty by enabling the many to combine with a view to contributing small sums periodically so that each may be assured of the payment of a substantial sum whenever death may end the income-making power.

The family is the cornerstone of society. Speaking in an economic sense, it should be established and run as a business and on a sound business basis. It should be protected against needless bankruptcy. The death or disability of the head of this business institution should not involve its impairment or dissolution any more than does the death of the head of a store or a bank. Proper provision for the family is a strictly personal duty and no man has a right, if his income at all permits him to do otherwise, to place upon the community any part of that duty. His duty in this respect is not limited to his days on earth, although many seem to think so. Family responsibility implies provision on the part of the income producer not only while alive, but also subsequently. "He that taketh not care of his own is worse than the heathen," and certainly one of the greatest questions that should confront both parties to the marriage contract is: What will be the financial condition of our home (our little business) in case unforeseen death, illness or accident spoil our nicely arranged plans? Life insurance has really a more vital bearing on the welfare of women than of men. Women, particularly, should be educated in the family benefits of life insurance both for themselves and their children, and should claim its protection as a matter of right.

Buildings, ships and stocks of goods are nearly always insured.

Property insurance is assumed to be a necessity. Ask any property owner about it and you will be told frankly that it is simply good business to insure. Yet, when it comes to the value of the life of the head of the family—he that holds in his care the sustenance, education and future prospects of his children—is it not strange that so many should regard that value as of less importance than buildings and goods, when in the overwhelming mass of instances we know it to be of infinitely greater importance both as concerns the family and the community as a whole. Is it not strange to see a man gamble with the greatest of all risks—an untimely death—when the welfare of his own confiding family is at stake? Not to carry life insurance is to gamble. When the family benefits of life insurance are understood and when an adequate estate is not at hand, the wilful assumption of such a gamble is a very mean act, since in case of death the loss falls not upon the gambler but upon those he should love dearest. It is also an unfair gamble, since it is apt to make friends or society assume a burden that it was the strictly personal duty of the head of the family to carry. Life insurance is a plain Christian duty. He that does not capitalize himself through life insurance for the benefit of those dependent upon him and whom it is his legal and Christian duty to provide for when he has had the matter fully explained to him, when his income makes it at all possible, and when he does not possess an adequate share of the world's goods, deserves rightfully to be placed in the class of scoundrels. Such a man, as Dr. Talmage well said in his famous sermon on "The Crime of Not Insuring," "is a defalcation, an outrage, a swindle; he did not die, he absconded." Let it be taught that the finger of scorn should be pointed at any man who, although he has provided well while alive, has not seen fit, when his income permitted, to adequately discount the uncertain future for the benefit of his dependent household.

(2) Life insurance is also the only safe method of accumulating a competency in a convenient and certain manner to meet the needs of old age or periods of adversity. No other institution is so vitally related to saving, and in this connection it is not

only important that we should do all we can to get the wage and salary earners to capitalize their value against the uncertainty of the future, but we should also inculcate in them the spirit of thrift. The statement will be recalled that only about one-third of this country's wage-earning families possess a savings bank account. Life insurance bears the following five distinct relations to saving, all of which are important to the rank and file of our population.

(*a*) It serves as a hedge against the saving period being cut short by death, even assuming that a person has the strength of will to resolve upon a policy of saving and to carry the resolution through to the end. Such strength of will is the exception and not the rule. The commonest argument against life insurance is: I do not believe in life insurance; I believe in saving. How foolish to argue thus when a dependent household is at stake! What shall it profit a man to say, "I will save $5,000 in twenty years," when he does not know that that number of years—yes, even one year—will be given to him. It takes time to save, and life insurance secures one against the contingency of the saving period being cut short by an untimely death. It assures one of an estate equal to the full face value of the policy as soon as the first permium is paid.

Let us assume that it is the purpose of a person aged 25 to accumulate a savings fund of $10,000 out of wages or salary during the next forty years, or by the time age 65 is reached, the age which marks the close of the average man's working life. This proposition may be attempted by saving a certain amount each year and investing the same. But this method involves three great dangers: (1) death before there has been time to save the desired amount; (2) failure to continue the plan, the resolution being more often ended in this way than by death; and (3) failure to keep intact what may already have been saved, owing to bad investment or needless expenditures. The result can be accomplished more definitely by the purchase of a $10,000 forty-year endowment policy maturing at age 65. Mathematically this policy is a combination of a savings bank account and decreas-

ing term insurance. Thus, in the first year of the contract when the savings portion of the contract is small, the term insurance amounts to nearly $10,000, but if at any particular time the savings accumulation under this policy is $1,000, the insurance protection amounts to $9,000. When the investment portion equals $9,000, the insurance portion is for only $1,000; likewise when the accumulation of the $10,000 fund is completed and paid at age 65, the insurance portion is reduced to zero. It is thus seen that this policy assures an estate of $10,000 at all times during the forty-year period and protects the insured from the chief danger—death before the fund reaches the desired amount —attaching to any plan of saving which is not hedged with a life insurance policy. Both saving and insurance should be practiced if possible, but it is clearly unwise to practice saving to the exclusion of life insurance. If only one is possible because of limited means, insurance should be selected because of its much greater certainty in leaving a stipulated fund for the support of the family in case of untimely death.

(*b*) Life insurance not only makes saving possible, but it is saving. What has been explained for a forty-year endowment policy is true of nearly all forms of life insurance policies, although the size of the saving fund may be larger or smaller, depending upon the nature of the contract. So a $10,000 ordinary life policy, which is an endowment policy at age 96, the extreme limit of life according to the American Experience Table, gradually grows in value until it amounts to $10,000 at age 96, which sum will be paid in case of the insured's survival to this age. If 96 seems an illogical age at which to receive the money, let the insured have a more reasonable age, like 65 or 70, substituted as the date when the face value of the policy shall be paid. Moreover, in case of adversity the savings fund portion of a life insurance policy, subject to certain restrictions, may be withdrawn, in which case the policy terminates, or may be borrowed from the company at a reasonable rate of interest, the policy continuing as before upon the repayment of the loan. Let it also be remembered that practically all the companies are earning

between 4½ and 5 per cent on the savings which they are holding in trust for their policy-holders. Past experience shows that on the average life insurance companies have earned on the savings left with them by policy-holders the largest interest returns consistent with safety. Owing to the mathematical and scientific character of the institution and the stringency of government supervision of the companies, there has not been a failure of a large and well established life insurance company in the last quarter of a century, despite the fact that we have witnessed several severe financial panics during that period. It is said that only one mutual life insurance company, and that a comparatively small one, has failed in the entire history of the United States.

(*c*) By requiring the payment of premiums at regular intervals, life insurance tends to encourage thrift on the part of the insured. The regular payment of the premimum from year to year will soon be looked upon by the insured in much the same manner as he comes to regard interest upon a mortgage. To secure the necessary funds to pay the premium the insured will increase his efforts to save the required sums out of income, the saving habit thus being inculcated. Household and personal expenses will soon be adjusted to the premiums. It is the common assertion of innumerable policy-holders that at the end of twenty, thirty or forty years they have become the possessors of a considerable sum of money which under other circumstances they would never have accumlated, or which, if they had done so, they would have lost or dissipated. Life insurance tends to bring about compulsory saving and represents the accumulation of small sums (which in all probability would not otherwise be accumulated) over a long period of years, into a substantial sum. In brief, it bears the relationship to thrift that the modern utilization of by-products, largely wasted in former years, bears to many of our leading manufacturing enterprises today. The assets of life insurance companies today, as already stated, aggregate nearly five thousand million dollars. The larger part of this huge sum, it safely may be stated, represents compulsory

saving, the odds and ends, the by-products of saving, which would otherwise have been wasted.

(*d*) Life insurance makes possible the utilization of what has been saved, thus greatly increasing the initiative of that large class who have saved a little, but who dare not use it in any undertaking that involves risk. Assume that the head of a family has saved a few thousand dollars and is afforded an excellent opportunity for the investment of these savings in some business pursuit. If it were not for life insurance the owner of this capital could not afford to invest this sum and assume the speculative hazard connected with most business enterprises because of the fear that the savings might be lost, and that in case of premature death no provision would exist for those dependent upon him. In cases of this kind life insurance furnishes a hedge against such a contingency and assures the prospective investor that in case of death and the loss of the investment the insurance company will reimburse his dependents to the extent of the sum placed in the business.

(*e*) Life insurance also makes it possible for many to borrow although they possess no tangible collateral, *i. e.*, it enables a large class of young men, who have had no opportunity to save, to obtain an education or to start in business without first being obliged to save out of limited income and in that process waste the best years of their life. Many young men have relatives or friends who are interested in their welfare and who could be induced to advance the necessary amount at the current rate of interest and without tangible collateral if only assurances could be given that the loan will be repaid. Knowing the young man's reliability, the lender feels certain that the loan, with interest, will be repaid in due course of time, but he cannot afford to gamble with the contingency of death, because he knows that should the borrower be removed by an untimely death the loan could not be repaid. This uncertain element in the transaction may be obviated in one of two ways—either the young man may insure his life for an amount sufficient to cover the principal of the loan, any premiums that the creditor might have to pay and

all anticipated interest charges, and then assign the policy to the creditor; or the creditor may, if he so desires, take out a policy on the life of the debtor. Life insurance in this way serves as a means of enabling many young men to obtain the initial supply of capital to acquire an education or to start in business.

(3) Lastly, reference should be made to the peace of mind and freedom from worry which one purchases when buying a life insurance policy. This factor alone is well worth the price to the insured. Worry is one of the great curses of man. By removing a load of care from the mind life insurance promotes efficiency and makes life happier. "For this reason," as I stated on another occasion, "life insurance should be regarded by the average man as one of his most treasured possessions, and premium payments should not be looked on as an expense to be grudgingly borne." It may safely be stated that the possession of an adequate amount of life insurance causes the average policy-holder to eat better, sleep better, feel better and, as a result of these, to work better.

The foregoing advantages pertain particularly to the great mass of wage and salary earners of the country, and, as already stated, time does not permit an explanation of the many special business uses of life insurance. The effect of the described advantages upon the community is inestimable. Economists have generally taken the view that life insurance is not a producer of wealth; instead, that it simply represents the shifting of payments from the fortunate to the unfortunate. In this view, I believe, they are wrong. By changing uncertainty into certainty, because of its fivefold relation to saving, and by the elimination of worry, life insurance is a powerful factor in increasing the wealth of the country. It is the handmaid of human labor and thrift in the same way that property insurance in its various forms is the handmaid of manufactures and commerce.

If the foregoing advantages of life insurance are conceded, it follows that this form of protection is a wage-earner's necessity. But to what extent do wage-earner's today enjoy the benefits of

life insurance? Only about one-fourth of this country's wage-earning families carry as much as $500 protection or less, and only about one-third possess a savings bank account. Professor H. R. Seager concludes, in his book on "Social Insurance," that about two-thirds of this country's families would be dependent in case of the income-producers death or disability, and that it is conservative to assume that about one-half this number would, upon the happening of this contingency, fall into a lower class in the industrial scale. We are apt to be deceived by the largeness of the figures that represent the amount of life insurance in this country. Despite the $22,000,000,000 of life insurance, it is estimated that only about one-tenth of the value of human lives in the United States has been capitalized, and, if we exclude the policies carried by the middle and wealthy classes, the proportion for the wage-earning class will be found to be much smaller. Only about one-tenth of our population, we are told, succeeds in accumulating a reasonable competency, and through reverses a majority of this limited number lose the same by the time age fifty is reached. Only three forms of life insurance have met with any considerable measure of success in reaching the wage-earning class, viz.: so-called industrial insurance, which necessitates weekly collections of premiums from the homes of the insured and the fundamental purpose of which is to cover the expenses of burial and last illness rather than to capitalize the life of the income-producer for the benefit of dependents; fraternal insurance chiefly known today for the insecurity of the protection promised in the past; and group insurance or private insurance funds conducted by employers, although this method has as yet been applied to only a limited portion of the working population.

Nor is there likelihood of a change, either as regards the taking of life insurance or the development of voluntary thrift, unless some comprehensive plan is adopted by society. It is exceedingly difficult, I believe impossible, to remedy the problem through education. The average wage-earner is by nature an optimist as regards the risks referred to and relies upon his luck.

His natural impulse is not to sacrifice a portion of present earnings for protection against a possible future contingency. It is natural for him to let the future take care of itself. As has been well said: "His desire to provide against the contingency of disability and premature death is feeble in comparison with the desire to live better in the present." Nor is there the same incentive to save today as there was in the past. Two great inducements to saving have been the ownership of a home and the ownership of the tools of production. Relative to the first the wage-earning class is becoming increasingly a class of tenants. Relative to the second, business is rapidily becoming large scale production and workers are increasingly forced to a realization that they must always remain wage-earners. Even with reference to the large class of agricultural workers, there is a distinct tendency towards the development of a class who are, and expect to remain, wage-earners and tenants.

But even assuming that the tendency were otherwise, the insuperable obstacle to the application of regular life insurance to wage-earners is the present level of wages. This is too low in most instances to furnish the means of paying for even two or three thousand dollars of life insurance protection. The wage level at present is adjusted to a basis which does not consider life insurance as a necessity of life, although any thinking man will view it as a necessary item of the family budget, like food, rent, clothing and fuel. That the insurance problem in its relation to wage-earners is a real one is recognized by both employers and labor leaders all over the country. It is evidenced by the attention given to the subject in labor reports, by numerous compulsory workmen's compensation acts passed during the last five years, by the recent introduction in various legislatures of compulsory health insurance measures, and by the numerous private plans of life insurance carried by employers for the benefit of their employees, either because they regard it as the humane thing to do, or because it is considered as a profitable policy to increase the co-operation and efficiency of their working force. Yet, employers who follow this method are

greatly in the minority, and the amount of insurance provided too often seems woefully small.

Evidence abundantly shows that a comprehensive plan of life insurance protection for wage-earners cannot be left to voluntary action. The success of ordinary life insurance companies has been due primarily to the agency system, but this system, owing to the insuperable obstacles mentioned and for no fault of the agent, has not succeeded in reaching the wage-earners. Life insurance, in the absence of compulsion, must be sold by salesmen. Companies which have depended upon advertising instead of agents have not even succeeded in reaching the middle and wealthy classes, thus showing that life insurance is reluctantly taken even by those who understand its benefits.

All comprehensive voluntary plans of life insurance undertaken by governments have also been failures. On various occasions, for example, England has enacted laws providing that the post office savings banks might be used as a medium through which the government might sell annuities and insurance contracts. These laws recognized the problem I have explained, and had for their purpose the wide dissemination of insurance among the working classes. Purposely, however, these laws were not compulsory and depended upon the voluntary action of the public. What was the result? During the seventeen years of the operation of the Act of 1864, only 6,524 life insurance contracts and only 11,646 annuities were sold. The Act of 1882 resulted in a similar showing. At the end of the twenty-fifth year of its operation the total number of annuity contracts in force aggregated only 2,930 ($297,307); the total insurance contracts only 13,262 ($3,727,000); while the average number of annuities written per year amounted to 2,026, and of life insurance contracts to only 677, a result attained by various individual American companies in the course of a few days. The voluntary plans adopted by Massachusetts and Wisconsin give further evidence to the same effect. After three and one-half years of operation, the Wisconsin plan, in 1915, showed only 352

polices with a face value of $266,500 on the books (a day's work for any one of our large companies), and during the first half of 1915 only forty policies were written. Group insurance of employees, paid for by the employers, is also, in the main, a recognition of the fact by employers that wage-earners will not insure if left to their own initiative.

The foregoing statements are made to show that we are confronted by a condition and not a theory, and that, if the benefits of life insurance are to be generally applied and to a reasonable extent to this nation's wage-earners, it is necessary for society to apply the principle of compulsion. Why not apply this principle to so important a matter as life insurance protection when we can already point to its application in this country to other important matters that intimately concern society as a whole? We have adopted compulsory education and accept it as a matter of course. We are rapidly extending the principle to the drink evil. During the past few years thirty-one states and territories (nearly the whole of the industrial portion of the United States) have adopted workmen's compensation acts which offer protection against the loss of income through industrial accidents. A considerable number of these states make the compensation plan compulsory, and in nearly all the states the laws are compulsory in effect, since the employer is allowed to select only one option in place of the compensation schedule; but said option is so drastic that the employer, for all practical purposes, feels compelled to come under the compensation schedule. In Massachusetts and New York compulsory health insurance bills were introduced in the legislatures within the past few weeks, and I am advised that bills will be introduced in other states in the near future.

Workmen's compensation laws have been enacted with such rapidity as to show a general approval of such legislation on the part of the public. Most employers with whom I have discussed the matter recognize the principle as fair. Now, I ask, why is it not just as fair to apply the compulsory principle to the risk of premature death as it is to extend it to death from indus-

trial accidents? Certainly life insurance is much more vitally related to the workman's family and to the community than accident insurance. Let us not forget that our workmen's compensation laws, concerning which so much has been said and written of late, and which have received such hearty endorsement, are a comparatively small factor in protecting workmen and their families against the risk of the loss of earning power. These laws protect only against the risk of industrial accidents. They do not protect against accidents occurring outside of industrial pursuits, although these comprise about one-half of the total number of accidents; secondly, they do not cover occupational diseases, much more numerous and serious in the aggregate than accidents in business; and, thirdly, they do not cover premature death from causes not related to industry at all, a factor many times more important than the preceding two combined.

Our present compensation laws, while good as far as they go, are really only a "drop in the bucket." Is it not true that the average working family needs support just as badly in case the income producer dies from causes not connected with industry as when he dies from accident while engaged in his industrial pursuit? The harrowing details of the latter are brought home to us in newspaper accounts, while the former are so numerous as to be considered ordinary events which do not call for a statement. For the average family, however, both are equally important from an economic point of view, and I see no economic reason for singling out the one for special legislation to the exclusion of the other. During the past few months several mothers in Philadelphia murdered their children and attempted suicide. In each instance the story was about the same—no resources left by the father at the time of death and no ability on the part of the mother to continue the struggle. These are the few cases that become public. There are hundreds of instances each year in this great city alone where the misery, although unrecorded by the press, is equally great, and only greater strength of will prevents the crime.

Now let us turn to the remedy. Any comprehensive plan must contain the element of compulsion if life insurance is to be widely disseminated among wage-earners and is to fulfill its great mission for this class. But in the application of compulsion emphasis should be placed on the fact of insurance rather than the method of insuring. There should be a compulsory requirement of a minimum of protection, but no compulsion as to the insurer from whom the insurance must be purchased. The insurance should be compulsory and the insurer optional.

The limits of this paper permit only the suggesting of the general outline of a plan, and I appreciate the necessity and difficulties of working out the numerous details that present themselves in a proposition of such magnitude as the one under discussion. Briefly stated, I believe the state should require a minimum of at least $2,000 of life insurance for all who have assumed family responsibilities or have legal dependents. This minimum should be required along the same general lines provided for under the Pennsylvania, New York and other workmen's compensation acts. In the first place, an exception should be made where a property account can be shown which will satisfy the state authorities, appointed for the purpose, that the minimum amount of insurance is unnecessary. Permission should be granted to take the insurance in either (1) a stock or mutal life insurance company or society licensed to do business in the state, (2) a state fund, or (3) a benefit or fraternal society if operated on a sound mathematical basis. Moreover, if an employee is insured under a private fund, or under a group policy, the same ought to be accepted, provided the protection is equal to the required minimum and is based on sound mathematical principles. Permit me to add that it would be well to make the policy payable in ten "instalments certain," of $200 each, to be followed thereafter by the continued payment of the same instalment throughout the lifetime of the beneficiary. This feature will not add much to the cost, and will avoid the danger, on the part of beneficiaries not accustomed to the possession of considerable sums of money, of dissipating the proceeds of the

policy through wasteful expenditure or foolish investment. Fortunately, and for the reason just mentioned, the instalment plan has been adopted in the Pennsylvania Compensation Act. The ten instalments certain will do much to protect the children, and the continuous instalment feature will protect the widow throughout life. I also believe that it would be advantageous to have the policy contain a disability clause, providing for the payment of instalments in case of the insured's total disability through accident or illness. Lastly, allow me to suggest the desirability of having the insurance mature as an annuity at some reasonable age, like 65 or 70 (the close of the productive period of life), thus providing a fund for old age support.

The requirement of a minimum of life insurance should meet with hearty approval for three main reasons:

(1) The plan should be supported because of the immense amount of misery and suffering that will be eliminated, and life insurance salesmen, as well as those connected with companies in a managerial capacity, should be the first to lend their hearty support. They, more than any other class, have advocated life insurance as a necessity, a duty, a religion to be preached and taught on every possible occasion. They have been the prime movers of life insurance education. Yet, despite all that has been done, it remains a fact that the wage-earning classes have not been reached, and there seems to be no solution except compulsion of a minimum. Now I say: "Be consistent and help bring about a realization of the widespread beneficent influences of life insurance to those who need it most." By doing this you will not only make easier the lot of the present generation, but by protecting the children in workmen's families you will enhance the opportunities of the next generation.

(2) The plan will do much to lessen the excessive tax burden on the life insurance business. Whereas other leading countries encourage the taking of adequate protection by lenient taxation or otherwise, it has been the policy of American commonwealths to tax life insurance most unmercifully. Not only are many of

our law-makers laboring under a wrong impression as to the nature of the enormous funds held by our companies, but they feel that the institution of life insurance has as its patrons chiefly the wealthy and middle classes. The intimate relation of life insurance to the masses is not so apparent to them. Bring life insurance into the homes of the masses, and I feel that it will not be long, especially in a country where numbers count so much politically as they do with us, before the life insurance institution will be honored and fostered at the hands of the lawmakers.

(3) The educational effect of compulsory insurance applied to our millions of wage-earners will be many times greater than all the efforts at education by insurance salesmen, companies, associations, newspapers, schools and universities combined. The requirement of only $2,000 of life insurance for each wage-earner with dependents will more than double the present amount of life insurance. The initial required amount of insurance will cause the policy-holder to realize its great benefits, thus bringing him into the market for additional insurance. I believe that the plan would, in the course of a decade, much more than double the amount of insurance now carried by the regular companies. Industrial insurance furnishes proof of the great educational value of insurance among wage-earners. The evidence shows that many who start with burial insurance come into the market for ordinary life insurance as soon as conditions permit. Nor need insurance companies fear the operation of a state fund. In view of the conditions surrounding our governmental system, the companies, I believe, will have no difficulty in competing successfully with such a fund, and in any case the insurance that might be placed with a state fund should be limited to the required minimum only. I also believe that the plan should be supported for the reason that, if life insurance is required of all workers with dependents, the present level of wages—now disregarding life insurance as a necessary item in the family budget—must rise sufficiently to pay for the required insurance, thus placing the insured in as favorable a position for

additional insurance as he previously was when he carried no insurance at all. If my economics should be wrong on this point then I feel that the payment of the premium should, as is now done under our compensation acts, be placed on the employer, who, in turn, will shift the cost on the consuming public through a raise in the price of his goods or service.

THE RETURN TO NATURE

By Frederick Ehrenfeld
Assistant Professor of Geology and Mineralogy

Over a troubled sea dotted with the cockle shells which men call ships there rises the voice of the wind in the first words of a dialogue which is leading to angry discussion, passionate deeds and a resurrection of the wildest forces of Nature, for such is the way of the winds and such is the way of the sea. On many a sandy beach or rocky cliff by the sea may be seen the ineffaceable records of such dialogues in the past and we grasp the fact that this is one of the conflicts which outlast time and tides, for the passing of winds and the roar of the ocean have nothing to do with time, they are and they have been; even the solid arches of the mountains of the earth are built of foam and sand and shell which bear record that here once blew the wind and here was once the sea.

Now to those who this day go down to the sea in ships this is still the vital thing—in the face of such winds and water what shall we do?

Somehow when we really face this thing of Nature in her wilder moods, newspapers, stock exchanges, electric lights, city apartments and even wireless seem of rather less value and are not so indicative of man's wonderful progress as we like at times to think they are.

A storm brews in the Caribbean, passes along the coast and the tangled mass of steel girders, concrete piles and scattered wreckage bear ghastly witness to the fact that Nature still retains some things in her grasp to baffle the greatest ingenuity of man.

Again the winds change with the climate, the moisture of the skies ceases to fall, and gardens and cities a thousand years old

give place to the shifting sands of the desert which will endure in turn for other thousands of years.

Or yet once more the growth of trees and vine may cover all so that where once was a populous city there is now the song of the birds, the dense tangle of the jungle and the gleaming eye of the tiger; for to Nature time is nothing, her processes are neither swift nor slow except in the mind of man.

And so the dialogue between the winds and the sea has become a vast drama in which man is both a spectator and a participator, and once more we ask: What then is man to do? From the dawn of time and from the faint shadows of prehistoric records to the present hour man has faced this question of himself and nature.

Always in some time and place nature has to some minds seemed hostile, and so misunderstanding her ways and lost in processes which seem at times to be inconceivably slow and at other times to be appallingly rapid and malevolent, the human imagination has conceived alike a set of cold and heartless divinities or a hell host of evil spirits infesting equally the woods, water and skies.

It has been a slow and toilsome process to extricate ourselves from such a mental condition towards Nature and to perceive that earthquakes and tempest or the pest of fly and insect are not punishment inflicted for sin but are part results of a natural order which began long before the human race appeared and will perhaps continue long after man has ceased to be a physical being; though it is often true, of course, that by interference in the ways of Nature man had disturbed the balance of natural laws to his own hurt.

It was in the closing years of the eighteenth century that the philosopher, James Hutton, one of the founders of modern geology, wrote: "It is not to common observation that it belongs to see the effects of time, and the operation of physical causes, in what is to be perceived upon the surface of this earth; the shepherd thinks the mountain upon which he feeds his flocks, to have been always there, or since the beginning of

things; the inhabitant of the valley cultivates the soil as his father had done, and thinks that this soil is coeval with the valley or the mountain. But the man of scientific observation, who looks into the chain of events connected with the present state of things, sees great changes that have been made, and foresees a different state that must follow in time from the continued operation of that which actually is in Nature.

"It is thus that enlightened natural history affords to philosophy principles from whence the most important conclusions may be drawn. It is thus that a system may be perceived in that which, to common observation, seems to be nothing but a disorderly accident of things; a system in which wisdom and benevolence conduct the endless order of a changing world."

It is in some such state of mind as this that we must approach Nature, an attitude in which wisdom and well wishing take the place of superstition, fear and selfish warfare.

Not a few of the turmoils and troubles of man with Nature arise from his ignoring the chain of natural events connected with the present state of things and by thinking that he may at will change the sequence of natural events without producing any ill effects, or by imagining that natural events will not recur merely because he has not himself observed them to do so. But in "the endless order of a changing world" may be seen the germs of systems of thought which have profoundly affected art, philosophy, religion and life; the philosophy of the Greek, the idea of rebirth of the Oriental, the Christian Resurrection, and the doctrine of evolution of the modern scientist are in their last analysis expressions of the hope of the human heart that in the grand orderly processes of Nature are concealed the seeds of new life and of all that we call progress.

Under the influence of such thoughts the soil ceases to be mere mud and the dust of the earth becomes a divine medium for the creation of life and beauty, while from the wastage of death and decay itself in the slime of the pool springs up the lotus, ever fragrant and new and forever fresh with the imperishable strength of the spirit.

Why then do we speak of the return to Nature? Because man in time forgets her, quarrels with her and with all the greatest ingenuity of skill wars upon her and deludes himself with the idea that because he has leveled a mountain he has conquered her, and, worst folly of all, comes to think that he does not need to concern himself about Nature at all, and eventually thinks of himself apart from Nature.

And again others, after a time, rediscover Nature, write verses in her love and praise, paint her, study her, and opening their hearts and souls receive, as from on high, exaltation and freshening of spirit and a new light into the system of things.

There are some whose ultimate ideal is the complete domination and subjection of Nature by man. But this is a confusion of language, for man is only a part of Nature, and in warring upon Nature he wars upon himself while the greatest subjection of Nature he can make is to subdue himself, and this the human race has always been unwilling to do.

In the idea that man is somehow separate from the remainder of Nature or that I am one thing and that Nature is another, lies one of the greatest dangers of the darkening of man's spiritual vision, to say nothing of the outrageous wrongs he is committing against his own physical welfare. It is not one of the accidents of symbolism that the venerable person who put together the narrative of the Hebraic story of Creation should have set forth as one of the penalties of transgression the expulsion of man from his garden. For whatever else may be said of this ancient story which has come down to us from the mists of the past, it remains true that the loss of the love of Nature and of the opportunity for a sweet communion with her has been, and is today, one of the profound tragedies of the human race. We may yet come to see that one of the cardinal sins of our contemporary civilization is the wandering farther and farther away from the love of Nature for her own sake, and that in following a utilitarian attitude and permitting the indiscriminate destruction of forests, the leveling of mountains and the disappearance of wild life, we are committing acts which,

paraphrasing Napoleon's remark, may be best described as blunders and crimes together.

Since the phrase "return to Nature" has been used in a more or less restricted sense to indicate often a literary movement, let me say that I wish in this lecture to indicate some of the ways generally by which human love and thought of Nature has found expression, and also try to show that the return to Nature is a fundamental condition of mind which is subject to processes of change. This state of mind is so interwoven with those greatly absorbing ideas which we call religion, philosophy and science, that we can never hope to understand one without knowing something about the others; and this is true of the artistic expression of Nature love as well. The world of science today is making one of the greatest returns ever made to Nature, but it is of so different a character from that which was dominant only a few generations ago that our entire attitude towards the whole world of Nature which we call the universe is in process of change of a far-reaching character. Religion, art, philosophy and whatever concerns society are all of them together responsive to this modern return to Nature, but at the same time are so involved in it as to be an integral part of it.

Yet we find strange and unexpected analogies between the world of science today and the cosmic philosophies and religions of the past; and amid much that is objectionable in the Nature attitude of today we find grounds for hope that the Nature worship of the past united with the far flung gropings of today will lead us still farther towards the goal of final enlightenment. But actually the history of the human family has always been one of recurrent changes, of periods of ebb and flow of Nature thought and forgetfulness; no one race of people shows either a monopoly or an unbroken uniformity of such appreciation, however much the means of expression may vary from each other.

When we study the relationship of man to the world of Nature about him, we see that this is particularly true, and that running back into the past are alternating epochs of appreciation and indifference, if not abhorrence of Nature. We trace also in

the Nature movements of today forces which received their impulse ages ago in human thought, though often reappearing under changed forms.

Probably there are many intellectual and well-educated persons today who still hold the idea that the Nature movement led by Wordsworth in England was a new discovery, and was for the first time a really modern appreciation of the natural world as a thing of beauty, a source of poetry and an inspiration of life. The fact that people do think so simply shows how completely thought in England had become detached from previous Nature epochs by a period of deadly dryness and sterile artificiality, through which Wordsworth broke with his daisy fields and the voices of running water. Now it is evident that there are certain questions or problems to be solved in all this. Considered merely as a study in origins, the condition of mind which has led men to love Nature and to express their devotion, presents problems alike baffling and absorbing; when we add the further ones of why, if man ever returns to Nature in love of her, he then forgets and loses her, and the consequent recurrent epochs of his return and forgetfulness we still further complicate the subject.

It is difficult now for us to put ourselves in the position of primitive man who saw in every passing cloud, in every tree, and brook and stone some angry or jealous supernatural being, ready, on the slightest pretext, to slay or destroy, or in the position of the German peasants of the middle ages whose whole possible pleasure of the forests was destroyed by the belief in witches and subterranean beings lying in wait to strike.

Very poetic and picturesque to us now, no doubt, but a horribly uncomfortable state to live in.

We need to do no more than suggest the long train of social and personal ill effects produced by such a belief; men went a long way about rather than pass a particular tree or rock; to remain out after dark was an act of folly; houses were logically constructed to keep out the night air and the witches and demons who rode upon it.

It is not too strong a statement to say that much of the discomfort of life and many of the devastating plagues of disease which ravaged Europe in the middle ages were directly the result of a loss of appreciation of the beauty and loveliness of Nature and sympathy with her.

The people of Europe were too much afraid of Nature to study her, to try to understand her or to separate the good from the bad, or to seek a union of sympathy with her. They hated her.

In the misery of superstition and the ravages of disease with the spiritual blight of both, the world of Europe in the middle ages paid the full penalty for the turning away from the real appreciation of the world of Nature. Thus it becomes evident that if we are fully to understand what the return to Nature or the appreciation of Nature means, we must apprehend not only the attitude of the contemporary world, but also dig deep into the soil of human history to see if perchance we may find, as we find in other soil, new food to refresh the whole life of man.

It is only in this way that an answer may be had to the question of the roots of Nature movements which are affecting modern thought.

Is there any appreciable or ascertainable connection between the appreciation of Nature by the contemporary world and the appreciation shown by earlier people back to the mists of antiquity?

We are met at the outset by two more or less widespread opinions; one is that the love of Nature as we have it expressed by landscape painters such as the Dutch School, Corot, Millet, and by the Americans—Harrison, Richards and Winslow Homer, or by such writers as Wordsworth, Shelley and a host of others in America and Europe, is a comparatively recent thing; that the ancients did not so love Nature.

Carried to its farthest and most logical conclusion, this idea leads to the opinion expressed in a certain "History of the Sandwich Islands," where it is stated that "to the heathen the book of Nature is a sealed book. The Sandwich Islands present some of the sublimest scenery on earth, but to an ignorant

native, to the great mass of the people in entire heathenism, it has no meaning." Each of these assertions as to so-called heathens in general and the Hawaiians specifically, is flatly contradicted by the actual facts as we have them. In the folk-lore and literature of the Hawaiians are abundant references to the beauty of Nature. If we may turn the author's assertion about to mean that every one who does not love sublime scenery is a heathen, we might admit the truth of his remark, but I am afraid that is not what he meant.

The other conception of Nature love is that it appears in its purest and best forms as an objective appreciation; that anything of an idealistic kind or an idealization of birds, flowers, mountains and so on, to include or to indicate any of the aspirations of the human soul is a modern sentimental fallacy, and something which has no place in Nature appreciation. One of the most recent expositors of this position, Mr. R. W. Livingston, is particularly annoyed, for instance, by the poets speaking of the sky-lark as a "blithe spirit," when it is simply a high flying bird which sings. This same objection would rule out Blake's "Tiger, Tiger, burning bright in the darkness of the night," and many other expressions of Nature love conceived in a similar spirit. Livingston, in short, draws the line clearly between objective, material reality and the symbolism which seeks the expression of the unseen, the spiritual in Nature.

I wish to draw clearly our attention to the importance of this distinction, for between these two antagonistic conceptions of the world of Nature lie vast systems of thought expressed in schools of religion and in schools of painting, poetry and other art forms; it is a reappearance of the two antagonisms, the material and the spiritual, the objective and the subjective, which have troubled the thoughts of men back through the long ages.

Need we be surprised, therefore, if we find that this conflict has expressed itself in landscape painting and other forms of Nature expression?

The spiritual, the unseen part of man, is as much a part of

Nature as is his physical body, and unless we are cognizant of both, there can be no entire comprehension of Nature, and I hold this to be true both of mankind itself and the whole field of Nature.

The question of the relation of early mankind to Nature is not so hopeless a problem as it would seem to be, for the primitive races expressed the facts of their observance of Nature in forms which have been preserved from destruction and are more and more being recovered by systematic search. In addition we have in traditions and practices of tribes, still or recently living under primitive conditions, evidences of the greatest value in piecing together the fragments of primitive human thoughts about Nature. We may almost consider these as living fossils portraying the connected history of man's attitude towards his place in the universe.

More particularly the idea of evolution so firmly held in modern thought leads us naturally to expect that as we approach nearer and nearer to the primitive people of the world, that intimacy with Nature will be an inseparable part of their whole existence.

Created out of the ground or dust of the earth and growing up among animals almost as intelligent as themselves, men in those days were in a peculiar intimacy with the world of Nature about them.

And we may trace the feeling for Nature back to a past so remote and so intimately connected with general Nature events that it partakes of geological history as well as of human.

Man as a geological incident appears at a time, estimated on the same basis as other geological events, at a period of nearly half a million years ago. At that stage of his career we may say that he was decidedly a "natural." Leaving his records on bone, stone, in caverns and in wall paintings as he grew up, we find that about 20,000 to 30,0000 years ago he had not only made several "returns to Nature," but had become an artist able to express in a very objective way his acquaintance with the world of Nature about him. This very early art has been traced from

its crudest stages up, step by step, to a period in "which wonderfully naturalistic effects are produced by the combination of three colors—black, ocher and red in polychrome paintings." (H. F. Osborne.)

In the famous Bull Buffalo from the caverns at Altamira, Spain, there is reached a form of animal painting which may rank with those of our own era. Twenty thousand years ago and some one could do this! Our appreciation of Nature has ceased at one stroke to be anything to pride ourselves upon as a discovery of the modern world.

But what an inspiration to draw in again the breath of Nature from these old cave men. We are once more placed in our proper position as one of the things of the divine soil from which we have so often wandered away.

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I wish to pass now to a brief consideration of Nature thought and its expression in ancient Greece and China, and try to throw into contrast two very different attitudes towards Nature, attitudes which are in theory, though not in manner of expression, struggling in the thoughts of the world today.

Greek Nature thought was a growth; it was also a culmination. As we find it expressed in the great names in Greece in the half millennium before the Christian era, it was a blending of elements from all the cultures clustered about the Mediterranean Sea; it came from Persia and the East, from Egypt and Crete, and the islands of the sea, to culminate in the flower of Greek thought. Partaking of the characters of each separate source it yet produced at last, as its culmination, a conception of Nature which the world has come to regard as essentially Greek. The Greek mind, too, discovered Nature in a manner which in some way has never ceased to engage the thoughts of men. The great humanistic reactions in the modern world are in many respects essentially Greek.

From early Greek myth have come two of the greatest stories ever written—Pygmalion and Galatea, and Orpheus and Eury-

dice; for in them the stones are made to speak and the dead return to life, and the heart of the world knows that this is true.

When we approach the poetic and esthetic appreciation of beauty we are lost for words to describe the culminating glory of Greek art, which had its inspiration from Nature.

"The isles of Greece where burning Sappho lived and sang" are like the poems of the great poetess herself, preserved as fragments, outwearing the corroding of time and sea tide. Like the scattered fragments of the continent set in the frame of the sea, the fragments of her poems come to us across the wastage of the sea of time. We burn with her in love and passion, we hear the call of the mariner and we still catch the murmur of the sea lapping the shores of the isles of sunny Greece.

In the placing of a marble temple the Greek esthetic sense chose that site which would best recede into the landscape about it. It is one of the most wonderful things I know that the most beautiful stone in the world, marble, which it has taken the most profoundly far-reaching geological forces to produce, should have been at hand to express the supreme beauty of Greek art. I cannot but think that the noble nature of the stone itself entered into the Greek soul and spoke through it, for "there are some things which can be said only in marble."

We must admit the great attainment of this Greek conception of Nature. The picture of the Greek gods with their deification of the forces of Nature is a tremendous thing for any race of people to have evolved. The sight of the gods on Parnassus is one of the most sublime conceptions of the human imagination. As we see them in all their perfection of form and almost godlike beauty our hearts beat and our bosoms swell; Venus, Apollo and Minerva seem the very final expression of beauty, art and wisdom. How beautiful, how beautiful it is! But after all when we presume to draw near they are seen to be only enlarged images of ourselves, our strength, our own weaknesses, our own vices, and we fail to find here the solution of the problems of Nature. We fail to find even a satisfactory statement

of the problems of man and Nature as the modern world now understands it.

So that at last the attitude of the Greek mind towards Nature became an objective one; his appreciation of Nature was real, it was beautiful; but in time it became, because of his intense individuality, simply a reflection of himself. Compared with the thought of the modern world the Greek conception of Nature was materialistic rather than spiritual. Since I conceive it to be impossible to arrive at the full appreciation of Nature without including those elements called spiritual as distinguished from the objective material, this lack in the Greek attitude towards Nature seems to me a vital defect.

Whether it would have remained so is, I suppose, at the least, open to conjecture, though the ultra-humanistic Nature of Greek thought makes any other than an objective conception of Nature seem very doubtful.

There were outside influences coming into Greece in the few centuries preceding the Christian era which, if uninterfered with by catastrophes to the Greek state, might have introduced into Greek life elements of the Persian, the Buddhistic and other eastern conceptions of Nature which would in time have modified in a far-reaching way Greek thought and particularly Greek art in its portrayal of Nature.

One of these influences was the invasion of Greece by the Persians under Darius and Xerxes, and another influence was Alexander the Great. It may seem forced to introduce into a discussion of Nature appreciation the personality and exploits of a man best known as a military conqueror, but I venture to recall the fact that we are dealing not alone with outward symbols and forms of Nature love, but with the epochs of human thought; whatever has affected this thought to change its attitude towards Nature and its expression in some art form becomes pertinent to the discussion.

Alexander the Great was more than simply a ruthless military conqueror with a policy of "Weltpolitik." He was an explorer and discoverer of the East to the West; he introduced into the

world a great increase of knowledge of geography, and above all else he was a pioneer in breaking down the colossal walls of ignorance separating the East from the West and making a highway from Europe to Asia. While he did take Greek learning, art, literature, to Asia, he brought home a vast store of treasures, art objects and, no doubt, scholars, all of which might in turn have permanently altered Greek conceptions of Nature and its forms of expression. But with the death of Alexander in 323 B. C., ancient Greece was tottering to its fall, and internal strife and external foes prevented any profound reconstruction of ancient Greece.

So Greek learning and its attitude towards the world of Nature remained fixed for all time in the fragments of her art, her poetry and architecture and in the great names of the very few centuries preceding her decline and fall and the domination of the western world by the Roman Empire.

When, after the fall of the Roman Empire, Greece once more became an independent people and country, the impulse ran in other channels; the old culture was gone forever.

So it seems fair to say that the Greek, having failed in his science to solve or to unravel the complex system of Nature, and his theology being either a reflection of himself or an objective personification of physical force, the only thing he conceived to be left was to retreat farther within himself and try to find in human Nature and its activities the be all and the end all of the world.

A beautiful dream! And one which today is reality to many.

It was Heraclitus, who, in the fifth millennium before Christ, is reported to have said of his fellow Greeks: "It behooves us to follow the common reason of the world; yet though there is a common reason in the world, the majority live as though they possessed a wisdom peculiar each unto himself alone." So at last our attitude towards Nature is not simply a matter of theory or academic discussion, neither can it remain simply an attitude of objective pleasure. It is a vital matter. We may not ourselves realize it, but in the long run of time it so affects thought

that the whole fabric of a social organization may rise or fall, depending upon the attitude which people take towards Nature. For my own part I am not willing to admit that a purely humanistic philosophy can ever solve, or ever has solved, the problems of man and Nature. There is too much Nature which is outside of our human experience. A Nature impossible for us to ignore permanently. Yet if the modern world has not solved these problems, we at least know more about the matter, and while we see clearly that man is only a part of the universe, we believe that it is full of activity which is not to be taken as hopelessly unfathomable, because so much greater than we are, nor to be dismissed as of no use to us because we cannot very clearly, as yet, see it. Above all else we are coming to see that the material is the means by which unseen forces act, and that these unseen forces may be the real matter, which act now in one form and now in another.

The modern world has by the very necessity of the case, by reason of our own Nature, become involved in a confusion of material and non-material, spiritual and physical phenomena, which a primarily humanistic philosophy is unable to unravel. If it were possible for such a philosophy to succeed, perhaps the Greeks would, in a few centuries more, have solved the problem.

We are, in plain language, interested in and entangled in problems for which the objective material world, as we understand material, has no solution. Now this is a part of Nature, but it is the unseen part. It is not possible to avoid all this for it is part of human nature to wish to know the all. While it is often said that interest in religion is on the decline (an assertion easier to make than to prove) the fact remains that the religion of the Jew, the Buddhist and the Christian have all of them permanently altered the attitude of the human family towards Nature.

If then we abolish the unseen for the modern world the whole meaning and value of life is altered and the meaning of Nature is altered.

I wish here to insist upon the point that if our return to

Nature is to take us anywhere it must be more than the plaything of a summer vacation, it must be more than the passing verses of spring poets, sweet as these often are.

The full discovery of evolution in the nineteenth century has in itself opened out whole series of highways into countries, mountains and continents of Nature almost undreamed of to the ancient world.

So that our return to Nature is our entire philosophy of life, our attempt to solve the meaning of the universe, and to place ourselves in harmony with the system of things. May we not say that the lotus springing up from the slime is still the outward and visible sign of a realm of Nature for which neither ancient Greek religion nor Nature philosophy has any solution to offer?

Yet whatever we may feel that the Greeks missed in their attitude towards Nature we must not fail to grasp the great fact that to them as to the advanced thinkers of today, Nature is clean and beautiful.

As the sun of the old Greek world set St. Clement of Alexandria protested against the prudery which was creeping over men's thoughts, and said in part: " We should not be ashamed to name what God has not been ashamed to create." Perhaps we do not realize today that our own struggles to return to Nature are a repetition in part of the struggles of the early Christian Greeks against the twilight shadows of an oncoming retreat from Nature; a night of darkness which blowing in as a fog from the sea, settled down over man and Nature, over mountain and forest, blotting out them and the starry heavens above with a misery of blind groping and fear.

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As we turn to the Nature philosophies and Nature returns to the vast continent of Asia, we seem to pass into a land where Nature has from the dawn of time been man's thought and aspiration; rivers of water and life flow from the four corners of the world across all the ways of life; there are gardens,

flowers and a teeming life which for so long has clung to the ground that all things, earth, rocks, trees, serpents, birds, man and the wild animals are sacred because all contain the spark of universal life. To such a conception all things have a touch of beauty.

The religions, the philosophies, the sages, which have arisen in Asia, have one and all contributed to a grand conception of Nature; out of the spirituality which has made the Pantheist, the Jew, the Buddhist and the Christian has been distilled a conception of Nature which comprehends the love of the ultimate, the absolute. From the flying of far-soaring birds, from the motions of waterfall and broad flowing river they have conceived realms of Nature which are not simply objective material, but are also the symbols of the unseen spirit.

The first and the last; creation, death, decay, resurrection and enlightenment! The final purpose of Nature, the ultimate good.

The great phenomena of existence, the facts, as we call them, of life, comprehend the entire realm of Nature. To return to Nature is to find the grand ultimate spirit of things while the blessed existence becomes a union of man, Nature and creator into a One which is the final, the absolute, the beautiful.

These waves from the tides of human aspiration have swept across the continent of Asia, have swept on to the far East and like the waves of the sea, have left the ripple marks of each receding tide; the ineffaceable marks of the ceaseless tidal flow of human spirituality.

Reaching their roots down into the deep soil of the earth and taking their breath from the starry heavens above, and receiving the waves of all the religions and philosophies of Asia, the Chinese people have persisted and flourished with a love of Nature which shows now the delicacy and loveliness of spring flowers and now the vigor of the pine, ever fresh and green, outlasting storm, tempest and mountain cataclysm. Even the vast tempests which at last uproot the pine they have taken as the greatest inspiration, and in the flying dragon, which hovers over waterfalls or rides over mountain crag, they have symbolized

the spirit; that spirit which is forever young, forever fresh, strong, pure and unconquerable, beyond the power of the material world to destroy.

In China, as in Italy, Nature expression is inseparably interwoven with religion. Comparisons between Nature movements in China and in the West are very apt to lead to critical disaster, yet this may perhaps be said of the two religions of Buddhism and Christianity. Whatever may be said or believed of their relative truth or inspiration, each has survived because each has responded to the feeling of man for a need of explanation of Nature beyond his own unaided ability to discover. Even Buddhism has developed beyond its first forms in response to this demand.

Men of today may reject both of these forms of religious belief, but they cannot thereby uproot or destroy the human need for the enlightenment about the universe which they offer though in such radically different ways. Though so different from each other both religions agree in the inability of the visible objective phenomena about us to satisfy or to explain the problems of life. Each introduces into the conception of Nature certain factors which we must call spiritual because each claims to offer a solution of things above and beyond the power of this earthly life to solve. Not to push the comparison too far it may be said that in a certain sense each is pessimistic in its outlook upon the struggles of man with the powers of Nature, so that each has permanently modified our ideas of Nature. St. Paul has expressed it for Christianity in saying that "the things which are seen are but temporal, but the things which are not seen are eternal." The Buddhist has expressed it by the desire to lose himself in the universal life "as the dewdrop slips into the shining sea."

One of the results of this is that in Chinese Nature painting there is often reflected an attitude which portrays Nature stripped of human association or at least of human limitations.

I have heard some persons deplore this as being a limitation upon the proper manner in which to portray Nature. They

want it associated with human society. But this is an unreasonable demand, there are phases of Nature which are independent of humanity. We are apt to forget that landscape, birds, the sea, mountains, the sky and God all exist quite independently of man and have so existed for ages past; to carry the idea still further, before this earth existed at all there was Nature.

All this being so why not try to symbolize that realm of Nature which is not subject to our human limitations?

So it happens that what are intended to be and are complete entire paintings in China are apt to strike the Westerner as mere sketches or the portrayal of fleeting emotions and not worthy of serious attention.

(I beg to remind those who hear me that I am not discussing art or its limitations or powers, but an attitude towards Nature. An attitude necessarily expressed by symbols of some sort.)

Thus in a painting of a Bamboo Branch (by Wu Chung-huei, Yuan Dyn.) at first glance there seems the cold non-personal element of a casual sketch. But to the man who painted it and to his critics, what is left out is of more importance than what is included for it may possibly have suggested just as we see it, a succession of ideas which would end by including almost the entire universe. The exact meaning of such a painting is perhaps not easily comprehended, but we may say of it that it is not alone a depictment of Nature, but a grand commentary, an essay on Nature which embodies the results of the attitude of a dynasty, a kingdom of thought about Nature.

Each stroke in this painting might represent a moment of life and death, and such a moment is of equal importance, whether expressed in what we would call a religious painting or in simply a spray of bamboo, which is the very quintessence of refinement of thought; because in the last analysis the figures of the Gods and the infinite suggestion of waving branches of bamboo must each share in the laws that govern all existence.

It is symbolism, the outward and visible sign of emotions, thoughts and beliefs which it is much better to try to suggest than to attempt to portray.

For who can portray the ultimate reach of human aspiration?

This position towards the realm of Nature was not a sudden attainment.

The philosophy of Nature—thought in China as it has been elsewhere, is a culmination and blending together of thoughts and ideals running in various channels, but at last it became essentially Chinese; just as the action of diverse channels in Greece produced at length something typically Greek. Poetry and the culture that accompany it have been in China for long ages past the recreation of statesmen, rulers and men and women who wished to escape from the weariness of things and life. Back in the past, almost two millenniums before the Christian era, men and women lived in the life of the open world; they tended flocks and herds, they gave attention to "the rocks, metals, jade and the waves of the sea." (Hirth.), or retiring from the cares of court and town they mused upon the banks of the Yellow River.

It has been said of their early ballads that unlike the early ballad literature of almost every other people they are prevailing ballads of peace, there is little of war. They speak often of personal sadness, or a gentle pensive melancholy inspired by the waning moon and the cold north wind forshadowing winter, or again they breathe the spirit of spring, meeting time of young lovers. Of lovely young girls whose delicate hands are like the "lily fair and rare to see," which she holds in her hands.

A famous singer, Chü Yuan, of the fourth century B. C., fallen into disfavor and retiring to the hills, pictures himself "On the lonelier mountain top," where the clouds surround him and lie beneath him; in the softly blowing wind and the gently falling rain, he gathers the larkspur and says "joy like a mist" blots out the home where none would honor him.

So it seems to us now as we read the short poems and fugitive verses of this long past age that in the common things of Nature lay solace for sorrow, for wrongs done and for the cares of life.

But with the coming of Buddhism into China and the mystical philosophy of Tao antagonistic to the formalism of Confucian-

ism, new sources of spirituality entered into poetry, and in the great epoch of T'ang (sixth to ninth century) the golden age of Chinese poetry is reached.

It was an age of philosophers, painters, poets, musicians and great lovers, and also of singers who sang of all the others. It was an age also when men and women left court and palace to journey far into the woods, up to the mountains, to seek inspiration; above all it was an age of refined leisure when there was time to place one's self in complete surrender to a mood or to the beauty of Nature until in turn the beautiful surrenders to the artist and enters his heart.

The poetry[1] of the period is an art expression in which condensation and suggestion are carried to an extreme which to ears unaccustomed seem but mere remnants or furtive snatches of verse, but to the Chinese poet, and it may be remarked to the Japanese as well, concentration and suggestion are the final marks of genius. It is the aroma or the perfume only which is desired.

In reading their poems we seem ever to be catching distant gleams of the mountains or hearing the gentle patter of rain, and the murmur of waterfalls far off.

Yet in times of tragedy they can strike into the heart like a two-edged sword. There is the poem of the Emperor who was enraptured of the love of the most beautiful woman of the time, and yet under pressure of mobs of mutinous soldiers about his court and with the state tottering to its fall he sent her forth from the palace "lily pale, between tall avenues of spears to die," and the Emperor broken and his spirit dead went forth to exile.

But one of the deepest chords of human emotion had been strung and to all poets coming after "these two figures became types of the mystical and romantic love between man and woman;" while the soul of the beloved woman sent from the land of beautiful immortals her message of faith in their ulti-

[1] The quotations of poetry are from "A Lute of Jade," by L. Cranmer-Byng. See also "Poesies de l'Epoque des Thang," D'Hervey-Saint-Denys.

mate reunion. They two have been symbolized freely in the poems of the East, in the trees with interwoven boughs, as types of the heavenly lovers in the constellations of the stars, while in the paintings of later dynasties they are figured in the beautiful mandarin ducks, again the symbols of the deathless love which triumphs over death.

In another poem the type of reality and of love triumphant over death is the figure of the young girl in springtime:

Gathering the water-plants
From the wild luxuriance of spring,
Away in the depth of a wild valley
Anon, I see a lovely girl.
With green leaves the peach trees are loaded,
The breeze blows gently along the stream,
Willows shade the winding path.
Darting orioles collect in groups.

Eagerly I press forward
As the reality grows upon me . . .
'Tis the eternal theme,
Which, though old, is ever new.
—History of Chinese Literature, by Prof. H. Giles, p. 180.

In the verses of another poet (Chang Chien) we see the expression of one who set himself far from court and warfare to seek the harmony of the universe, "to become like a harp, through which all the chords of Nature might sweep at will."

It is night on the mountain and he has watched by the closing light of day the tiny boats drifting across the lake beneath him even as human lives seem to skim across a world of peril, "while the great round sun weakened towards the waves."

. . . the night winds fret afar,
The north winds moan. The water fowl are gone
To cover o'er the sand dunes; dawn alone
Shall call them from the sedges. Some bright star

Mirrors her charms upon the silver shoal;
And I have ta'en my lute, my only friend:
The vibrant chords beneath my fingers blend;
They sob awhile, then as they slip control

Immortal memories awake, and the dead years
Through deathless voices answer to my strings,
Till from the brink of Time's untarnished springs
The melting night recalls me with her tears.

Yet with all this plaintive melody, which seems to us at times so far away, there is often the note of a genuine world-wide human attachment to the color of this world and life.

The verses have come down to us of one artist who loved not alone the glory of the unseen, but who clung tenaciously to the common earth, "who reveled in flowers without let" and who sang "fair is the pine grove and mountain stream that gathers to the valley far below."

But in the "Color of Life" he has sung a world-wide note of human desire:

THE COLOR OF LIFE.

Would that we might forever stay
The rainbow glories of the world,
The blue of the unfathomed sea,
The rare azalea late unfurled,
The parrot of a greener spring,
The willows and the terrace line,
The stranger from the night-steeped hills,
The roselit brimming cup of wine.
Oh for a life that stretched afar.
Where no dead dust of books were rife,
Where spring sang clear from star to star;
Alas! what hope for such a life?

It was the steeping of the Chinese culture in such ideals that produced in the great dynasty of Sung (our tenth to thirteenth centuries), the golden age of Chinese art and culture, a culture which has never wholly lost its influence in the world and which is still the inspiration of the East.

This dynasty of Sung saw the culmination of landscape art in China, an art which is one of the great achievements of the world.

We have paintings in which may be traced out the influence of natural diversity of geography to produce their varied effects

upon the human emotions; a study of these influences would lead to the consideration of both realistic and idealistic schools.

So we have paintings in which is reflected the far-off effect of wide river valley leading across wide, open plains to far distant hill or mountain. In the long roll by Tung Yuan, early Spring, painted almost a thousand years ago, we have a wide sweep of nature hardly surpassed in any art. Or again, the long-living and romantic pine, torn and worn by tempest and winter wind, stands presented to us as the leading motive, about it all other features are subordinate; it dominates the whole. Yet this art can be beautifully human and intimate, just as the poetry of this and the preceding periods could be direct and personally intimate. The farmer and his boy going home with the cows across the winter snow should be human enough for anyone. Local scenario being changed it is as modern as though done in our own time and yet it is said by critics to be in the spirit and perhaps an exact copy of a painting of the dynasty of about our fifth century.

So in the religious painting of this age we find again the expression of a universal appeal. Nowhere, possibly, will this be better illustrated than in the painting by Chou Chi Chang of a Lohan or Saint distributing alms. Will you pardon me if I venture to obtrude upon you my own emotions about this picture, which is now one of the treasures of the Boston Museum? Its soft and wonderful colors of gray rock, green pine and all the soft tones of Nature, combined with its miraculous blending of all the great aspects of Nature; the divine, the human and the earth earthy.

Yet we have as natural a painting as could be wished, merely a few destitute vagabonds, some of whom are clustered about a mass of rock, while others scurry to receive the alms of the Saint; beyond it all, yet embracing all, the sense of landscape. But what a landscape it is, the rugged ledge of rock with its overhanging pine, the sweep of sloping hill and valley across to the horizon beyond it; the mysterious and poetic waterfall and mountain crags, down which come the figures of the saints,

compose a tremendous wide sweep of Nature which comprehends into one great whole man, Nature, and the divine compassion towards all.

Where but in the soul of some great Nature lover, who has looked upon them all and loved them, could such a painting be created? Nor does the introduction of the supernatural destroy the naturalness of this picture, for in the largest view of the matter there is here no supernatural; it is all Nature.

For what greater return to Nature can we make than to realize that man, the earth he walks on, the blue sky above, and the compassionate love of the divine creator of them all, are in essential nature one?

This is more than the expression of an individual soul; it is a prophecy, a challenge to all who would make of Nature only a blind, relentless material force.

To this view of the Nature world there is presented always the returning miracle of the rebirth of the lotus, and as we leave these philosophers and Nature lovers sitting in a profound spiritual contemplation before the mysteries of life, we must feel in our own hearts that here is one of the very fundamental truths of Nature and of life. More, too, than that there has here been formulated and set forth one of the moving forces of this world, the belief of the existence in the realms of Nature of the spiritual, and the real beyond the material, of the world of reality and of life beyond the illusion of the material and of death.

Across this world of the wonderful age of China there fell one of the great catastrophes of human history. From out of the wild ranges of the Asian continent there rolled out the wilder hordes of the Mongol Tartars, which, as the breath of the destroyer, fell upon and all but annihilated the culture of this golden age. It is a proof of the wonderful vitality of the Chinese people that they have still retained and are nourished by their perennial hold on the Nature world.

As has so often been said of the culture of ancient Greece, so we may perhaps say with even greater truth, that the cultures

of the Nature returns of the East have given to the world some of the most sublime conceptions of the human soul; that the material is but the illusion of the real, that the seen is but the symbol of the unseen, which is the spirit of Nature and of life.

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When the investigation of Nature movements in Europe is undertaken the same fact of complex sources is discovered with the further facts of periods of rise and decline of Nature thought. In the history of Europe, as in all other great national and racial history, the relation of man's thoughts toward Nature, his return to Nature is interwoven with culture in general. Social custom, the habits of the common people in their lives, houses and the presence or absence of bodily comfort, have all had their influence. We cannot fully understand the perennial enthusiasm of spring poets, nor the springtime frolics of May Day in England and the Continent (themes which have been worked over and over in literature), if we do not know something of the fact that in Europe, in the first millennium or more of its history, winter life was almost certainly a period of long, gloomy physical discomfort and depression. The annual return of the warm spring sun, the full richness of summer and the fruitful autumn, must often and often have returned to the thoughts of men in these early centuries of Europe, while the cold of winter penetrated house and living place.

So also in the admixture of racial tradition.

In Europe (as in Asia and in the nearer East) there were waves of human ideals; the Teutonic, the Slavic, the Gallic and the Celtic have met in perennial conflict as they met in the course of tribal or national migrations.

It is a singular fact in these processes of development and adjustment of ideals, that those portions of the inhabited world which are separated from direct continental conditions by being wholly or in part islands or archipelagoes or groups of islands, should become at last a kind of crystallized expression of the impulses of all the others.

If we take Greece, Japan and England, each is seen to have become, by reason very largely because of its geographic position, a repository of so many waves of thought that there is finally separated out an ideal or a fusion of ideals, which, while it partakes of the features more or less of all, yet finally achieves something which is more universal than any of the others. I do not know whether this comparison of Greece, England and Japan has ever been made before, but as each of these island centers of human ideals is studied, each is seen to show the derivation of its ideals of Nature thought from outside sources which are possible of untangling; and yet each is also seen to show a culmination of Nature ideals, of religious and philosophic ideals, which partake of the nature of the final expression for all of the various sources.

To understand this is of itself to understand Nature.

Life has often been compared to a sea, to the ocean of water. This is in some respects almost a literal, as well as a poetic, allusion; life is subject to disturbances, to waves of thought, which will be transmitted with a gradually decreasing force to all the outlines of its limits, just as waves of water are transmitted to the farthest shores.

The comparison has been made before for Japan; I wish to make it for three culminations of human thought. Greece, England and Japan are so situated towards the great land masses nearest to them that only the most violent of these waves of human impulse reach them, the smaller ones die out before they can possibly produce any very far-reaching modification. Thus Japan became the repository of those waves of thought in Asia which were strong enough to pass over a continent, yet because of her geographic isolation Japan was spared the overthrow of her culture by the Mongols, who almost destroyed China. So it has been claimed by some modern scholars that Japan constitutes in some important aspects the real repository of Asiatic thought.

Greece became, as I believe history will more and more eventually show, the final expression for a succession of Nature

cultures which had grown up about the borders of the Mediterranean Sea. It is possible to show that evolution or "becoming," was suggested to the Greeks from Egypt, and yet after all the Greek ideal was neither Egyptain nor Cretan; it was Greek. Greece differs from the other two in the fact that the full blossoming of the flowers of its thought was prevented by the downfall of the nation itself. Some historians have claimed, however, that this downfall was due to the nature of the Greek ideal, which carried the seeds of its own destruction.

So in the case of England. This country has not been a pioneer in the revival of Nature thought to anything like the extent which is popularly believed to be the case, yet it has produced a body of Nature literature and Nature thought which is typically English and which is also exceedingly fine and beautiful, hardly to be surpassed in Europe. History will show that here again is a culmination which represents more than one nation. The Nature verse of Chaucer, the man who helped create the modern English tongue is a great deal of it not originally English at all, but Italian. So the "History of the Mort d'Arthur," by Thomas Mallory, is not an original creation, even though much of its local color is English, but it is a composite of several sources, many of which came nevertheless from these same British Isles. So England has received from the Dane, from the Teuton and from France an amount of inspiration about the sea which is very great.

Yet one does not need to be an Englishman to be willing to admit that no finer body of sea verse has come out of Europe than the long rolls of sea verses which have surged about the British Isles.

From the Battle of Maldon to Kipling's "White Horses," and to John Masefield, there is ever present, in fog and mist and in gales, the voice of the Atlantic Ocean, which has carried the boats of all the nations of the world.

Mr. Sidney Lee, in his illuminating study of the influence of "The French Renaissance in England," has discussed very fully the fact of the late flowering of Renaissance literature

in England, it passed from Italy to France to England. Lee attributes this to a sluggishness of wit. This seems to me an ignoring of certain natural facts, the isolation of island life.

Island life is always more restricted; if, however, it is less sensitive to impressions of newness it is also less sensitive to the merely temporary. There was considerable in the Italian Renaissance that was temporary. That the influence of the Renaissance was felt in England later than on the Continent is an historic fact we need not try to gloss over nor disguise, but it may be contended that it reached a climax or a commingling of thought, and for our purpose here a climax of Nature thought which represents better today the modern European ideas about Nature than any one single country. This is a difficult thing to prove and I do not mean to claim it as proved, but I do mean that natural geographic conditions, as well as past history, go to show that in such separated places as England and Japan we are more likely to find a proper reflection of thought than by taking some one continental people.

China, though not insular, was shut off by a vastness of mountain barrier which allowed her to become such a repository of thought; but the conquest and submersion of the Asiatic continent by the Mongols so broke the flower of Chinese culture and dominated it that China became in a sense petrified. It is in Japan, after the "dark ages" of the East, that we must turn for the preservation of Asiatic waves of culture. Japan is then the collector of the main currents of Asiatic culture. This conception of islands as collectors of the main currents of human thought is, I believe, possible of proof in Greece, Japan and the British Isles; and it is an intimate part of our own place in Nature, something which is due to Nature hereslf.

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In Europe generally the close of the Middle Ages was marked by a revival of Nature interest; having its impulse in part in the Italian Renaissance, it spread by a process which was the breaking down of the bonds laid upon thought by tradition in

literature and philosophy as well as in theology. This breakdown manifested itself in a variety of ways, but it was given tremendous impetus by the long line of those who were at once men of letters and what we may in modern speech call men of science, that is, of natural science—those who were observers of Nature in the attempt to influence society by the effort to understand Nature.

Also we must remember that one of the greatest Nature movements ever made in any time or place was originated in Umbria by the great religionist, St. Francis. In Italy, as in China, Nature love and its portrayal in art, is inextricably involved in religion and its ideals.

While at this time of the Renaissance the Greek and Latin classics were rediscovered to the world and absorbed into the fiber of its mental growth, the free Nature attitude of the classical world had yet a long fight to wage before its discussion and acceptance were possible. So that the feeling for Nature and its expression in literature and art were possible long before the acceptance of a scientific attitude.

We may fix the beginning of the Renaissance as the thirteenth century, but as late as 1751 the great naturalist and man of letters, Buffon, was summoned to appear before the Sorbonne or Faculty of Theology in Paris and compelled to recant a doctrine of a geological nature which had been stated by Aristotle nearly 2,000 years before. It was the idea that the same distributions of land and sea were not permanent throughout all time. It was, in short, the same idea which the geologist, James Hutton, only a few years later, built a large part of his fundamental theory upon, and which is now one of the commonplaces of earth science. It is hardly a fair statement to blame this upon the Church alone. The fact is that human nature is rather afraid of things it does not understand and the thoughts of Europe after the breakdown of Greece and Rome did not run in channels which prepared men for great scientific truth.

The formative period of Europe had been spent in years of

wars, of tribal inundation and in the adjusting of the wreckage of the Roman Empire. In all this time there had been feeling for Nature, but it was either a limited pastoral feeling, or else a sensual love verse, and it did not stir the hearts of the intellectual classes to a serious study of Nature. In the thoughts of many of those who have brought about the modern attitude towards Nature we see a return essentially to the objective conceptions held by the ancient Greeks, highly modified now by the development of the idea of evolution, and in our day seriously damaged by a commercial exploitation of Nature.

In France there was a further factor; the pursuit of the ancient classics, under the influence of the new learning, had had the rather natural result of a cultivation of a classical ideal in French literary thought and, of course, in its philosophic expression in art, which became fixed in set forms and lost the springtime naturalness of the original classic model. It was a dry, dead skeleton. Before there could be a return to the spirit of Nature this classical ideal had to be broken down. The details of that breakdown form one of the most interesting chapters in the whole history of Nature movements, and we do not obtain its full fruit until we reach the influence of Romanticism and the still further naturalistic reaction from that. Painting in France today, Impressionism and the landscape schools, are a part of the modern trend towards Nature, but they are a return unhindered by the fetters of a false idea of classicism. Regnault's romantic treatment of the classic theme of Achilles' Horses is an instance of the break from the old classicism. This free treatment of the "Heroic Nude"—so shocking to the classical tradition—and the work of Millet and others are part of the same great modern awakening to Nature.

But the important fact stands out that the attitude of the modern European world towards Nature is not that of an idealism but is an intense realism. We are, if I may so state it, trying to discover in a really clear way just what Nature is.

The brilliant color painting of the Impressionists, to which I

have just referred, is an attempt to translate direct science into art. Whether this is successful or not may be left for others to say.

To those not familiar with the history of the natural sciences it may be worth while to perceive that of the various fruits of the Renaissance the freedom of Nature investigation has been the last to ripen. If there are dangers, as I believe there are, to the preservation of the beauty of Nature in the exploitation that is thriving around us, it is well to remember that we are witnessing the first full flush of opportunity to discover the secrets of Nature, and that there are germs of an idealism along with the material which may yet modify profoundly our contemporary attitude towards Nature.

In the discussion of the development of the Nature movements in modern Europe, we may select only a few of the many which deserve consideration; we must note, however, that all the great interests of the human mind, art, theology, literature, science, have been involved in an essential manner in these movements towards Nature. They share in and are dependent upon each other's domains in a gradually uniting flood.

One of the primary reasons for the cross currents, the upheavals and what often seems the hopeless confusion in the world of thought today, is the fact that all the various channels by which the return to Nature may be made are in full tide. For the first time in history all of these absorbing ideas of science, religion and art are free to express their ideals, their aims, in an untrammeled investigation of truth as they see it.

The history of past Nature movements has been a series of periods often connected together, often separate, but dominated by some one ideal. The condition of Nature thought today is a cataclysm of ideals—ideals running often parallel, but more often against each other. We are overwhelmed by a flood, a flood which, like the Mosaic deluge, is finding old channels too small and which has become a vast tumbling mass of currents, sediments and wreckage borne out to sea.

It is a river system which, by floods in all its tributaries, is

broken into a network of independent currents each seeking by its own force to control the way of all to the ocean.

In all this flood, which is the stronger and which will prevail?

How shall we say, for we may not even see clearly by which particular current we are carried on. But this much we do know: we are bound outward to the ocean of universal thought in which clarifying and settling will separate the false from the true, the real from the unreal, the shadow from the substance; the tide of thought, like the tide of the sea, will become one of the harmonies of the universe. This ultimate fusion of the ideals of knowledge, art, and faith in the attempt to place ourselves in complete harmony with things, is given to us as a vision of that perfect return to Nature which man has in his power to make.

Viewed as the result of a permanent impulse, which has manifested itself in literature, painting, poetry, folklore and science the return to Nature in Europe is not then a series of happy accidents; it is a movement which though alternately active and subdued has never ceased to be in some manner a permanent part of the trend of modern thought.

Complex as these movements have been it is still possible to trace the threads woven through many different fabrics and to find their leading places of adherence.

In Italy, in the thirteenth century, appears almost suddenly the personality and figure of one of the greatest men of all time in his turn to the love of Nature, St. Francis of Assisi. His love was so profound, so all inclusive in its reaches, that as he walked the roads, in field and mountain, the wild birds and still wilder animals clustered about him and repaid his love with their own obedience. In an age marked by cruelty and heartless bloodshed this man, poor and barefooted, went about Italy preaching the gospel of love to the birds and flowers and calming the wild natures of wolves, both four-footed and human. He is almost evidence enough of himself to prove the fact of a Garden of Eden.

He was the Orpheus who calmed wild Nature not alone by music but by the surpassing harmonies of love which sang always in his own heart.

Among the stories told by his thousands of followers is the famous "Sermon to his little sisters the birds," often quoted, but never to be quoted enough for the tender and poetic sympathy which unites all created things into brothers and sisters.

On a certain day St. Francis happened by a place where there were in the trees nearby great multitudes of birds—sparrrows, crows and doves. He said to them: "Dear little sisters the birds, ye ought always to praise God your Creator for that He has preserved you, that your race might not perish out of the world . . . that He has given you the streams and fountains, the mountains and high trees for nests;" and the Saint rejoiced with them at their beauty and friendliness and gave them his blessing, after which the birds, with great flapping of wings, flew off, singing "wondrous songs." As we read of the wonderful love between St. Francis and the wild things of Nature we are reminded of the saints and hermits of the old Celtic and British Church, of St. Columba playing with his friends the birds and squirrels, of St. Gall and the wild bears of the Alps, of that old Irish hermit-saint in his woodland chapel, "who offered mass to such as pleased to attend," while as the people hardened their hearts the only ones who did attend were the lowly ox and ass; and again of that Abbot of Iona, whose litany sang of the saints of all the year, "The Saints of Green Springtime," of the "Golden Summer," "Red Autumn" and "Gray Winter."

Here is no note of a sickly, feeble sentimentalism, but a healthy love, which is all the more tender because born of actual living in open fields, mountain height and in the wide waste of moor and fens among all the life of the wild.

No discussion of Nature movements can pretend to be complete which does not include some details of those Celtic strands which have been woven in golden threads through all the literature of Western Europe.

I care not which particular text you follow, nor which series

of stories you select; the medieval tales of the "Welsh Branch" of the mythology of ancient Britain or the Irish tales of Cuchulain will do well enough. The Celtic stories are always in the background of the woods and hills, the birds of the air; "the color of the raven" is the hair of the hero, the color of the yellow autumn leaf nor the ruddy apple is not more ruddy than the hair and cheeks of the maiden as she rides forth; so run always these ancient stories "of ruddy russet men" and of women "whose breasts are whiter than snow in winter" and "whose lips are redder than the red-breasted robin in springtime."

Whether we take these old stories in their quarrelsomeness of Irish hero fights, or in their religious forms, as in the Legends of the Holy Grail, or whether we consider their mystical and transcendental forms as in the voyage of Bran to the "Land of the Living," we are always in the same vitalizing atmosphere of the beautiful open world of Nature.

Across century-long rolls of parchments and out of dusty wrecks of time these wonderful stories refresh us as we are hardly refreshed otherwise save only in the annual return of spring itself.

Nor can we say that these stories came when the world was young, for they did not. Their tremendous power and importance for us lie in the fact that they come from the perennial youth and freshness of the human heart, a freshness which is as the new birth of spring, outwearing time and decay. The modern Celtic revival is sufficiently familiar to us, but it has an especial interest because it is a self-conscious designed movement, fostered and encouraged in the expressed hope of a revival of Nature in the broadest and best sense of the term.

We need quote no extracts, but no one who has lived even briefly along the North Atlantic coast can remain unmoved in the wild winds, tempests and fury of Nature in John Synge's "Riders to the Sea."

And so the strands are once again gathered and passed along, weaving into the literature of yesterday, today and tomorrow the fabric of Nature love which will endure, we hope, until with

Bran we make our final voyage to the "Land of the Living" and with the ruddy breasted robins live in eternal spring.

Likewise the art movements in the modern sense are another instance of the fact that impulses which burst out upon the world to captivate it and control it are not to be torn away from their own sources of growth. There had grown up in Europe, in the Middle Ages, a strong sense of the use to be made of color, of drawing, of pigments. The churches and the great cathedrals were full of art, an art possessed of a technique and feeling for form and color beyond anything known in Europe before.

"The Church, however, having thus educated people to understand painting as a language . . . could not hope to keep it always confined to the channel of religious emotion. People began to feel the need of painting as something that entered into their everyday lives almost as much as nowadays we feel the need of a newspaper." This picturesque assertion of a modern art critic (Mr. Bernhard Berenson, "Venetian Painters of the Renaissance"), is only another way of saying that when in Italy men's emotions turned to new aspects of Nature they expressed these emotions in the most powerful and convenient medium they had, which in this case was painting.

So that art in Italy set forth, as it did in Greece and in China and Japan, the thoughts of the world about Nature because men became again vastly interested in Nature in its various aspects.

The development of the art of the Renaissance and its modern sequences is a long-continued discovery and return to the truths of Nature. As the beauty of the physical world and the love of color and the form of the things of Nature spread abroad, art became an expression of all the forms of Nature. We see here what we saw in China, that art was not confined to one phase of Nature nor was art any more than life content to be crowded into the expression of a single formula, neither one is limited to the expression of the past experience. Art in Italy became then the expression of the discovery of Nature by the modern world; and because it was capable of expressing life itself it is one of the supreme achievements of human genius.

The historical development of this art is not the purpose of this discussion, but we may pause long enough to observe that even the works of the "Primitives" of this art development stir us today though lacking the technical skill of many a later artist, because they breathe again in form and line and color the energy of a living thing.

It was also a rediscovery of the fact that Nature, including human nature, is clean and good, but it expressed this discovery in a manner understood by its own generation and time.

As we follow out its varied forms of expression and its subjects chosen from so many sources, the classic myths of Greece, the martial deeds of Rome, or the parables and dramatic stories of the Bible, there is seen no mere imitation of the antique. Botticelli did not paint the birth of Venus in the Greek style any more than any other genuinely modern artist would. These things became part of the life of the time not because the ancients had them, but because the modern world had discovered them again for itself and was treating them in the modern way; it was the same modern idea which has been at the heart of so many returns to Nature.

It was the freedom of the old that was assimilated, not its peculiar trappings or colors. The color of this Italian art was the color of the hills and towns of this beautiful modern Italy.

In addition, the world, in the passing of time, following the death of the old classic world, had assimilated religious ideas which had never lost their influence to color the expression of the art of the time. This art then can no more be understood apart from its religious influences than the art of China. But because the ideals of this religion are not those of the ancient classic world it was expressed in symbols which would, in many cases, have been unintelligible to the Greek, while still retaining an aspect of open nature with which we may easily suppose the Greek would have been in full sympathy.

So the art of Botticelli, of Giotto, and of the great Venetian school so full of the color of this world, is a mixture of the pagan and the Christian, the material and the spiritual. The saints

and martyrs of the Church and the pagan divinities of the classic world move together in an atmosphere of clear open sky, of woods and of free landscape; the artist passes with an apparent ease of conception and execution from one theme to the other, and the miracle is that each is Nature and each is true. He paints a Venus and Our Mother the Virgin with the same beauty of form and the same loveliness of physical surroundings; nor is there any irreverence committed or implied; the artist and the world are absorbed in the disovery of a life so keenly felt, so intimately alive and overwhelming in its intensity that the whole world of Nature is conceived as a grand harmony of goodness and beauty. Man seems to have discovered that God too loved the world, for He made it fair.

But as time went on men of the Renaissance discovered as has been discovered in other times and places that life here on this earth is not all of it pure joy and free pursuit of learning, humanism and glory. If we may read the times as we read other human history from its own sayings and doings a serious and sad disappointment in its own magnificence struck the heart of the Renaissance; as we follow out its history in either painting, literature or life there is inevitably discovered a loss of that pagan joy and freedom which the world of make-believe likes to associate with the life of the old classic world. The artists were painting instead of these things scenes of the Crucifixion or of Judgment.

But why should this have occurred? It would seem rather that now if ever men should have been able to put away the thought of the oncoming of age, of decay and death. Had not the long preceding ages of spiritual enslavement and gloom seemed now at last really overcome? Must now these serious and disturbing problems be brought up again to threaten or destroy the happy freedom, the splendid beauty of this newly discovered life?

Different people have given different answers to this question, others in whom the wish is no doubt father to the thought have either ignored the question altogether or have offered some

particular agency such as "the power of the Church" or "the Catholic reaction" or scores of other explanations.

But are not all of these to the serious student of nature seen to be vain efforts to cover over the workings of Nature herself? For after all the color of this life has been enjoyed it is from the heart of Nature herself that we are confronted with the one great surpassing problem of problems: What is after this life? After youth comes age, after age death. What next? The wonderful representations of the greatest tragedy of history, the Crucifixion, must be regarded as far more than pious make-believe executed for the adornment of the great churches; they are the expression of the great cry of the human heart as it realized that here in this wonderful age full of the glory and trappings of a newly discovered life there had appeared again the forgotten enemy: death.

From the art of this same gorgeous Renaissance have come some of the greatest portrayals ever painted of the all-absorbing problem of all time, the mystery of life. The development of this phase of the Renaissance can neither be refuted nor its supreme pre-eminence denied; though frequently ignored in the discussions of this epoch of human history the modern world of thought has taken this problem to itself. Our contemporary world can not be accused of trying to ignore it; it has entered once and for all into the world of science, for before all other problems at the forefront of modern science lies that one vast all absorbing question which whether it be called by one name or another is at last the same problem of life and death. Death then is a part of life for it is a part of Nature.

Even so, what is it? The answer to this must be sought in our view of Nature. As we pass over the whole vast field of nature thought and explore its myriads of paths and well-worn roads, and even as we sail the seas there hovers ever before the eyes all the visions which through the long ages have been seen of man as part of that same Nature of which he himself is also a part; the Elysian Fields, the Land of the Living, the Islands of the Blest, the Seven Seas, the River of Heaven are all answers

from the poets and people of the world to the questions of life and Nature. They are all "returns to Nature."

> "Sail forth, steer for deep waters only,
> Reckless, O Soul . . .
> O farther, farther sail!
> . . . . .
> O darling joy, but safe!
> Are they not all the seas of God?"

So after another age of doubt speaks again through a modern poet the voice of universal trust in the goodness of nature which makes even death to be only an incident in the unmeasured reality of life.

* * * * * * * *

It is upon this varied basis of Nature movements, a basis composed of the classical antique, the colorful threads of folklore, the religious idealist, and the great discoveries of modern art, that the modern scientific and direct observation of Nature rests. It rests there not because it is the logical development from them, but because after the Renaissance the discoveries of Nature, which are popularly called science, are the most characteristic features of the Nature movements which for several centuries past have most engaged the thoughts of the world.

The astronomical discoveries of Copernicus and Galileo, the influence of such men as Leonardo da Vinci, Francis Bacon and Isaac Newton; the rise of the science of geology in France, Germany and England, and lastly the great biologists, Darwin, Huxley and others, are all parts of a Nature return so profoundly disturbing to the methods and manners of human thought before their appearance that it has often been difficult for those who care most for the so-called poetry of Nature to see anything but evil in this vast flood of modern science. But let us be reasonable about the matter. Science is only another term for knowledge, and poetry and art do not rest their appeal upon ignorance. We cannot if we would put ourselves again solely in the position

of either the ancient Greek or the mystical Buddhist, because the modern world of thought is a uniting together of streams which have long flowed apart; life has become a development in which the visible present is both the inheritor of an immeasurably remote past and the forerunner of a future whose possible developments are matters in which we take the keenest interest. Nowhere is this more true than in what the old humanistic Greek would have called the unseen.

Are the songs of the birds less moving and poetic to us now because science has discovered that thousands of centuries before man set his foot upon earth springtime came with its flowers and the lovemaking of the birds? Is the stormy sea less poetic and wonderful because we have discovered in the hearts of the hills the forms of small things which once swayed with the tides of the sea or lay along the quiet bottom of the ocean, rounding out their little lives as do the corals, crabs and other sea forms today? Or are the starry heavens less wonderful because we think we see in the whirling of nebulæ the action of forces which out of cosmic dust are creating new worlds and a new heaven? Is our possible return to Nature doomed to death because the human mind today is reaching out in every possible direction to solve the problems of its own growth and future development and is seeking also to count and weigh the stars? No; this is no danger to poetry or to Nature. Nature is not a form of humanitarianism, nor is Nature to be defined by the limitations of our human experience.

It is discouraging in this day to find men, because of ignorance, misjudging both Nature and science. From this very platform from which I speak I have heard a professor in one of our great State universities refer to the Grand Canyon of the Colorado as "Devil's work;" that wonder of the world!

That anyone in this day of enlightenment should be so pusillanimous in the face of Nature gives one a spiritual depression. Perhaps the lay mind does not understand a vast natural creation such as the Grand Canyon, but why consign it to the devil

or to dark powers of evil? It is a survival of those same mental and spiritual limitations which in the tenth century made men cower in abject fear over the passing of a summer cloud and which filled the world with demons and hobgoblins and destroyed the love for Nature.

Modern science in attacking such a vicious state of mind is doing noble work in bringing man to see that Nature is pure, that it is beautiful and that there is poetry in Nature apart from ignorance and superstition. No; the dangers to the beauty of Nature in the modern world are in their last analysis a mistaken idea of humanism; this is true both in the unwillingness or inability to see in Nature anything bigger than man or more beautiful, and it is shown also in a perverted form of commercial exploitation which assumes the right to kill, misuse or destroy the products of Nature with no thought of anything but human desire. Our forests are cut away that the world may be flooded the more with printed trash. We owe to Mr. Havelock Ellis, of London, an earnest protest against the continued adherence to the legendary injunction to increase and multiply and subdue the earth. To quote Ellis: "This legendary injunction, uttered on the threshold of an empty world," is "singularly out of place in an age in which the earth and the sea, if not indeed the very air, swarm with countless myriads of . . . undistinguishable human creatures until the beauty of the world is befouled and the glory of the heavens bedimmed." (H. E., "The Task of Social Hygiene," 1913, p. 23.)

So one of the greatest needs in a return to Nature is to bring ourselves to see more clearly our position in the world of Nature, that we are of the same stuff as the animals, trees and the stars —the universal matter of creation. And that we may say of Nature, as we say of God, this is of the spirit and of life.

Wild Nature. How much the human spirit needs it. I like to think that in the jungle still gleams the fiery eye of the tiger. Wild Nature? Yes; dangerous even and annoying. As dangerous as the flights of the human imagination and as uncontrol-

able. Uncontrolable to those who hate her and fear and abuse her, or seek only their own desire.

A story has come down to us from the Nature lovers of the East, the "Story of the Taming of the Harp." In the possession of one of the philosopher kings of the ancient East was a wonderful harp made from a tree which had reared its head "to talk to the stars," and its roots were coiled "with the silvery dragon which slept beneath."

But to those who sought to play upon it the harp refused to recognize a master. At last came Peiwoh, the prince of harpists.

"He caressed the harp as one soothes an unruly horse and softly touched the chords; he sang of Nature and the seasons, of mountains and flowing waters and all the memories in the tree [in the harp] awoke. Once more the breath of spring sang in its branches and the young cataracts as they danced down the ravine laughed to the budding flowers."

So in due time came flowery summer, mellow autumn and across the winter snow glistens the moon.

The hearers were in an ecstasy and the king demanded of Peiwoh how he had mastered the harp.

"Sire," replied the player, "others have failed because they sang but of themselves. I left the harp to sing for itself and I know not which it was that played, I or the harp."

Thus it is if we seek a union with Nature or would understand her; to love her, to try to understand her, we must in some way yield to her spirit. We must be content to sit at her feet and learn.

Our triumphs over Nature are not so many flourishes of a humanly exercised supernatural force; they are in reality our triumphs over our own ignorance.

But we go to Nature demanding cures for disease, or we demand gold or silver that we may become wealthy; we slay and kill that we may eat and enjoy and we are slain and killed in return. Wars will never cease as long as we murder the animal world about us.

We go to Nature demanding always that she do something for us. We do the same with religion, art and the Church, with the eternal cry, "Do ye something for us."

Thus we are not seeking Nature or the truth, but only the image of our own desires, and the mirror of truth reflects back what we put before it. So the great harp of the universe remains unplayed; its thousand chords of harmony remain unsung.

So then the harmony of man and Nature is not a mere vision of reality; it must become reality.

For if this idea of a permanent impulse running its roots down to the same great soil of all Nature is not comprehended, then the real point, as I see it, of the return to Nature will be lost. There will be lost also the only rational basis upon which all the Nature movements of the modern world may meet. For while these movements are subject to the same ebb and flow of reaction which are found in all phases of human impulse, they have their final source in the great all-comprehending fact that Nature is one. This union of Nature began before man's foot touched the earth in the divine plan of things; we are one with the flowers, the birds, the stars, and with God in a union from which to detach ourselves is to court extinction, darkness, death.

From a modern painter, John Sargent, we have vigorously set forth this withdrawal of man back not into himself, but into the Nature world about him. In "The Hermit" we see man so absorbed, so passing into the woods, the trees, the wild things about him, that it is only by straining our vision that we may pick him out as a thing peculiar and apart from Nature; but why should we try to do so?

For beyond the hills of dreams, beyond the mountains of desire and of aspiration, beyond our highest climb, we are still Nature, to which we must again return or die.

The springs of thought and of will burst up through many a rock and flow in a vast diversity of currents, but they flow always to the sea.

So as we gaze upon the sea of the universe we return often

to that stupendous ring of the Cosmos, the Celestial River, with its myriads of millions of flaming suns; they are abysmal distances apart, yet across the darkness of space they flow forever as a mighty river of Light, the sublimest physical showing forth yet given us to see of that River of Heaven, which gathering all our tiny ships upon its flood, bears us out to that longed-for Nature land beyond the sea, where burns the Eternal Light.

PROPERTY RIGHTS OF MARRIED WOMEN IN PENNSYLVANIA

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Any statement as to the property rights of a married woman in Pennsylvania must be a statement of her common law status as modified by legislation. Her status has been, until recently, one of limited capacity to contract, and of limited ability to deal with property as she could have dealt with it had she seen fit to remain a single woman. And even now certain of her contractual rights are exercised under slight limitations.

The law starts with the theory that the husband has complete freedom of action so far as his contractual rights are concerned, and with the theory that the wife has no freedom of contract whatsoever. Legislation concerning the property rights of the man has been by way of limitation on those rights, while legislation concerning the rights of the wife has been by way of increasing those rights. Until the whole field of her activities is covered by statute the married woman's contractual rights will remain limited.

After marriage, neither husband nor wife has complete freedom of action. Each is somewhat restricted, and each acquires some rights in the property of the other. These restrictions bear a little more heavily upon the woman than upon the man. The reason for the restrictions lies deep in the history of the human race, in the attitude of the Church, and in the different psychology of the male and female minds. Thus, marriage to the churchman may be a sacrament wholly spiritual in its nature; to the man it may be a means of satisfying his procreative desires; to some women a protecting shield for physical weakness; to others a safe harbor, but to the state it is now, as

always, an institution which results in the creation of a certain personal and a certain property status.

Entirely to separate the personal status from the property status is altogether impossible. The effect of marriage on the personal status is alike the concern of the Church, the natural instincts of love and affection, and the desire for children. Thus far marriage is very largely regulated by religious concepts and by the individuals directly concerned. But we find even here many of the religious concepts are written down in our law books, and we have come to view them as part of the regulations imposed by the state. The effect of marriage upon the property status is the concern of society. Where the property is involved the individual interests sink into the background and the actions of husband and wife and their duties and obligations are arbitrarily fixed. From the time when the human race emerged from utter barbarism, from the time when marriage ceased to be the offspring of the family and became the basis of the family—since then society, no matter what its name or nation, has felt itself called upon to regulate the property rights of married persons. This regulation has confined itself to the readjustment of the property rights of two persons, theretofore independent, now by their own act become dependent.

The law which fixes the rights of married women has a well-defined institutional and historical basis. It is, therefore, pertinent to the subject matter to explain the character of the marriage contract, and also briefly to trace the historical course of married women's property rights. Marriage, as an institution, seems to have passed through three stages: first, the physical; second, the legal; and third, the personal or moral stage. With the first we have nothing here to do except to remark that the woman was practically a slave, the purchase of her master. Mutual rights were unknown. The rights were with the strong—the man. The duties were with the weak—the woman. As social life advanced there became more ceremony in selecting the wife, and continued recognition of the husband's supremacy. In the second stage, permanence was secured by assigning to the

husband a property right in his wife. He continued his control over his wife's person and took dominion of her property. In the third stage, or we may call it the present stage, the relation approximates that of two individuals on a basis of equality. But even in the present stage marriage, as at common law, is but a civil contract. Its aesthetic features, however desirable, are not legal essentials.

The marriage contract may now be made by any appropriate words in the present tense without regard to form between parties competent to enter into it. The parties should be without disqualification of blood, mentally competent, physically fit to discharge the duties of the relation, neither of them bound by a coexisting nuptial tie, and they should express their mutual asset substantially in accordance with the forms prescribed by law. The law visits certain pains and penalties upon the magistrate or minister who performs a marriage ceremony without strict compliance with the terms of the law. It is slow to interfere with the status once it is created, and this not alone when the forms have not been complied with, but even when there has been no form whatsoever observed. Thus, in Pennsylvania, the law affixes the marital relation with its restrictions, duties and obligations upon the man and woman who live together and are publicly known as husband and wife.

Although marriage is a contract and, like other contracts, has mutual assent as its prominent factor, it, nevertheless, is isolated from all other forms of contracts. In other contracts the parties make the rights and duties what they please. Here the law interferes only when the parties undertake to consummate that which the law prohibits. By the contract of marriage the parties cannot fix their rights or their obligations. Every right and every duty which arises because of the marriage relation is arbitrarily fixed by the law. As we emphasize the personal or moral relation of the parties, mutual assent becomes the chief constitutent element, and we tend to throw into the background the legal aspects and requirements of marriage. As we emphasize the effect of the relation upon property we bring into the fore-

ground the contractual aspects and the necessity of arbitrary regulations of the resulting status by the state. No matter where we place the emphasis, we are brought face to face with the fact that when man is united with woman both are brought under certain arbitrary legal restrictions for their mutual well being and the well being of society. We subject ourselves by marriage to the law of the family. The law of the family is independent and above the individual. The voluntary act of the parties creates the marriage relation. They cannot voluntarily alter it nor can they voluntarily retreat from it. Public policy has fashioned a system, and each one is required to obey the arbitrary rules which result. The provisions of the law are for the man and the woman who have chosen voluntarily to become husband and wife, not for a business firm.

The law concerning property rights of married women, however, is now emerging from a state of confusion. But on some points the duties and obligations of the married pair are still unsettled. The reason for this lies in the contest that has long continued between two opposing schemes for adjusting property rights. The one is the Common Law scheme. The other a scheme like that of the Roman law. The first is the real basis for our jurisprudence, but the latter has showed itself a powerful influence in shaping our statutes. Pennsylvania is a common law state and the rules of the common law apply, except where those rules have been changed by legislative act.

The common law property scheme makes unity in the marriage relation its chief point. This unity was not secured by depriving the wife of mental capacity and placing her on the plane of a minor or an insane person, as is often stated. But, it started with the assumption that the wife's legal existence was suspended during the married state and that her being was merged into that of her husband. Her property interests were placed in her husbands' keeping. Her fortune passed temporarily or permanently into his hands for his enjoyment. Her wearing apparel, jewels and other adornments were his property and as such might be disposed of by him during coverture. They

were liable for his debts. Even her earnings belonged to him. The derivation of the word husband, shows the scope of his position. The first part, "hus," is the word "house" in our language. He was the householder. The wife had no part in it. She could not contract, sue or be sued because, in legal contemplation, when she married she ceased to be a person. She could be her husband's agent, but that was the extent of her power to act. Husband and wife were one, and it has been playfully said the husband was that one. Husband and wife could not even be joint contractors. Their joint promise was the promise of the husband alone.

The husband, on the other hand, lost but little of his independence. Marriage did not affect his ability to contract nor did it affect his liability on his contract. But he was compelled to pay the debts of his wife which she brought with her, even though she brought no property to him. And he was bound to support her in condition befitting his estate. Husband and wife took curtesy and dower interests in one another's lands—interests which depended upon survivorship. The advantages were with the husband. Whatever the wife did was under the cover or protection of her husband. Her condition was called her coverture. The wife's disabilities, says Blackstone, are "for the most intended for her protection . . . So great a favorite is the female sex of the laws of England." The position of the husband and wife at common law is set forth by Sir Thomas Smith in his Commonwealth of England in the following language. "The naturalest and first conjunction of two towards the making of further society continuance is of the husband and wife each having care of the family; the man to get, to travel abroad and defend; the wife, to save, to stay at home and to distribute that which is gotten for the nurture of their children and family; which to maintain God has given the man greater wit, better strength, better courage, to compel the woman to obey by reason or force; and to the woman beauty, fair countenance and sweet words to make the man obey her again for love. Thus each obeyeth and commandeth the other;

and they two together rule the house so long as they remain in one."

Another writer, in commenting upon the status of the married woman at common law, has said: "The law entrusts the husband not only with a certain degree of care and protection, but also with authority over his wife. He is to practice tenderness and affection, and obedience is her duty." Upon this principle of unity of person in husband and wife depend the legal rights and disabilities that either of them acquire by the marriage. "It is better to regard the wife's position as a compromise between three notions of absorption, guardianship and a kind of partnership of property in which the husband's voice normally prevails." (Bryce's Studies, Hist. & Juris. 819.)

Under the early Roman law the husband had absolute control over his wife and her property. He could chastise, sell or kill her. He was the owner of all her property, and was entitled to all her labor and earnings. Her only rights were her support and an interest in the husband's property at his death. With the advancing brilliancy of Roman civilization this control grew less and less until, at length, the cvil law gave little attention to the unity of the pair, and they were regarded as partners. It looked to the personal independence of both. The husband had the right to choose the domicile, the right to his wife's society, the right to regulate household expense, and the right of custody and education of the children. It was his duty to support her, but he had no legal control over her actions. The husband and wife were regarded as distinct persons with separate rights and capable of holding separate estates. The wife was responsible for her debts, could sue and be sued on her contracts, and her property was not subject to attachment for payment of his debts. Marriage per usum, *i. e.*, cohabitation, became universally prevalent in the latter days of Rome. The parties so united acquired no general interest in one another's property. The wife brought her dowry and the husband his counter dowry, but with respect to all other property each retained full rights of ownership. Each could manage or sell his property without

reference to the other. At death the total property reverted to the donor unless purchased by the other for full value. Thus the individual interests became the chief factor in the Roman law scheme, whereas identity of interest was the chief factor in the common law scheme.

No one can say that it was the lack of identity of interest, or that it was the failure to incorporate the idea of unity of persons which made the Roman scheme defective. We do know, however, that widespread licentiousness followed marital independence; that as the property interests of husband and wife began to diverge, the bonds of the family were weakened, and that when Rome fell, woman possessed her full share of personal freedom, yet at the same time she had reached the lowest levels of morality. (Schouler, Domestic Relations.)

There is a third doctrine as to the property rights of husband and wife which has found its way into the codes of Louisiana, Mississippi and the southwestern states through the codes of France and Spain, which is known as the Community System. The relation is there regarded as a partnership. This partnership applies to property acquired during marriage, and the debts of the partnership have priority over individual debts out of the community estate. The wife has not the capacity to sue and be sued. The husband is the "curator" of his wife. He has the management of her property and that of the community. She is entirely excluded where her acts cannot be referred to an authority, express or implied, from her husband. By the French law, only personal estate entered into the community. The Spanish law included both real and personal estate. (Childrens *vs.* Cutter, 16 Mo., 24.)

The American community doctrine is that all property purchased or acquired during marriage by or in the name of either or both, is deemed to belong to the community. But this community incident may be overcome by proof that the property was acquired as the separate estate of either the husband or the wife. This community rule permits each party to keep apart his or her separate property.

These are sources from which Pennsylvania derives its jurisprudence covering the property rights of married women.

In Pennsylvania, at the present time, we have the property rights of married women defined almost entirely by statutes. These statutes are a complex of the common law, the civil law and the community of interest idea. The first legislative act which removed some of the disabilities placed upon women by the common law was passed in 1718; the last act for this purpose was passed in 1915, two centuries of legislation, and there is still room for further legislation. These statutes have been enacted in some instances for the benefit of creditors, and in others to enable women to engage in business enterprises where their husbands have ceased to support them and thereby to relieve the community of their care as possible objects of charity. No doubt, in most instances these statutes are the result of the desire to accord to woman that same status with respect to freedom to control her property as she has gained for herself in the intellectual world.

But through all the series of more than twenty-five statutes is to be seen the pressure of the woman seeking for wider influence, desiring her property secured to her own use, chafing under restraints imposed upon her, and indignant at the inadequate remedies afforded her for redressing her wrongs and preserving her rights.

While at common law, the contracts of a married woman were void; she alone could take advantage of that fact, and if she performed her part of the contract, the other party being under no disability, was bound just the same as though the contract was made with a person having full capacity. In other words, her contracts were valid when set up by her in her own behalf without default in the performance of her part. (Mansley *vs.* Smith, 6 Phila., 223.) Thus, while the married woman had no power to contract, neither did she suffer under any obligation or duties. With each statute passed by our legislature increasing married women's rights, their obligations have been increased in like degree.

The Act of 1718, just referred to as the first of a long series of acts, gave her a few rights and at the same time affixed to her reciprocal duties. It had in view the case of a wife left to shift for herself by a husband who had gone to sea. She was left to contract debts on the credit of her husband, but he could not be reached by legal process, hence her credit was limited and she often found herself in a sorry state. Accordingly the act gave her the right to contract debts on her own credit and authorized her to gain her living by shopkeeping or other employment, and subjected her to reponsibilities as a feme sole. The act clearly indicates that there must be a business of some kind in which credit is given to the wife, and she had therefore to engage in business before any liability could arise. As the court has said, "Indeed, it is only in the prosecution of such a calling (feme sole trader) that she is likely to contract debts, or be entitled to claims requiring the aid of the law by suits for or against her." (Cleaner *vs.* Sheetz, 70 Pa., 496, 499.)

The Act of 1855 extended the provisions of the Act of 1718 to cases of desertion and neglect or refusal of the husband to provide for the wife. Here, again, she must be engaged in some trade, business or employment pursued by her for a livelihood in order to constitute her a trader and to make her contracts binding on her as such (Cleaner *vs.* Sheetz). The husband remained liable for her support, and if she engaged in business or trade she, too, became liable for her necessaries.

The most recent act of our legislature with respect to feme sole traders was passed May 28, 1915. This act permits a woman where her husband has lived separate from her and has not supported her for one year or more, to be declared a feme sole trader. Thereafter her property, however acquired, is subject to her absolute disposal; her husband cannot interfere with it, and in case of intestacy it goes to her next of kin as if he were previously dead.

It is to be observed that the Acts of 1718 and 1855 were based upon a condition, *i. e.*, absence of the husband. This condition, when found to exist, was fixed by these acts as sufficient, when

she brought herself within their provisions, to release a married woman from the ordinary disabilities of coverture and charge her with obligations formerly her husband's. The common law remained the same in general as to the contracts of married women and the use of their earnings, but prohibited the application of the common law doctrines in certain cases to the contracts of the wife. The Act of 1915 goes further. It is based on separation and non-support, and it ousts his interest in her property completely.

It was the Act of 1848 which marked the first real advance in the exercise of property rights by married women. It will be observed that prior to this act marriage meant a gift to the husband of the wife's chattels in possession, and the loss of her power over her choses in action. If he reduced the choses in action to possession they became his absolutely just as the rest of her personal estate. Since this Act every species of property, whether consisting of real or personal property, which she owned as a single woman continues to be hers as fully after as before marriage. Any property which she may acquire by deed, will, descent or otherwise during coverture is her own property and is not subject to levy for his debts. Her husband cannot sell or mortgage such property without her consent, acknowledged before one of the judges of the Courts of Common Pleas, that such consent was not the result of coercion but was voluntarily given. At the same time this act exempted the husband from debts contracted by the wife before the marriage, and it left the wife's property liable for seizure and sale to satisfy her debts contracted before marriage. This act did not enlarge her general contractual power. It secured to married women their separate estates, but their earnings still belonged to their husbands. (Speakman's Appeal, 71 Pa., 25.) What it did give her was the right to own, use and enjoy her separate property, and to make contracts necessary for this purpose, such as contracts for improvements and insurance. At the same time it charged her with liabilities, and so far as necessary to protect herself, enabled her to sue and be sued. "Were it otherwise a married

woman, no matter how simple her estate, could not put a new roof on her house when necessary nor rebuild it if destroyed. If she loaned her money she could not recover it. On the other hand, the mechanic who repaired her roof or rebuilt her house would have no remedy to recover his money." (Bovard *vs.* Ketterling, 101 Pa., 181; 184.) This act protected her estate and the property purchased by the wife on the credit of her separate estate, or by her earnings derived from the management of it, from being encumbered by her husband or seized by his creditors. His control over her separate estate was excluded. (Shuster *vs.* Kaiser, 111 Pa., 215, and Hanes *vs.* Ellis, 24 Pa., 253.) It enabled her to hold property not as a feme sole, but as if it were settled to her as a feme covert. She could dispose of her property by gift or loan to her husband and become a creditor of her husband by the payment of a debt for which he was liable. She could purchase land and give her bond for a purchase money mortgage, but this bond binds the property so purchased only, and no other portion of her estate. When the husband receives from his wife moneys of her separate estate, which he applies with her knowledge and approval to the purchase of real estate in his own name for their joint occupancy and use, neither the wife nor her representative can recover it after his death. (Kreider's Estate, 212 Pa., 587.) It becomes a part of his estate.

This act is broad in its scope, and seems to remove almost all of the common law restrictions in so far as the control of her separate estate was concerned. The courts, however, when required to interpret the statute in connection with claims of creditors, felt called upon to take into account the great possibilities there were for fraud upon creditors by the husband and wife and the fact that under our social conditions man is the producer and woman the one to stay at home and save. Accordingly, where property is claimed by a married woman as against the creditors of her husband, she must show by evidence convincing beyond a reasonable doubt, either that she owned it at the time of her marriage or else acquired it afterward by gift or purchase. In case of purchase after marriage, she must prove dis-

tinctly that the purchase was not made out of funds furnished by the husband. The presumption that the husband furnished the means of payment is a very strong one, whether the purchase was of real or personal property. (Rhoads *vs.* Gordon, 38 Pa., 277.) This, however, does not prevent the husband from settling property upon his wife so long as it is not done in fraud of the rights of creditors.

Prior to this act, except where a woman had become a feme sole trader under the acts provided for that purpose, she was not liable for necessaries, but by the act of 1848, where the wife incurred debt for the support of the family, the husband and wife both became liable for necessaries so furnished, and where execution was first issued against the husband and he had no assets, an alias execution could issue against the wife's separate property. Neither this act nor the acts of 1887 and 1893 affected the liability of the husband for necessaries furnished the wife and family, and he is still primarily liable therefor even though they are contracted for on the credit of her separate estate. Suit begun against him for such necessaries is conclusive against the liability of the wife. (Roll *vs.* Davison, 165 Pa., 392.) To make the separate estate of a married woman liable for a debt contracted during coverture, all that is required is that the claim shall be for necessaries for the support and maintenance of her family, and that they were contracted for in her name or by some one authorized by her, and that her husband is insolvent. No exact legal definition of family necessaries can be given. The quantity and quality of the articles purchased, the wife's estate and her rank in society are all to be considered. In various cases under "expense for the family" have been charged cook stove, sewing machine, food, organ, doctor's bills and a diamond shirt stud worn by the husband. In a case decided many years ago a buggy was held to be necessary to a married woman who was aged, corpulent and who manages a farm. (Fremoyer's Estate, 2 Lanc., 1870.) Speaking broadly, there would be included in this list any debt incurred under the above conditions on account of the family where the

subject of the debt is used in the family. (Bear's Estate, 60 Pa., 430.)

The Act of 1872 conferred on married women a single right additional to those granted by the act of 1848, and this was the right to retain her earnings from whatever source derived as against her husband and his creditors, the same as if she were a feme sole; as, for example, money earned by a married woman by keeping boarders cannot be taken on execution to satisfy the debts of her husband. (Rafferty *vs.* Rafferty, 5 D. R., 453.) The wife is also entitled to the income of her separate property, although the labor of her husband mingles in the production. (Martin *vs.* Davis, 30 Pa. Sup., 59.) Any married woman might avail herself of the act with or without cause. When the married woman received the benefit of this act she undertook the obligations. "That Act" (1872), said the court (Bovard *vs.* Ketterling, 101 Pa., 181, 182), "was not intended to license a class of female pirates who should engage in business without responsibility and make reprisals upon the grocer, the baker, the mechanic and other persons with whom she may deal in the tranaction of her business."

She does not, even under this act, acquire the right of contracting generally; but she does acquire the right to make any contracts necessary in the course of such business or employment as she may engage in. (Zurn *vs.* Noedel, 113 Pa., 336.)

It is interesting to note that under this act she may make a contract binding upon her separate estate for the purchase of a sewing machine for her own use, her husband not being liable unless the machine be a necessary of their joint household. (McQuillen *vs.* Singer Manufacturing Co., 99 Pa., 586.)

Between 1848 and 1881 came a long series of acts, none of them general in nature but each addressed to the purpose of further freeing married women from the restrictions of the common law. The following is a list of those statutes: Acts of 9 April, 1850; 4 May, 1855; 11 April, 1856; 24 February, 1859; 22 April, 1863; 17 May, 1871; 2 June, 1871; 1 April, 1874; 18 March,

1875; 25 May, 1878; 9 April, 1879; 10 April, 1879; 11 June, 1879; 10 June, 1881.

Under the provisions of these acts, power has been conferred upon every married woman to insure the life of her husband for her own use; to execute a refunding bond; to act as executrix or administratrix; to act as incorporator of any institution composed of women, or to be under their management, for the care and education of children, or for the support of sick and indigent women; or for purposes of learning, benevolence, charity, or religion; to sell and transfer stock owned by her in any railroad company; to sell and transfer any loans of the commonwealth, the city of Philadelphia, or any corporation created under the laws of Pennsylvania, and her stock in such; to sell, assign, transfer and satisfy of record mortgages and judgments held by her; without the consent of her husband, to postpone her judgment to and for the benefit of a subsequently entered lien; if of age, to hold stock in building associations, have all the rights of members therein, including that of borrowing money, with all its incidents, and to secure the loan by transfering her stock or other securities, or giving bond and mortgage on her separate estate, in which, however, the husband must join; if deserted, abandoned or driven from her home by her husband to assign, transfer, or indorse over to any person any mortgage, bond, judgment, promisory note, or other evidence of indebtedness against him, or any other person, and to sign, seal and deliver in person or by attorney to a guardian requiring it, her own refunding bond, and to deposit money in a bank and withdraw the same on her own check. By the act of 1893 married women may now be corporators of any corporation. They may also become members of the partnership and be entitled to the same rights and subject to the same liabilities as other partners. (Loeb *vs.* Mellinger, 12 Sup. C., 592.)

These acts may be regarded as excepting contracts of a certain class of married women from the application of the common law rules and excepting all married women from the application of the common law rule with reference to certain transactions.

They are not acts of general application. The act of 1848, or the married woman's emancipation act, as it is sometimes called, stands out in bold contrast with these acts.

But as we have seen the general power to contract is nowhere given to a married woman by the act of 1848. That act was intended to protect her property from the encroachment of the husband by virtue of his common law rights. Her contractual powers were limited by it to such contracts as are necessarily involved in the right given her to own, use and enjoy her separate property, and in the liability imposed upon her where debts may be contracted for necessaries.

The next act of wide importance was the act of 1887. Among other things this act provided that: "Hereafter marriage shall not be held to impose any disability on, or incapacity in, a married woman as to the acquisition, ownership, possession, control, use, or disposition of property of any kind in any trade or business in which she may engage, or for necessaries, and for the use, enjoyment and improvement of her separate estate, real and personal, or her right and power to make contracts of any kind, and to give obligations binding herself therefor, but every married woman shall have the same right to acquire, hold possess, control, use or dispose of her property, real and personal, in possession or expectancy, in the same manner as if she were a feme sole, without the intervention of any trustee, and with all the rights and liabilities incident thereto, . . . as if she were not married; and property of every kind owned, acquired or earned by a woman, before or during her marriage, shall belong to her, and not to her husband or his creditors."

The general results of the act, as relating to the wife's powers to contract, have been summarized (Endlich & Richards, Rights and Liabilities of Married Women in Penna. (1889), p. 125–27) as follows:

First. The right is conferred to contract in and relating to any trade or business in which a married woman may engage, including the power to make, execute and deliver all instruments and obligations usual and proper for such purpose, as notes,

bonds, drafts, bills and the like; excluding, however, engagements of a collateral kind, not directly for the benefit of the wife, such as accommodation indorsement, guaranties and suretyships.

Second. The right to contract for necessaries—the only right given to the wife of becoming liable upon a contract not exclusively for her own benefit—including instruments and obligations evidencing such contracts, or fixing her liability therefor; but again excluding the assumption of another's indebtedness by becoming accommodation indorser, etc.

Third. The right to contract for the use, enjoyment and improvement of her separate estate, including the right of giving such obligations and entering into such contracts, evidenced by such instruments as are appropriate to the exercise of this right, as bills, bonds, etc., for indebtedness incurred in this behalf, executing leases of her real and personal estate, assignments and transfers of personal property, powers of attorney to act in her stead, and the like, but not to become liable, or to lend her credit, for another's debt.

Fourth. In all these cases the liability to suit follows the right to contract and is co-extensive with it.

Not satisfied with this act, the legislature passed a further statute in 1893. By the act of 1893 a married woman is given the same right as an unmarried person to acquire, own, possess, control, use, lease, sell or otherwise dispose of any property of any kind, either in possession or expectancy. There are only two limitations on complete freedom with respect to her contractual power and property rights. She may not mortgage or convey her real property without the joinder of her husband in the mortgage or conveyance. She may not become accommodation maker, accommodation indorser, guarantor or surety. Under this act she can carry on business as a feme sole. The proceeds of the business belong to her and cannot be seized by her husbands' creditors. Without having any separate estate she may, for the purpose of engaging in business, purchase property wholly on credit, and hold it against her husband's creditors. (Wayne

vs. Lewis, 23 W.N.C., 441.) She is entitled to an exemption of $300 in her separate estate just as is her husband. (Freyburg *vs.* Glosser, 14 Sup. C., 94.) Her earnings are her separate property, and she may sue to recover them in her own name. Even under this act a man continues entitled to the assistance of his wife, not only in the home, but in his business; still he may contract with her for the performance of extra and unusual services in the course of his business outside of the family relation and the contract will be deemed a waiver by him of all claim to her wages and she will be entitled to be paid for such services out of the proceeds of a sale of her husband's property. (Nudig *vs.* Urich, 169 Pa., 289.)

The Act of 1911 makes it lawful for a married woman to convey her real estate to her husband in the same manner as if she were a feme sole. Where husband and wife are living under a separation agreement, and in that agreement he has released all his interest in her real estate by recording this agreement in counties where her lands are situated, she may convey her real estate without her husband's joinder.

Before the acts of 1887 and 1893 the capacity of a married woman to contract was exceptional and her disability general. Since these acts her disability has become exceptional. When she seeks to avoid her contract the burden is on her to bring it within the exceptions. She has full power to bind herself in any manner, except as surety, by any variety of obligations. The general rules relating to contracts apply to those made by her. But she cannot by any device be bound for the debt or default of another except by deed or mortgage. Even a bond given and a judgment confessed by a married woman are both valid unless they show specified exception to her power to contract. As was pointed out in the case of Peter Adams Paper Co., *vs.* Cassard, 206 Pa., 179, every restriction imposed by the common law has been removed except in two cases: first, she cannot become an accomodation maker, guarantor, or surety for another; second, she cannot, unless her husband joins, convey or mortgage her real estate. Her deed or mortgage without the husband's joinder

is absolutely void. In the first instance she has no power to contract at all. This is for her own protection against the wiles of crafty persons, not excluding her husband; for the protection of the one who, because of her peculiar mental make-up through a course of training since the world began, is by nature trustful and unaccustomed to business stress, against those who, because of their peculiar mental make-up, a desire to acquire and a willingness to battle with chance, have become cunning and unscrupulous. The second restriction is removed if the husband joins in the deed of conveyance. This restriction is for the husband's benefit. It is to preserve his curtesy right in her property, a right which he had at common law.

At common law, in order that the curtesy right should arise, there must have been (1) legal marriage, (2) possession during coverture, (3) issue born alive, (4) death of the wife.

Now no issue is necessary providing that such issue, if it had been born, would have inherited.

The Pennsylvania Statutes which gradually enlarged the contractual powers of married women and deprived the husband of some of his rights to her personal property, preserved his curtesy right. Where the wife dies and there is issue living, the surviving husband now takes personalty share and share alike with the issue, and a life estate in all the realty. Where there is no issue or descendants thereof living, the surviving husband takes the personalty absolutely and a life estate in all the realty. But where the husband has deserted his wife or wilfully neglected to provide for her for a period of one year, he loses this curtesy right.

This curtesy right is not dissimilar to the dower right which, the wife has in his estate, and from which he in turn cannot oust her so far as her real estate is concerned, unless she join in the deed of conveyance, though a foreclosure sale under a mortgage will divest her dower interest. This dower interest is as follows:

Where a man is possessed of property, real and personal, and dies, leaving a widow and issue, the widow receives a life interest

in one-third of the real estate and takes one-third of the personalty absolutely, together with her exemption of $300.

Where a man dies and leaves a widow but no issue, under our act of April 1, 1909, the widow is entitled to personality or realty, or both, to the extent of $5,000, together with an exemption of $300. If the estate exceeds $5,000, then she takes personalty or realty, or both, to the amount of $5,000 absolutely, a life interest in one-half of the remaining real estate, one-half of the remaining personalty absolutely, and the balance goes to the collateral heirs.

The wife may make a will and dispose of her separate estate as if she were unmarried; but she cannot, by her will, deprive her husband of his curtesy right. Nor can he, by his will, deprive her of her dower right. Either may take against the will of the other, and under those circumstances their rights are fixed by the laws governing intestacy.

By the act of 1893 a woman may sue and be sued civily, just as an unmarried person may be sued; but she may not sue her husband except for divorce, or in a proceeding to protect or recover her separate property when he has deserted or separated himself from her without sufficient cause or may have neglected or refused to support her. He, in his turn, cannot sue his wife except under like circumstances. His property is liable to seizure for the support of his wife when he separates himself from her or absents himself from the state.

Broad as are the acts of 1848, 1887 and 1893, they do not and were not intended to release a married woman from her conjugal relations and marital duties. They do, however, give her control of her separate property with broad rights and privileges incident thereto.

So the Roman law has gradually supplanted the common law so far as the property rights of husband and wife are concerned. Substantially only the right of curtesy and dower remain. But for these exceptions each can manage or sell his or her property without reference to the other.

So far, however, as community property is concerned, aside

from the real estate, this is the husband's to deal with as he may see fit. It is, in reality, his personal estate. He may reduce himself and his wife from affluence to penury without her consent or interference. He owes her no more and no less than he did at common law. Her wedding presents may be hers, but the household equipment, unless it is shown to be part of her separate estate, is his, and it may be seized by his creditors. During the continuance of the marriage relation, the wife has no right to the community personal property or any portion of its proceeds. It is all his. The husband is the head of the family. He has the right to fix the family name and choose the domicile. He is entitled to the custody of the children, and it is his right to decide matters concerning their education. In all matters concerning community property, husband and wife are one, and he is the one.

What Sir Thomas Smith said of all the property of the married pair is equally true of today of the community property, . . . "the man to get, to travel abroad and defend; the wife to save, to stay at home, and to distribute that which is gotten for the nurture of their children and family; which to maintain God has given the man greater wit, better strength, better courage, to compel the woman to obey by reason or force; and to the women beauty, fair countenance and sweet words to make the man obey her again for love. Thus each obeyeth and commandeth the other, and they two together rule the house so long as they remain in one." Man-made laws are not perfect. Our laws with respect to the rights of married women are imperfect like all the rest. The meager restraints still remaining on the contractual power of married women may be a fault. Married women have not yet come to the full realization of their contractual power or property rights. What may happen when they find the full extent of the freedom they now possess is a matter for conjecture. The future will have to speak for itself. In any event our system has worked out thus far much better for the welfare of the social fabric than did the absolute freedom of property rights under the Roman system.

THE HINDU BEAST FABLE AND THE STORY OF ITS TRAVELS

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For a half a century now it has been commonplace knowledge among students of folklore that a great many of our best-known European fables and stories, especially beast fables, came to us from India. The exact extent of Europe's indebtedness in this respect is, however, a matter that is much open to doubt. For my part, I suspect that this indebtedness is very great indeed—in fact, much greater than we can ever hope to prove by decisive evidence.

To begin with, the time at which Indian stories first began to be transmitted to Europe is uncertain. *Literary forms* of Hindu fables cannot be proved to have passed into the literature of western peoples before the sixth century of our era. About 550 A. D. we know that a book of fables called the Pañcatantra or "Five Books" was translated from Sanskrit into a Persian dialect. Two centuries later this same work, now perhaps most familiarly known as the Fables of Bidpai or Pilpai, was further translated from Persian into Arabic, and from thence it passed, after the tenth century, into various European languages. From the twelfth century on, this work began to exercise an enormous influence on European stories, both literary and popular.

But long before this time European fables contained Indian elements.

We know, unhappily, very little about the origin of the Greco-Roman fables which circulate under the name of Aesop. This name itself is half-legendary, perhaps wholly so. We are not sure that there ever was such a person as Aesop. Fables attri-

buted to him must have been in existence as early as the middle of the fifth century B. C., when Herodotus speaks of them; later in the same century we find allusions to them in Aristophanes and Plato. Apparently, however, they were at that time simply a floating mass of popular tales, not yet reduced to literary form. Demetrius of Phalerum is said to have codified these fables about 300 B. C., in Alexandria, which was already becoming the center of the literary life of the Greek world. But his collection, which is not preserved, may have contained fables which were not "Aesopic" (whatever that may mean), and it is very possible that some of them were Indian in origin. This may be guessed from the fact that the earliest extant collection of classical fables, the Latin one of Phaedrus (floruit 25 A. D.), seems to have been based mainly if not wholly on the collection of Demetrius, and to have contained some fables which ultimately came from India. The next oldest classical book of fables preserved to us is the Greek one of Babrius, who wrote probably in Rome in the third century A. D. Babrius himself professes that his fables are taken partly from Aesop and partly from one Kybisses, a Libyan; this indicates that part of Babrius' fables were at any rate of Oriental origin and not Greek. The collections which now pass under Aesop's name have even less right to it than Phaedrus or Babrius, for they are all still later than these two authors and based at least in part on one or both of them. You will see, then, that it is impossible to say how many of the so-called Aesopic fables date from classical Greek times, say from the fifth or sixth century B. C., when Hindu influence would be less easy to assume; although it would be rash to deny the possibility of Hindu influence even then.

Now the earliest datable evidence for the existence of beast fables in India is certain rock sculptures, representing in relief scenes from well-known beast fables, the Buddhist Jâtakas; the sculptures belong to the third century B. C. There is, however, little doubt that fables had existed in India for some centuries before this time. And, as will appear in the course

of what follows, there is every reason to believe that certainly most of the Indian beast fables are native to India.

On the other hand, there is equally little reason to doubt that at as early a date as the sixth century B. C. fables were current in Greece; and since most of the so-called Aesopic fables cannot be traced to any other country than Greece, and show no internal signs of non-Greek origin, it appears that there are no particular grounds for doubting that they are native to the Greeks. Greece and India are by no means the only countries of the world where fables have originated; they are found among many primitive peoples the world over, including our American Indians. There is, then, nothing at all improbable in the assumption that beast fables sprang up in India and in Greece independently. And such appears, in fact, to have been the case.

Our current stock of fables is a mixture of these two streams. Perhaps it may contain somewhat more Greek than Indian elements, though this is not certain. Some of the Indian fables in our collections have come to us through the medium of classical Greek and Roman fables, others through later channels. I want particularly to emphasize the fact that this mixture of Greek and Indian elements is found already in Phaedrus and Babrius, the most ancient European fable-collections now in existence. *We have no collection of purely Greek fables.* Though it is probable that many, perhaps most, of Phaedrus' and Babrius' fables are native Greek, it is, I believe, nearly certain that some of them are Indian.

These first advance guards of Indian fables in Europe were probably, like the earliest "Aesopic" or native Greek fables, with which they are mingled in Phaedrus and Babrius, not literary but popular compositions. We must suppose that they mostly traveled by word of mouth all the way from India to Greece and Rome, told and retold from one place to another, carried perhaps by merchants and traders across sea, mountain or desert, finally to be picked up and incorporated in the literary collections which have been directly or indirectly handed down

to us. In this respect this first wave of Hindu fables presents a marked contrast with the later migration typified by the so-called fables of Bidpai. These latter traveled over the same course, from India to Europe, but by literary channels, mainly or exclusively. In their case there is little or no ground left for conjecture; we can for the most part clearly trace and definitely prove every step of the journey.

But some of you must have been wanting to ask me: How can you be so sure of the Indian origin of a fable found both in Greece and in India? If it be true, as I have said, that the demonstrable age of at least some fables is greater in Greece than in India, why may not the borrowing, such as there was, have been in the other direction, from Greece to India?

To this I will frankly admit that clear and indisputable proof is, in the nature of the case, out of the question. If any of you are firmly determined to resist my proposition, I cannot hope to deprive you of all possible ground for your dissent, nor could I if I had unlimited time at my disposal. It is simply a question of the balance of probabilities; clear certainty there is none. It seems to me, however, that in the case of a number of individual fables, it can be shown that there is a reasonable likelihood that they came from India to Greece, although I emphasize once more my belief that the great mass of the fables of both countries are independent of each other.

The strongest indication of the Indian origin of a certain group of Greek fables is their Indian stage setting. That is, they refer to animals, to customs, and to points of view which to the Greeks would be more or less exotic, sometimes to the point of being unintelligible, while in India they are commonplace and natural.

In cases of this sort we could not, of course, expect always to find the exotic elements of the fables preserved unchanged in their Greek form. Sometimes they show themselves only in stray traces, or in a certain unevenness of the narrative, more or less clearly visible, which indicates a change from the original form of the story. Sometimes, again, the stories are com-

pletely Hellenized, so to speak. That is, the foreign elements are displaced by more or less obvious Greek equivalents.

In the latter case, of course, it is not always clear that the Hindu version is the original and the Greek borrowed. But that this is at least often the case is shown by the evidence of a group of fables drawn from still a third source, to wit, the fables found in the Hebrew Talmudic literature. These, which can be traced back almost but not quite to the beginning of the Christian era, reproduce in a number of cases—perhaps a dozen or so all told—fables which occur both in Greece and in India. These Hebrew versions are of prime interest because it is reasonable to suppose that they are in a way connecting links between Greek and Indian fables. In traveling between Greece and India the tales must have passed through some part of the nearer Orient; and here we find, right in the nearer Orient, among the Jews, a number of the very fables we are looking for.

And the all-important thing about these Jewish fables, for our purposes, is this: *In matters on which the Greek and Hindu versions of fables differ, the Hebrew versions, so far as they occur, regularly agree with the Hindu variants against the Greek.* Now it is, for various reasons which it would take too long to set forth, highly improbable that these differences were introduced into originally Greek fables by Hebrew borrowers, from whom they were then in turn borrowed by the Hindus. That being so, I think you will agree that a fairly plausible *prima facie* case has been established for the Hindu origin of at least the dozen or so fables to which these facts apply.

A concrete instance will, I think, make my argument on this point more clear. Take the famous and familiar story of the Wolf and the Crane, which occurs in Phaedrus and from then on in many European collections. You perhaps remember the story; how the wolf got a bone stuck in his throat and could not get it out; he was in great pain, and vainly tried to get various animals to help him by promises of rewards. But no one dared venture into the wolf's throat to extract the bone.

Finally a crane consented, put his head into the wolf's throat, and picked out the bone, or, as Phaedrus has it—

Periculosam fecit medicinam lupo,

"performed this dangerous operation on the wolf"—dangerous for the doctor for once, rather than for the patient. But when the crane asked for his medical honorarium, the wolf replied: "You ungrateful wretch! Isn't it enough that you got your head safely out of my jaws, without your asking for any other reward?"

Now the very same fable occurs in India. The crane is still a crane, but instead of the wolf we find a lion. The story is otherwise very close indeed to the Phaedrine version. It is quite unbelievable that the two should have originated independently. But which was the source of the other? It resolves itself into the question, lion or wolf. Either one is perfectly suitable; internal probability, therefore, tells us nothing. But the Hebrew form of the story, otherwise similar in all respects, has a lion. The altogether most likely solution seems to be, then, that the story originated in India, with a lion in the chief rôle; that in this form it traveled from India at least as far as Palestine; but that by the time it got to Greece, or more exactly to Rome, where Phaedrus wrote, the tropical lion had been replaced by the wolf, as a gentleman of similar propensities, but more familiar to Europeans.

You say: but the lion nevertheless appears frequently in Greek fables. I reply: very true, and this in itself is a reason for suspecting that such fables were imported into Greece from some land where the lion is familiarly known. The fables were not learned treatises on zoölogy, composed by travelers or men of science; they were homely, popular anecdotes, pertaining to every-day life, and appealing to the peasant and the common man. When unfamiliar animals appear as characters in a fable, it should strike us as a matter distinctly calling for explanation. Now it may be stated as a general fact that all Indian fables, both as to their animal characters and in other respects,

show all the earmarks of native Indian life—the life especially of the Indian village and small town. In the same way *most* Greek fables present scenes of commonplace Greek life. But there remains a not inconsiderable minority of Greek fables that contain elements which are certainly not characteristic of normal Greek, or European, life, but rather of Oriental life. And the only Oriental country which is known to have produced independently any considerable number of beast fables is India—where, moreover, appear a number of those very same fables which in Greece seem somewhat exotic.

Let us test these international relationships once more by another very widespread story, which will at the same time illustrate the weakness of arguments based on the relative chronology of the literary works in which fables are recorded. In this fable the two oldest known versions, both European, are very manifestly fragmentary and corrupt as compared with versions which appear many centuries later in both Europe and India.

Fable of the Man, Boy and Snake.

The Babrian version, traceable to Rome in the third century A. D., is freely as follows (based on "Aesop," Halm, 96 b):

A serpent stung the son of a farmer to death. The farmer pursued the snake with an axe and succeeded in striking off part of its tail. Afterwards, fearing its vengeance, he brought offerings of food to its hole, hoping to reconcile it. The snake, however, replied that no friendship in such a case was possible; he would never be able to forget the blow of the axe, nor the farmer the loss of his son.

The Phaedrine version, traceable to Rome in the first century A. D., is freely as follows (based on Dressler VII, 28):

A man became friendly with a snake, which came to live in his house and brought him great luck, so that he became rich. One day he struck the snake, which then disappeared, and immediately the man began to lose his good luck and his wealth. He then tried to pacify the snake and make friends with him

again, but the snake repulsed his advances, saying he could never forget the blow.

These two stories are scarcely recognizable as relatives. So much is clear, that the dramatic construction of both is very weak. In the Phaedrine version the man's attack on the snake is wholly unmotivated, for nothing is said of the snake's previous attack on his son. The man's act can only be described as one of basest ingratitude and barbarism, as well as rankest folly. In the Babrian version, on the other hand, the reason for the man's desire for reconciliation with the snake is incredibly weak. The fear of the snake's vengeance would hardly lead him to make friends with the slayer of his son, if there were no ulterior motive, such as the wealth which the snake's favor had brought him; and Babrius says nothing about this.

The truth is that both of these versions are fragmentary; each of them must be supplemented by the other in order to get an idea of the real story as a whole. But the entire tale is found in what must evidently have been its original form, uniting the features of both the Phaedrine and Babrian versions, in an Indian story, which to be sure cannot be traced to ancient times; its oldest known form in India is an interpolation in a late version of the Pañcatantra—not older than, say, roughly 1000 A. D. (See Benfey, Pañcatantra I, 359 ff, and II, 244 ff.) The Indian version is essentially as follows:

A Brahman farmer whose field had remained obstinately unfruitful saw one day a great snake in the field, and taking it for the guardian spirit of the place, began to make daily offerings of food to it. Every day the snake left a piece of gold as a reward for the offering, so that the farmer became rich. One day, being otherwise employed, he sent his son to offer food to the snake. When the son received the gold piece he thought: "Surely the snake's hole must be full of these gold pieces; I will kill the snake and take them all at once." So thinking, he struck the snake, but failed to kill it, whereupon the snake, in fury, bit the boy, so that he died. When the farmer heard of it he could not fail to see that his son had deserved death,

so on the next day he went as usual to the snake's hole with an offering. But the snake would have nothing more to do with him, saying: "I can never forget your son's attack, and you will never be able to forget the fact that I killed him; we can no longer be friends."

Here, you see, is the whole story, in the only form which makes it intelligent and intelligible. Phaedrus and Babrius each preserved fragments of it—and different fragments at that. Now a still more curious fact is this, that the story is actually found in its complete form, almost exactly as in the Indian version just quoted, in certain medieval European fable collections, notably the famous one of Marie de France. By this you see how weak are arguments from literary chronology. The full form of this story is not found in either India or Europe until many centuries—probably more than a thousand years—after the date of the evidently fragmentary and corrupt versions of Phaedrus and Babrius.

The ultimate origin of this story, as of any other story found both in Europe and in India, can then be determined not at all by literary dates, but solely by other evidence, internal in character. Here the probabilities plainly point to Indian origin. In India, as in many parts of the Orient, snakes are sacred or semi-sacred animals. They are not infrequently worshipped with offerings of food, and also not infrequently kept as house pets. There exists, furthermore, in India, a widespread belief that they possess a knowledge of hidden treasures in the earth. None of these customs or beliefs is characteristic of Greece, Rome or other European countries; yet they are evidently presupposed in our story.

Since very early times, then—certainly several centuries before our era—fables and stories were being carried by popular channels from India to the west. There is no reason to suppose that these currents were ever interrupted. From that day to this the movement has doubtless continued, more or less intermittently. But with the growth of literature and the incorporation of originally popular fables and stories in literary form, we

begin to find them passing from the *literature* of one country to that of another. Here we are on more solid ground. We are, to a large extent, in a position to prove definitely the translation of books of fables from one language to another. And here, too, the general direction which the stream of transmission takes is—we can now say positively—from east to west, from India to Persia, Arabia, Syria, and so finally to Europe.

By way of illustration of this literary transmission of fables I should like to call your attention to the romantic history of one collection of Indian fables, which is most commonly known in India as the Pañcatantra. In Arabia and the nearer Orient it bears the name Kalîlah and Dimnah; in Europe it has various names, one of the common ones being the Fables of Bidpai or Pilpai. This collection has been translated and adapted, more or less freely, into fully thirty languages of Europe and Asia, outside of India. And if we were to count the different individual versions of it which have been made, sometimes as many as four or five in the same language through different intermediate sources, the number of separate non-Indian versions known in the world would come to well over fifty. Almost every country and almost every language or important dialect of Europe has at least one version of it. And as much can be said of Southern Asia, from the Suez Canal to the Malay Peninsula and beyond—even to the island of Java, while even in Africa it appears to be not unknown.

Unhappily the work which has attained to so much popularity is no longer preserved to us in its original form. We possess, however, a good many Sanskrit versions of it, some of them quite old. And these, together with the non-Indian versions, enable us to reconstruct with confidence not only the general plan of the work, but also most of its minor details and a considerable part even of its language.

The work was probably called originally the Pañcatantra, which seems to mean the Five Books, alluding to the fact that it was divided into five major sections. It was composed in the Sanskrit language, by an unknown author, probably about 300

A. D. But the fables and stories included in it—for it is by no means wholly composed of beast fables—were only to a slight extent, if at all, invented by the author. Most of them were drawn from older, popular sources.

The quaint introductory story of the Pañcatantra is briefly as follows: A certain king named Amaraçakti had three sons, who were idle, stupid and generally good for nothing. This grieved the king so that one day he called his ministers and asked them to devise some means of educating his sons. The ministers replied that no one could even begin the study of the political and moral sciences without mastering first the Sanskrit grammar, which, in the case of bright students, might be accomplished in twelve years. So the prospect for the education of the princes looked discouraging. But it seems that there were, already in those days, people who believed in short cuts to learning, people who would undertake to lay on, varnish fashion, the superficial appearances of an education without requiring the hard work connected with it. For one of King Amaraçakti's ministers says: "Your Majesty, life is short, and the grammatical sciences take a long time to learn. We must find a more summary way of educating the princes. Now I know of a very learned Brahman named Vishnuçarman, who will make them perfectly well educated without bothering their heads with that stupid grammar." So the king called Vishnuçarman, and obtained his promise to teach the princes in six months all the essentials of the "science of conduct." That is, you see, in modern terms: "Professor Vishnuçarman's Correspondence School. How to Succeed in Life. Taught by Mail in a Six Months Course. Satisfaction Guaranteed or Money Refunded." (To do Vishnuçarman justice, however, he declined the king's offers of money, and professed to undertake the task out of pure devotion to the cause of education.)

Now the Sanskrit word *artha-çâstra*, which I have translated "science of conduct," and which the king wanted his sons to learn, needs some explanation. *Çâstra*, the second part of the word, means science, or more exactly a textbook on any scien-

tific subject. *Artha*, the first part of the word, means here conduct, but conduct of a particular sort. There is another and a more general word for conduct, *nîti;* it means conduct in the widest sense. It has two branches, *dharma*, and *artha*. *Dharma* means conduct as determined by duty—the religious and moral side of conduct. The works called *dharma-çâstras* deal with the religious, the moral and the legal phases of human action (for law in India is based on morality—a state of things which my lawyer friends find it utterly impossible to comprehend). The textbooks of *dharma* set forth what a man ought to do in order to be virtuous or righteous. The *artha-çâstras*, on the other hand, profess to tell what a man should do in order to succeed in life—that is, in business, politics or anything except the moral life. *Artha* is practical success, worldly advantage. In connection with a king, it means particularly the art of government, or political science, international law and diplomacy. The *artha-çâstras* which we know, as a matter of fact, make the conduct of the affairs of kings their main interest. They are, then, Hindu analogues to Machiavelli, or the Mirror for Magistrates. They teach, by either precept or example or both, the means by which a prince may succeed in all his undertakings. And like Machiavelli they are not at all handicapped by moral scruples. They are, in short, entirely unmoral, not to say frequently immoral.

This then was what our friend Professor Vishnuçarman undertook to teach to the idle and stupid sons of King Amaraçakti—the science of conduct, the art of how to behave and what to do—not in order to be virtuous men and lead lives of righteousness—alas, no! Virtue was as out of place in diplomacy then as it is now. He was to teach them to be clever, to get the better of the other fellow—in short, to be ideal statesmen and rulers.

Now with this eminently practical purpose in view, the learned Vishnuçarman took up his occupation as tutor to the princes. But he evidently knew human nature better than some of the academic men of today; for instead of delivering a

series of scholarly lectures on political science and diplomacy, which would have aroused in the minds of the young ne'er-do-wells nothing but boredom, he began to tell them—fables.

First of all, in the story of the Lion and the Bull, he introduced them to a forest court, presided over by a lion king. Everything about the situation imitates or caricatures in an amusing way the court of a real human king. And this at once gives an opportunity for bringing out, in allegorical fashion, the right and the wrong way to manage the affairs of government. The dramatic action in this long fable, which is the frame of the first book of the Pañcatantra, centers about the machinations of one of the lion-king's ministers, a jackal named Damanaka (the Dimnah of the Arabic versions). This personage is the real hero of the book. He typifies the perfection of Machiavellian strategy. He first manages to arrange an alliance between the lion-king and a bull who had strayed into the forest. And then, because he finds himself neglected by the lion in favor of the bull, he proceeds by treachery and deceit to set them against each other. Damanaka's efforts are entirely successful. The immoral moral obviously is: Go thou and do likewise.

Into various points in this tale there are inserted many other fables and stories, all illustrating some diplomatic lesson and all supposed to be told by one of the characters in the major story to another. In the same way these minor stories frequently have still other stories imbedded in them, and so on, until you sometimes get a Chinese-box effect of story after story, enclosed within another. In this way, although there were only five principal tales told by Vishnuçarman, one for each book of the Pañcatantra, the work comes to contain a considerable number of fables. The later versions and translations also added stories here and there; the work grew like a rolling snowball.

Generally speaking, all of the fables originally contained in this work were such as tended to inculcate Machiavellian lessons. It is the clever tricksters who come out on top. The heroes may also be in the right, morally, but virtue is seldom one of their

prominent characteristics, and at least it is always due to shrewdness, not to virtue, that they succeed. The purpose of the book as we have it is evidently a very practical one—as the introductory tale of Vishnuçarman and the king's sons indicates. Of course we need not suppose that this tale is historic. There is, on the contrary, every reason to believe that it is a pure invention of the author. But it emphasizes the evident purpose of the author. He was not compiling a book of mere entertaining anecdotes. He distinctly claims that his stories have an extremely practical value—in fact, that they contain the very cream and essence of the *artha-çâstras*, of the science or art of worldly success. They teach you how to get along in the world, he says. And they do this by taking advantage of that universal human love of stories, which has led moralists the world over to do the same thing—to preach indirectly, through apologue and anecdote, or more ambitiously through longer novels.

The greatest novelist perhaps of all time—Leo Tolstoi—came in his later years, as you know, to believe that all art, including literary art, is in itself idle folly. In a passage of his posthumous works he speaks of the great fictional creations of his youth as "those wretched, vain, stupid, tales with which I once upon a time amused myself and others." For a time, after Tolstoi arrived at these views, he refused to write fiction at all, and published only essays expounding his opinions. But he soon yielded to popular taste, and in the last years of his life framed his messages mostly in the only form which makes any message appeal to the great mass of mankind—the form of stories. In the long run people get tired of anything practical. What would be entertaining as just a game becomes a bore if we are told that it will edify us or improve our minds or morals. Tolstoi recognized this, and made the necessary concession. His later works differ from his earlier stories only in that they professedly aim to teach moral lessons, while his earlier work is "art for art's sake."

Of course many other people, the world over, have recognized

that fiction, and especially fables, may thus be made practically useful. You remember Dr. Johnson's famous verse:

> "Fables, in sooth, are not what they appear;
> Our moralists are mice and such small deer;
> We yawn at sermons, but we gladly turn
> To moral tales, and so, amused, we learn."

And the "morals," which we find customarily attached at the end of our fables, suggest, or emphasize, this practical application of them.

At any rate, this view of fables and stories as a means of conveying instruction is so far from being limited to the author of the Pañcatantra that it is the regular—I may fairly say the universal—Hindu view, at least in theory. All Hindu fable and story collections profess to be books of instruction in the science or art of conduct, of one sort or the other—either that which aims at *artha*, worldly advantage, or that which aims at *dharma*, moral duty. In theory the Hindus seem never to have recognized that such books had a right to exist for their own sake, simply as stories. This did not, of course, prevent the Hindus from getting plenty of very evident enjoyment out of a good story. Nor, on the other hand, does it mean that they agreed with Tolstoi in refusing to honor art for art's sake. They have plenty of art for art's sake—more than a plenty, in fact—in some departments of their literature. But as to their fable and story collections, Tolstoi himself could not go farther than they do, theoretically at least, in devotion to practical ends, although of course Tolstoi would have strongly disapproved of their choice of ends at times.

Whether in spite of this practical purpose or because of it, at any rate the Pañcatantra is a storehouse of capital fables. Most of them are dramatically constructed, skilfully told, and full of a genuine wit and of a kind of plain, homespun philosophy of life which reveals the popular origin of the fables, even through the glaze of their literary form. The book's enormous popularity is easy to account for. And few literary works in

the history of the world have been more extensively translated, copied and imitated. In India itself the Pañcatantra has been a prime favorite with all classes of the population. It has been copied and recopied, abridged, expanded, put into verse, and retold in prose, time and again. It is found—frequently in a number of different versions—in almost all the modern Indian vernaculars which have any literature at all. Some of these "modern" versions go back to comparatively ancient times. Above all, however, the Pañcatantra, as I said, has passed indirectly into most of the languages of Europe, and so has greatly influenced European fable literature since about the twelfth century of our era.

I can only very briefly illustrate the devious paths which the Pañcatantra followed on this long journey.

All the European versions before the nineteenth century go back ultimately to a single translation, made from the Sanskrit into a Persian dialect, by a Persian physician named Burzôe. According to Burzôe's own statement, he did the work at the command of king Chosrau Anôsharwân, whose dates are given as 531 to 579 A. D. Unhappily, Burzôe's Persian text is not known to be in existence now. But from it were made two further translations, which are preserved. One is in Old Syriac, made by a certain Bud, in the same (sixth) century, perhaps in Burzôe's own lifetime. The other is in Arabic, and dates from two centuries later.

The Old Syriac version has left no known descendants, and we possess it only in fragmentary form. All the later European versions, and most of the Asiatic versions outside of India, are descendants of the Arabic, which is itself known in numerous manuscripts and printed texts. It was composed by one Abdallah Ibn al Moqaffa, in the eighth century A. D. It was called, perhaps following its Persian original, Kalîlah and Dimnah. These are the names of the two jackals, called in Sanskrit Karataka, and Damanaka, who appear in the frame-story of the first book.

Within two or three centuries the Arabic Kalîlah and Dimnah

was translated or adapted at least seven or eight times, into various languages. For Europeans its most important renderings are:

(1) The Greek, by Symeon Seth, a Jewish physician of the eleventh century. It is entitled Στεφανίτης καὶ Ἰχνηλάτης. It was early translated into Latin, Italian and German. But it is especially important because through it the Indian fables were introduced to the Slavic world. The medieval Slavs drew most of the little culture they possessed from the Byzantine Greeks, and Symeon's version of Kalîlah and Dimnah was soon rendered into a number of Slavic dialects, including Old Bulgarian, Bohemian and Serbo-Croatian. These versions, or some of them, seem to have become very popular with the Slavs.

(2) The Hebrew, by a certain Rabbi Joel, who wrote in the twelfth century. We still possess a single incomplete manuscript of this work, which has been edited and printed. But is is known best through its descendants. Chief of them is a Latin rendering called by the double title "Liber Kelilae et Dimnae—Directorium Vitae Humanae." This version was made from Joel's Hebrew by a Jew who lived at Capua, in Southern Italy, in the thirteenth century. What his original name was I do not know, and have not been able to find whether anyone knows. He became converted to Christianity, and thereupon adopted the Christian name of John, whence he is known as John of Capua. Though he is described by his modern French editor as a "mediocre Hebraist and a detestable Latinist," his literary deficiencies did not spoil the genius of the work. It was soon translated several times into the vernacular languages; into German and Spanish in the fifteenth century, and in the sixteenth into Italian. The Italian version, by one Doni, is of especial interest to us, because from it was translated the oldest English descendant of the Pañcatantra. It was done by Sir Thomas North, of Peterhouse, Cambridge, and was first published at London in 1570, under the title, "The Morall Philosophie of Doni." It was popular enough to go through a second edition in 1601, and it has recently been reprinted under

the editorship of Joseph Jacobs (London, 1888). This, you see, is a descendant of the Sanskrit Pañcatantra in the sixth generation, by way of successive translations into Persian, Arabic, Hebrew, Latin and Italian. Of course the good Sir Thomas North, who doubtless never even heard of the Sanskrit language, would have been immensely surprised if he had been told the history of the book he worked over.

Time will hardly permit me to go much farther into the really romantic history of this fable collection. All that I have done is to trace one of the many lines in which it descended into medieval and modern literature. You must multiply this in your imaginations a good many times. It spread in the same way in many directions, and reproduced itself with super-Malthusian rapidity. Thus, by the year 1644 there was published in Paris a book called "The Book of Lights or the Conduct of Kings" (*Livre des lumières ou la conduite des Roys*). It was a translation from a famous Persian book, the Anwâri Suhailî, but though the French translator did not know it, this Persian work was only a remodeled form of an older Persian translation of the Arabic Kalîlah and Dimnah, itself a translation from the still older Persian of Burzôe, which was a translation of the Sanskrit Pañcatantra. I might add that this French work was itself put into English in 1679, so that, a century after Sir Thomas North, English literature was enriched by still another sixth-generation descendant of the Pañcatantra—though apparently no one suspected, until very recent times, that these two books were sixth cousins!

Before closing I must take you back to India again for a few moments. Though I cannot, of course, pretend in the time at my disposal to give you anything like an account of Hindu fables as a whole, still less of Hindu fables and stories, yet I must not fail to speak of one other department of Hindu beast-fable literature, which for various reasons deserves more attention than I have time to give to it now. I mean the Buddhistic fables, the oldest collection of which is called the Jâtakas or "Birth-Stories."

The spirit of Buddhistic fables generally is markedly different from that of the Pañcatantra. The aim is still practical—more practical than ever, if possible. The fables are supposed to teach lessons of conduct. But this time it is no longer *artha*—Machiavellian intrigue, or diplomatic cleverness, leading to worldly success. Instead it is the other phase of conduct—*dharma*—moral and religious duty, aiming at righteousness, moral perfection and religious salvation. The Buddhists then try to teach morality by the use of the very same and similar fables which in the Pañcatantra are used to teach trickery and intrigue.

Dramatically, the construction of the Jâtakas or "Birth-Stories" is as follows: Some moral problem comes up in the community of Buddhist monks, and is referred to the Blessed One (the Buddha) for solution. The Buddha solves the problem and adds: "This is not the first time that these same people have become involved in the same problem. Once in a former existence . . . ." and then follows the story, in which the characters, both animal and human, are previous incarnations of Buddha and his contemporaries. Because they deal with previous "births" they are called "birth-stories." They always contain two stories, which are more or less allegorically parallel to each other, as I have just outlined—a "Story of the Present," in which is imbedded a "Story of the Past." The Buddha is always the hero of both—if only to this extent, that he offers the solution of the difficulty or points out the moral lesson.

Some scholars hold that these Buddhist fables contain the original forms of the Hindu beast fables as a whole. You will find statements to this effect, especially in books written by specialists in the literature of Buddhism. In my opinion, and I think in the opinion of most present-day scholars, exactly the reverse is the case. The main reliance of the upholders of the theory of Buddhistic origin is the argument from relative dates. Buddhist fables can be proved to have existed in the third century B. C. The earliest certain dates in non-Buddhistic

Indian fables appear to be a few centuries later. But—first, the difference in dates is neither very great nor very certain; and secondly, I have shown earlier in this lecture how impossible it is to argue about the age of a fable on the basis of the date of its literary occurrence.

The fact is that the very use to which fables are put in the Buddhist books is evidently unoriginal, as it seems to me. And it frequently compels more or less alteration in the form of the stories—generally to their disadvantage as stories, however much it may improve their moral character. The fables as a whole—as all of you know, for they are just the sort of fables that we all know from our childhood[1]—are admirably adapted for teaching cleverness; they are not, for the most part, so well adapted for teaching morality. In the Jâtakas and other Buddhist fable books they have to undergo a sort of moral transformation, with results that are sometimes ludicrous; or else they betray their origin directly by clever but shockingly immoral incidents which the pious Buddhists omitted to expurgate. In short, the Buddhist Jâtakas and Buddhist fables as a whole fall into two classes, generally speaking: those which are dramatically good but in which the moral lesson is hard to discover, and those in which the moral is satisfactory but the story has been spoiled.

To me this seems to indicate that most of the fables cannot originally belong to the atmosphere in which we find them among the Buddhists. They are much better adapted to the atmosphere of the Pañcatantra. They have a philosophy of conduct, indeed. They teach how to live, in a sense. But their teachings are, in general, diametrically opposed to the gentle humanity and loving kindness of the Buddhist morality. If you will try to imagine Jesus illustrating the Sermon on the Mount by stories like the Wolf and the Crane or the Ass in the Lion's Skin, you will get a fair idea of the appropriateness of the beast fables generally to the moral doctrine of the Buddha, which they

[1] Compare also Professor Kent's lecture on Folk Tales of India, in this volume, in which a number of good typical examples of Hindu fables are narrated.

are supposed to illustrate and teach. The golden rule of the Indian fables is that naughty perversion which we all remember from youthful days:

"Do unto the other fellow as he would do to you, and do it first."

THE ORIGIN OF THE GREEK ALPHABET

By William N. Bates
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One of the interesting questions with which the student of Greek epigraphy has to do is that concerned with the source of the Greek alphabet. This, it might be supposed, would not be a very difficult one to settle, but as a matter of fact many phases of it are still open to debate, although, as I shall try to show, in its general outlines the problem is capable of solution. During the last twenty years much has been published in this field. I have myself, either directly or indirectly, examined at least a score of books and articles, and it is possible that others may have escaped my attention. These are good evidence for the general interest in the subject, and I shall try to set forth what has been gained as a result of this study. I need hardly remind you that the problem of the origin of the Greek alphabet is equally the problem of the origin of our own. Our alphabet came from the Latin, which came from the Greek, each in its turn undergoing such slight modifications as were required to adapt it to the new language. This part of the story is perfectly well known; it is the earlier part with which we are now concerned.

When Herodotus in the fifth book of his history tells the story of the assassination of the tyrant Hipparchus, at Athens, he says that Harmodius and Aristogeiton, the murderers, were of the race of the Gephuraeans. These, he says, were connected with the Phoenicians, who settled in Boeotia with Cadmus. This leads him on to say that these Phoenicians introduced into Greece schools and the letters of the alphabet, and he adds that the Ionic Greeks took this alphabet and made changes in it. This view that the Greek alphabet came from the Phoenicians

was generally held in antiquity, although there was some difference of opinion as to who actually introduced it. Thus, in a scholium to the *Orestes* of Euripides 432, Palamedes is assigned this honor; and elsewhere (Plutarch, Συμποσιακῶν προβλημάτων, IX, 3, 2) he is said to have invented Z, Θ, Φ, and X. Other names mentioned by the ancients in this connection are Prometheus, Orpheus, Musaeus, Linus and Danaus; while others still are said to have invented certain letters, *e. g.*, that Epicharmus invented Ξ and Ψ, and Simonides of Ceos H and Ω. In the case of the last two writers the truth may be that they were the first in their own localities to use the characters associated with their names. For both H and Ω, and Ξ and Ψ are known to have been in use by the Greeks long before the time of Epicharmus and Simonides (*i. e.*, sixth to fifth century B. C.). But one fact stands out that the Greek writers generally regarded their own alphabet as a development from the Phoenician.

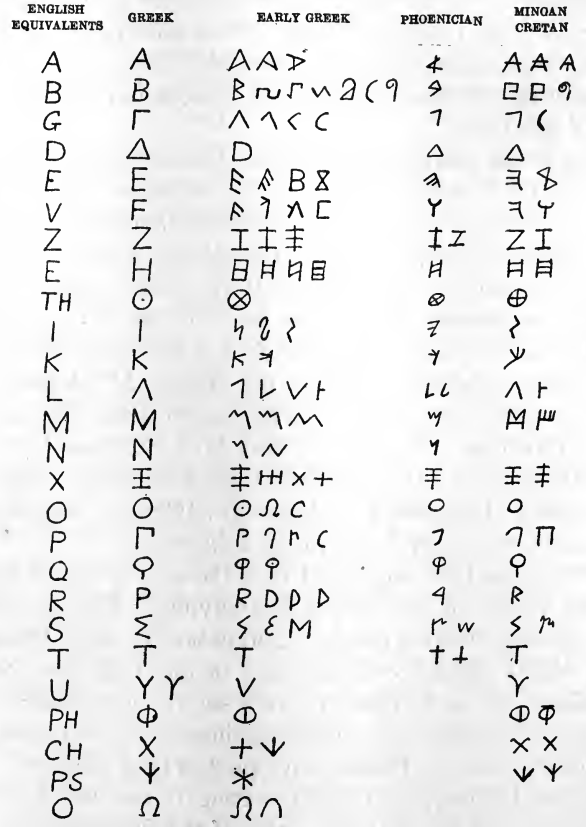
This traditional view has been accepted in modern times largely because the Greek tradition seemed to be supported both by the names of the Phoenician letters, and by the forms found in early Phoenician inscriptions. *Aleph*, *beth*, *gimel*, *daleth* sounded very much like *alpha*, *beta*, *gamma*, *delta*. And so with the other letters much was made of the resemblances, while the differences were explained away or overlooked. In other words, the resemblances were regarded as so strong that they outweighed what appeared to be differences. The question of the supplementary letters, as they are called, *i. e.*, of Υ, Φ, X, Ψ, and Ω was bothersome, but it was believed that the Greeks invented them as they needed them, and many and ingenious were the devices resorted to to explain how these forms came into being. In fact, I could give you a score of theories on this subject. As time went on this difficulty seemed to increase, and it began to be realized that there were peculiar forms in use in some of the Greek alphabets which could not easily be traced back to Phoenician letters, such as the *epsilon* of Sicyon, the *epsilon* of Megara, the *beta* of Delos, Naxos, and Ceos, the *beta* of Melos, etc. Even in the case of the curious

Corinthian *beta* and the Argive *lambda* it required a little imagination to connect them with Phoenician prototypes. Confidence, therefore, in the infallibility of the theory of a Phoenician origin for the alphabet began to be shaken, and the possibility that some other element had entered into it to be considered.

But another question began to demand more attention, namely, where the Phoenicians got their alphabet, for the old idea that they evolved it out of their own minds did not seem likely when it was realized that there were other systems of writing antedating the Phoenician. The first elaborate theory, and the one which still finds a place in our dictionaries, is that of De Rougé, first brought forward in 1859, and published by his son in 1874. It was warmly championed by Lenormant, to whom it largely owes its fame. De Rougé traced the alphabet back through the Phoenician and the hieratic Egyptian to the Egyptian hieroglyphic writing. His theory was sound in principle, *i. e.*, that the origin of a given type of writing should be sought in a pre-existing type, but if you will examine his tables carefully you will see that there is only one letter in the whole series for which the given pedigree is satisfactory. Nevertheless the theory held its own for many years, doubtless because there was no really good one to supplant it. It is needless to examine it in detail. It is enough to say that A he thought went back to a standing eagle, B to a standing crane, Γ to a throne, Δ to a hand, etc.

But there were other systems of early writing which might be supposed to have some bearing on this question, *e. g.*, the Babylonian. This is known to have been originally a picture writing, and it was thought by some scholars that the Phoenician alphabet might have been derived from this source. Such, for example, was the theory of Deecke (*Z. Morg. Ges.*, 1877, pp. 102 ff.), later developed by Peiser (*M. vorderas. Ges.*, 1900, pp. 43 ff.); also of Hommel (*Gesch. Bab. und Assyr.*, pp. 51 ff.), and to a certain extent of Delitsch. H. Grimme, too, argued (*Zeit. Assyr.*, 1907, pp. 49–58) that the Aramaeans might have evolved the alphabet from the Babylonian writing and passed

it on to the Phoenicians. The difficulty with this theory is that, as far as the forms are concerned, it is based on conjecture and lacks positive proof; and a jump of something like two thousand



THE DEVELOPMENT OF THE ALPHABET.

years must be made back to the Babylonian pictographs. Its advocates, too, in relying upon the Semitic names of the letters for its support get into difficulties. Thus Delitsch (*Entstehung des ältesten Schriftsystems*, pp. 228 ff.) thinks that the names

of about half of the Phoenician letters correspond with those of objects included in what he regards as the 45 or 50 original Babylonian signs, and H. Zimmern (*Z. Morg. Ges.*, L, pp. 667 ff.) tries to identify eleven letters with characters in the Babylonian signary, although they do not follow the same order. But even granting that half of the names are Babylonian, that is far from proving a Babylonian origin for the Phoenician alphabet. But more of this later.

Again it has been argued that the Phoenician alphabet came from a south Semitic source, but the evidence is all the other way. If, for example, there is a connection between the Minaean or the Sabaean alphabet and the Phoenician, it is the Phoenician which influenced the Sabaean, not the reverse. Thus, the oldest Sabaean inscriptions do not go back of 800 B. C. (they are probably not so early), and although it has been claimed that the Minaean alphabet is earlier (O. Weber, *M. vorderas. Ges.*, 1901, pp. 1–60), the evidence of the inscriptions does not point in that direction. I may add that M. Lidzbarski (*Eph. Sem. Ep.*, 1908, pp. 345–78) argues for a Cretan origin for these alphabets, while F. Pretorius (*Z. Morg. Ges.*, 1909, pp. 189–98), looks to a primitive form of the Cypriote syllabary.

Again, it has been suggested that the source of the alphabet must be sought in the Hittite hieroglyphs. This is von Luschan's theory. But a careful examination of the Hittite characters will, I think, convince most people that the points of resemblance are far too few to permit such an attribution.

All these theories sink into insignificance as compared with those which trace the Phoenician alphabet back to Crete. Even before the discovery of Cretan writing it was felt by certain scholars (*e. g.*, Peile) that the source of the Phoenician alphabet must be sought in some undiscovered type of writing. The inscribed tablets found by Sir Arthur Evans at Cnossus gave what was wanted, and most of the investigations into the history of the alphabet since that time fall into two general classes: (1) those which attempt to trace the ancestors of the Phoenician letters and the steps by which they came from Crete, and (2)

attempts to explain the Semitic element in the alphabet. And naturally there is an abundant opportunity for a difference of opinion in both cases.

Let me for a moment recall the character of the writing of Minoan Crete. We have it extending over a period of more than 1200 years beginning at the very end of the period known as Early Minoan III, or about 2500 B. C. to the downfall of the Minoan power in Crete about 1300 B. C. During this long stretch of years we find a primitive picture writing developed into a conventionalized pictographic script, and we find developed out of this two types of linear script: Class A, in which a small number of the tablets found at Cnossus were written, as well as others found at Hagia Triada, Palaikastro, Zakro, etc.; and Class B, to which the great majority of the tablets from Cnossus belong. Quite a different type of writing appears on the terra-cotta disk found at Phaestus in the southern part of the island. The characters, however, have no connection with either the Cretan pictographs or the linear script, and it is the unanimous opinion of those who have examined it that it came to Phaestus from somewhere outside of Crete, perhaps from Lycia. It, therefore, demands no further attention here.

Of the pictographic characters there are about 135 all told. They appear in a more primitive form on seals, where their pictographic character is marked. They represent, as in other systems of pictographic writing, parts of the human body, arms and implements, cult objects, houses, ships, animals, insects, plants, etc. Of these signs, as Evans points out, fifty-two are found both on seals and, in a linearized form, on clay documents. A peculiar feature of this writing is that in the earliest specimens the figures appear in a more linearized form, while in the Middle Minoan period there is a return to the original pictographs. Evans thinks that this may be due to Egyptian influence, and this conjecture seems to be a very reasonable one, for ten or eleven of the pictographic signs appear to have been borrowed from Egypt. They are, however, never absolutely identical, and the Cretan hieroglyphs, as a whole, are quite independent

and have a history of their own. So, too, three or four of the signs are similar to Hittite hieroglyphs, but this can hardly point to any strong Hittite influence on early Cretan writing.

Out of this pictographic writing, then, as I have already said, there developed two types of linear writing, in which the old pictures gave way to characters which apparently stood for syllables, or possibly in some cases even for letters. The documents of Class B, which you remember are much more numerous than those of Class A, show this linear writing in its most advanced form. Evans says of it that the characters "have a European aspect. They are of upright habit and of simple and definite outline, which throws into sharp relief the cumbrous and obscure cuneiform system of Babylonia," and I think that everybody who examines them will be impressed in the same way. This type has so far been found at Cnossus only. It is a more advanced script than Class A, but did not develop out of it. This is proved by the fact that several signs found in both classes appear in a more primitive form in Class B than in Class A, and by the appearance in Class B of a number of signs not found in Class A. At Cnossus the tablets of Class A seem to date from the period designated as Middle Minoan III (1800–1600 B. C.), while those of Class B date chiefly from Late Minoan II (1500–1400? B. C.). At the time when Class B was the only form of writing in use at Cnossus, Class A was still used in other parts of Crete. The two were, therefore, to a certain extent contemporaneous, though not in the same locality. In this linear script, it may be added, the writing ran from left to right, in distinction from the pictographic, where it ran either way; and, if there was more than one line, it was arranged *boustrophedon*, that is, running alternately from right to left and from left to right.

Now, if we compare the characters of the Phoenician alphabet as they appear on the Moabite stone with the Cretan linear script we shall find that there is a close resemblance in seventeen out of the twenty-two letters. Of the five dissimilar forms *beth* is not very far removed; and as it appears in a south

Semitic form, it looks much like a Cretan character; *lamed* may be paralleled if we include the Cretan pictographs, and *mem* and *pe* are not far removed from Minoan forms. That leaves one letter *nun* for which there appears to be no counterpart in Crete. Now what is true of the Phoenician alphabet is also true of the early Greek alphabet with the addition of parallels for Υ, Φ, X and Ψ. That is, there seem to be no satisfactory prototypes for N and Ω; nor is there for B in its usual form. There is, however, the character which I mentioned a few moments ago, which also resembles the form of *beta* in use at Corinth. We see, therefore, that the written characters of Minoan Crete give us what had long been wanted another possible source for the Greek alphabet.

Perhaps I should mention here the fact that because some of the letters resemble Cretan pictographs, certain writers have thought that they could point out a pictographic original for every letter in the alphabet. H. Schneider, for example, does this in his recent book, *Der kretische Ursprung des phoenikischen Alphabets* (Leipzig, 1913); but it is hardly necessary to point out that though some of his conclusions may be right, others appear to be rather far-fetched, and, in the light of our present knowledge, not justified.

Now, as you know, the phonetic values of the Cretan characters are as yet undetermined. If they were known we should probably be able to say at once whether a given letter of the Greek alphabet went back to a certain Cretan prototype or not; and when the values are made out there will doubtless be some changes in the genealogies which are at the present moment acceptable to many scholars. But phonetic values do not count for everything, and examples in various early Greek alphabets abundantly prove that a given form may have a very different phonetic value in a different locality, or at a different time. Thus, in some of the earliest inscriptions of Thera we find the word Zeus spelled with a character, which in all the other Greek alphabets stands for *xi*, not *zeta;* but nobody imagines that it was pronounced as a *xi* at Thera, and, in fact, this letter, (*i. e.*,

xi), as a separate character, was not used on that island at all before the adoption of the Ionic alphabet. It has recently been suggested that the character represented a double *s* in these early Theran inscriptions, but there is no evidence for such an assumption. Again, there is the character shaped like a new moon, which has the value of *beta* in the alphabets of Delos, Naxos and Ceos; of *gamma* in Laconia; of *omicron* in Melos; of *pi* in Crete, and of *sigma* generally throughout Greece in late Greek times. And various other examples might be given.

But if the contention that the Phoenicians got their alphabet from Crete is true, what can we say of the names by which they called their letters? Eleven of the twenty-two are good Semitic names which, as I have already said, may be traced back to Babylonia. These are, *aleph* = ox, *beth* = house, *daleth* = door, *yod* = hand (*i. e.*, side), *kaph* = open hand, *mem* = water, *nun* = fish, *ayin* = eye, *pe* = mouth, *resh* = head, and *shin* = tooth. It should be remembered, however, that the resemblance is in name, not in the form of the character. Furthermore, in the Babylonian syllabary, which consists of some 400 characters or more, the forms to which these names were given have a very different order from that which they have in the Phoenician alphabet. This, however, is not necessarily fatal to the theory of a Babylonian origin. Something more is needed. In addition to these eleven names *vau*, *cheth* and *tau* are said to be found as words in other Semitic languages. That leaves *gimel*, *he*, *zayin*, *teth*, *lamed*, *samek*, *tsade* and *koph* unaccounted for. It used to be supposed that *gimel* was connected with *gamal* or *gamalu*, meaning camel, but this etymology is now declared by Semitic scholars to be impossible. With eight of the Phoenician letters bearing names which are not Semitic, we naturally think again of Crete as a possible source for these names. We might imagine, for example, that the Phoenicians gave to some of the letters of their alphabet names which had a meaning in their language and which had been used previously to designate written Babylonian characters; and to others, names which were Cretan, pronounced as they sounded to Phoenician ears.

Even the familiar names may have been suggested by foreign sounds. But this is mere conjecture, and the names must remain a problem to which no definite answer can be made until we know what the Cretans called their characters.

If, then, the Phoenicians got their alphabet from Crete, we may ask how they got it, *i. e.*, by what steps was it carried to Phoenicia. The most natural way would be through the Cretan settlements on the coast of Syria, for it has been proved that in early times the Minoan Cretans had colonies in Syria and in parts of Asia Minor (*e. g.*, at Miletus, Erythrae (Paus, IX, 27, 8), and again in Lycia); that, in fact, the Philistines were Cretans, and their conquest of southern Canaan in the thirteenth century B. C. (*i. e.*, before Rameses III) must have brought Minoan writing into Syria.

That these colonists came by way of Cyprus seems also very probable; and, what is more, the people of Cyprus had from very early times an indigenous form of writing which is entirely different from that of the Greeks, but manifestly closely related to Minoan Crete. The earliest form of the Cypriote syllabary appears on three clay balls and an engraved ring found at Enkomi in Cyprus. Evans[1] would date the graves in which they were found in the fourteenth or first half of the thirteenth century B. C. All of the fifteen signs on these objects are also found in the writing of Minoan Crete, while ten of them appear in close parallels in the later Cypriote syllabary. In fact, there can be little doubt that the Cypriote syllabary, which continued to be employed in the island down to the third century B. C., was derived directly from the Minoan linear script. Thus, with the existence of Minoan writing firmly established in Cyprus at an early date, its transference to the mainland would follow as a matter of course.

I do not know how familiar you may be with the Cypriote syllabary; but for the sake of clearness I may say that it consists of fifty-five characters, most of which stand for syllables, *i. e.*, one character stands for the syllable *pa*, another for *pe*,

[1] *Scripta Minoa*, I, p. 70, to which work frequent reference is made in this paper.

another for *pi*, another for *po*, and another for *pu*, and so on with other combinations. Although used for Greek, it was not well adapted to it, as may be seen by an examination of the bronze tablet from Idalium, usually quoted in the books. This dates from the year 386–85 B. C. It begins thus in Greek, ὅτε τὰ(ν) πτόλιν Ἰδάλιον, but in the Cypriote characters *o-te ta po-to-li-ne e-ta-li-o-ne*, etc. It is needless to say any more of it, but the fact that it continued so long in use is good evidence for the conservatism of the inhabitants of the island.

Recently J. Sundwall (*Jb. Arch. I.*, 1915, pp. 41–64) has shown that thirty-three of the Cypriote characters have close parallels in the Minoan linear script; but we do not know that the characters had the same value in Cypriote Greek and in Minoan Cretan writing. During the past year a bilingual inscription from Cyprus has been published, both parts of which are written in the Cypriote syllabary. The Greek part can be read, but the second language is unknown. It may be the language of the Minoans. At least we seem to have here what may prove to be the key to the decipherment of the Minoan linear script.

Assuming, then, that the Phoenicians derived their alphabet from Crete, we must next determine whether the old tradition that the Greeks learned their letters from the Phoenicians is true. Would they not rather have derived them from the same source as the Phoenicians, we may ask; *i. e.*, is it not likely that the relationship between the two is that of sisters or cousins, rather than of mother and daughter? Let us look at the evidence.

Outside of Crete the remains of Minoan writing are scanty. A certain number of characters were found on vases from Phylakopi in Melos, as was to be expected from the date of that site. On the island of Siphnos a pendant has been found with six or seven characters in what appears to have been a local variety of the Minoan script, which at the same time resembles Cypriote writing. On the mainland Tsountas found in a chamber tomb in the lower town at Mycenae an amphora with three characters

resembling those of Linear Script A; again in a house on the citadel at Mycenae the handle of a stone vessel was found with four or five characters upon it. The first resembles a character in Linear Script A, but the others appear to be pictographs and different from those found in Crete. At Tiryns some inscriptions in what appears to be a local variety of Minoan script have been found painted on vases. At Delphi a bronze hammer has two pictographs, not found in Crete, upon it. In the bee-hive tomb at Acharnae an amphora with a single Cretan character came to light. At Orchomenos Bulle found a vase with five painted characters which closely resemble the Cretan; and I myself picked up on the same site a Late Minoan potsherd with six or seven characters scratched on it which have a Minoan look. These are all the actual remains of Minoan writing so far discovered in Greece proper. They are not numerous, but are sufficient to prove that this type of writing, no doubt with local peculiarities, existed on the mainland. There is, however, no evidence to prove that it underwent any such development as would lead to the invention of the Greek alphabet, or that it continued to exist after the downfall of Mycenaean civilization in Greece. On the contrary, there is evidence to prove that the Mycenaean civilization on the mainland was overthrown before such a development took place.

Of course, the meager scraps of Minoan writing so far found in Greece proper are but a very small part of what once existed, and in fact we have what appear to be authentic records of the discovery of such writing in classical times. As Evans has pointed out, Plutarch, in the essay on the daimon of Socrates (chs. 5 and 7), tells the story of the opening of a bee-hive tomb by Agesilaus near Haliartus and the finding, among other things, of a bronze tablet which nobody could read, although the letters were perfectly clear. A copy of the inscription was sent to Egypt to the priest Chonouphis at Memphis, who, as Plutarch says, after "three days study, having collected all the different sorts of characters that could be found in the old books," declared that the writing dated from the time of King Proteus,

i. e., from the time of the Trojan war, and that it exhorted the Greeks to establish a contest in honor of the Muses. This, of course, means what we should expect, namely, that the priest could not read the inscription.

But what about Cadmus and his Phoenicians? Did they really introduce writing into Greece? It is very hard to get to the bottom of that story. If the Phoenicians settled at Thebes or elsewhere in Boeotia we should certainly expect to find some traces of that settlement; but not a scrap of anything that can be called Phoenician has come to light in that region. On the other hand, remains of the Minoan civilization have been found in various places, and the very name of Minyan given to the people of Boeotia by Homer has long been claimed to be connected with the word Minos. And here let me call your attention to a theory of Sir Arthur Evans. He points out that the word Phoenician in Greek means "red man," and that the men on the frescoes of Cnossus are all represented as copper-colored, *i. e.*, not unlike our Indians in complexion. He argues, therefore, that the real Phoenicians were the Minoan Cretans, and that the name became transferred to the Semitic people whom we know as Phoenicians some time after the downfall of Minoan Crete. The theory is ingenious, and may, perhaps, be correct. Such a transference of name may be paralleled by that of the Keftiuans on Egyptian monuments. In Ptolemaic times this name was applied to the Phoenicians; but in the eighteenth dynasty to some other race, presumably to the Minoan Cretans; but whether Keftiu and Crete are one and the same place is still a matter of dispute. However this may be, even if we grant that Cadmus was a Cretan, the story by itself is not sufficient evidence to prove that the Greeks got their alphabet directly from Crete. And yet there are certain facts of which we must not lose sight. We have seen that forms corresponding to the so-called supplementary characters of the Greek alphabet, Υ, Φ, Χ, Ψ and Ω are not found in the Phoenician alphabet, while prototypes for four of them are found in Minoan writing. Furthermore, certain characters appear in some of the local alpha-

bets of Greece in a more archaic form than they appear in Phoenician, *e. g.*, the Boeotian form of *eta;* and still others are quite different. Here, then, one might conclude that there was a direct influence exerted by the Minoan script, and, perhaps, to that extent Evans is right. I may say, however, that he is not alone in his belief of a direct derivation of the Greek alphabet from Crete. Others hold that view, and Dussaud (*Journal Asiatique*, 1905, pp. 357–361) even goes so far as to declare that the Phoenicians got their alphabet from the Greeks, and that the oldest Greek inscriptions are older than the oldest Phoenician inscriptions. In this, however, he will certainly not receive support from any Greek epigraphist; and even the theory of a direct Cretan derivation must still be regarded as unproved.

Evidence for the source of the Greek alphabet has also been sought through its date; *e. g.*, Hogarth (*Ionia and the East*, p. 94) argues that the Phoenicians had no well-developed system of writing before the Ionic migration to Asia Minor, and on the basis of this argues that the Greeks got their alphabet from the Phrygians. In that case the Phoenician and Greek alphabets would have developed side by side. The absence of authentic information about the early Phrygian alphabet makes it impossible to test the correctness of such a theory.

There is, however, some evidence as to the time when the Greeks acquired their alphabet. Larfeld, for example, in the last edition of his work on Greek epigraphy, published in 1914 (pp. 208 f.), points out that the Peloponnesian colonists who settled in Cyprus did not know the Greek alphabet, and that this settlement was made before the Dorian invasion of Greece which Eduard Meyer dates at the end of the twelfth century B. C.; that is to say, the Greeks did not have their alphabet at the end of the twelfth century. On the other hand, the Greeks who settled the west coast of Asia Minor about 1000 B. C. brought the alphabet with them. He argues, therefore, that the Phoenician alphabet became known to the Greeks in the eleventh century.

Other evidence for the origin of the Greek alphabet has been found in the order of the letters, *e. g.*, H. Bauer, in a paper in *Zeitschrift der deutschen Morgenländischen Gesellschaft* (1913, pp. 501–02), argues that a primitive people would arrange the letters in an order which occurred in common words, and that traces of mnemonic words are evidence for the race of the inventors. The Phoenician alphabet, he says, begins with two words, *ab* and *gad*, *i. e.*, *aleph*, *beth* and *gimel*, *daleth*. Now *ab* means father in Canaanite and *gad* means grandfather. The Canaanites, therefore, invented the alphabet! This reminds one of the method by which the wise king Psammetichus found out that Phrygian was the original language, as is duly set forth in the second book of Herodotus. Such reasoning is, I am sorry to say, not unusual in discussions on the origin of the alphabet.

Here I might mention two other theories for the order of the letters, one because it is the most recent, and the other because it is a revival of a theory advocated long ago. I do not think that you are likely to be convinced by either of them. The first is Hermann Schneider's (1913). He argues that the first twelve characters have to do with the course of the sun, and the last ten with the Lower World; that they are, perhaps, symbolic of the life of a great hero or divinity, and that such a story would help fix their order. The other theory started by Lepsius in 1835 and now revived by Petrie is that the characters followed in groups of four, vowel, labial, guttural, and dental. This works very well for the first four letters, but after that there is trouble. To make this theory work it is necessary to resort to Procrustean methods and to imagine a hypothetical alphabet. That is what Petrie does, as you will see by a glance at his tables (*The Formation of the Alphabet.* London, 1912, pp. 17–18). I may say here incidentally that we do not know how the Greek letters (and this holds true also of the Phoenician letters) came to have their present order. I personally am inclined to think that it was their use as figures which settled the matter. It might be a matter of indifference whether one began with α, β, γ, or δ, λ, μ, or any other combination; but

one is forced to say *first, second, third.* In the Greek alphabet the letters were used for ordinal numerals as early as about 800 B. C., and I am inclined to think that if we knew more about Phoenician writing we should find something of the same sort there, too. Their use as figures would fix their order once and for all.

In my discussion so far I have omitted all reference to another possible element in the development of the alphabet, the value of which at the present time it is impossible to estimate with any degree of satisfaction. On the one hand we find it hailed as the one and only source of the alphabet, and on the other we find its influence wholly denied and the theory derided. Let me try to set it forth. From the very earliest times mankind in different parts of the world has indicated his possession of various objects by means of signs. Such signs made their appearance in Europe at a very early date, as early in fact as the Magdalenian epoch (late palaeolithic or reindeer period), and they continued to be used for ages; in fact, in certain parts of the world are in use today. The most remarkable series of these signs has been found on potsherds in Egypt. They begin in the Early Predynastic period and are found continuously through the Late Predynastic and Dynastic periods down to Roman times. In these signs we find exact parallels for every character in the Greek alphabet, including all the peculiar epichoric characters which have always been a puzzle to the epigraphist. In addition there are perhaps a score which do not resemble any Greek letters. They are all simple and clear cut and might well be models for the inventor of an alphabet, but nobody maintains that they ever had phonetic values. A man who owned a jar put a certain mark upon it to show that it was his; another man put a mark on his, and so on. The number of the signs was comparatively limited, but, as we have seen, they continued to be used for ages. Did these characters have any influence on the development of the alphabet? Those who argue for a European origin for the alphabet, *e. g.*, Wielsen (*Manus*, 1912, pp. 123–208), and von Lichtenberg (*ibid.*, pp.

295–305), naturally make much of this evidence; and above all Petrie in his *Formation of the Alphabet.* E. Naville, too (*S. Bibl. Arch.*, 1912, pp. 27–34), believes that the Phoenician alphabet was at first such a potsherd writing. But as yet we cannot give a decision. At the same time I think it quite possible that in the simplification of the forms of the letters these early signs may have had a part.

There are other theories which I might mention, *e. g.*, that of Stucken, who in recent book (*Der Ursprung des Alphabets*, 1913), sees in the letters of the Phoenician alphabet astronomical symbols; and that of Pilcher (*S. Bibl. Arch.*, 1905, pp. 65–68), who thinks them geometrical combinations of lines and angles, and that their order is due to an arrangement of similar letters in groups; but these call for no extended comment.

Well, you may ask, what have we gained by all the discussions of the last few years? So much, I think, we may regard as sure, that the Greek alphabet originated in Crete. Furthermore, in the light of our present evidence, it seems likely, though it is not yet proved that the Phoenicians simplified the characters which they got from Crete, and made the alphabet better known. And this accords with the words of Diodorus Siculus (V, 74, 1), that the Cretans invented the alphabet and that the Phoenicians merely changed the type of the letters and extended the knowledge of them.

ANDREAS VESALIUS AND HIS TIMES

By George A. Piersol
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In contrast to the youthful decades of bacteriology and experimental pathology, to which the world owes such revolutionary advances in our understanding of the nature and prevention of disease, anatomy claims recognition as one of the oldest divisions of medicine. Notwithstanding its feeble beginnings amidst the dim mists of a hoary antiquity, anatomy as a science, based on accurate observations on the human body, dates back to the labors of Andreas Vesalius, or less than four centuries.

Something of the life and accomplishment of the great Reformer of Anatomy is to be our topic this afternoon. In order to appreciate his services as the principal founder of anatomical science, it will be well to review briefly some of the events in the history of anatomy and to note, by way of background, the development which the preceding centuries had brought.

The fragmentary records concerning medicine left by the early civilizations present such a maze of confused speculation regarding the nature and cause of disease and are so largely devoted to methods of treatment, that the anatomist finds meager evidence indicating that the human body was the subject of study. Moreover, the natural repugnance to subjecting human remains to close examination was often fortified by superstitious tradition and religious belief.

Turning to Babylonia, with its wonderful civilization, we find, as is the case with all early peoples, the healing art in the hands of the priest-physicians, who looked on disease as the evidence of demons which were everywhere in the earth, the air and the water. Firm believers in astrology and omens, the

inspection of the viscera of animals and the recitation of incantations were the means by which the Babylonian priests fulfilled their double function as augurs of destiny and as protectors against the baneful presence of the offending spirits. The liver, particularly, was the organ claiming the inspection of the soothsayer, and to this circumstance are we indebted for one of the earliest known anatomical objects, namely, the terra-cotta model of a liver, found at Babylon, estimated to be over 3,000 years old. The model, which was identified by Professor Stieda as that of the liver of a sheep, was covered with inscriptions and certainly did not serve for anatomical purposes. Nor do the records of this people show an acquaintance with anatomy beyond the casual mention of various parts of the body.

Early Jewish medicine did little more, but later, in the Talmud, are to be found more definite anatomical data. The bones of the human skeleton are computed at 248, and among them was the bone of Luz, vaguely located somewhere between the base of the skull and the lower end of the spine. The special interest of the Luz lay in the Hebraic tradition, that it was "the indestructible nucleus, defying fire and blows, from which the body is to be raised at the Resurrection." The prescribed examination of animals killed for food gave opportunities for the recognition of pathological changes and the gleaning of anatomical facts; notwithstanding, there is no evidence to show that the ancient Hebrews possessed more than a fragmentary knowledge of anatomy. Their belief, that the vital spirit left the body only after the latter was completely decomposed, precluded human dissection.

Of all the ancient peoples the Hindus excelled in surgery, which, as practiced by them, included almost every important operative procedure. Their anatomy, however, was grotesque and consisted chiefly in the numeration of impossible and imaginary parts of the body. The number of the bones was 360; of the ligaments, 900—still more in women; of the veins, 700, some writers indeed placing the number of tubes passing from the heart at 72,000!

The procedures of embalming the dead naturally led to the assumption that the early Egyptians profited by their opportunities to gather a rich harvest of anatomical lore; that such was not the case is shown by existing records, which clearly indicate that the anatomy possessed by the Egyptian physicians was far more fragmentary and superficial than their possible opportunities warranted. That such ignorance should have prevailed need not excite surprise, when it is recalled that the opening of the body and, for the most part, its evisceration, were performed by ignorant persons of low station. The parachites, who with his knife of flint incised the body, was a social outcast, shunned, reviled and even stoned, as he who had mutilated the tabernacle of the soul. The despised calling was not from choice, but was passed from father to son, who, by accident of birth, was compelled to assume the hated duties without hope of escape.

That the early Egyptians had observed to some purpose is evidenced by a papyrus brought from Egypt by Professor Ebers. These anatomical memoranda, probably written sixteen centuries before the Christian era, make mention of the heart as the beginning of vessels to all parts of the body. The vessels from the heart are set at twelve, some containing blood, others mucus and still others air. "There are two vessels to the right ear, and the breath of life goes through them; there are two vessels to the left ear, and the breath of death goes through them," indicates the fanciful physiological conceptions of the unknown writer.

Interesting as are the early records of Greek medicine, with their theories and philosophies, interwoven of truth and fiction, the student in search of definite anatomical conceptions naturally turns to Hippocrates, the acknowledged Father of Medicine. From the writings of the period, however, there is little evidence that Hippocratic anatomy was based on more than the occasional observation on patients, the examination of animals and pure speculation—never on human dissection.

The succeeding century witnessed a marked advance in anat-

omy, due to the contributions of that ardent naturalist, Aristotle, who merits recognition as the founder of comparative anatomy. Prior to his writings accurate anatomical data did not exist, and, while his labors were directed chiefly to the elucidation of the structure of the lower animals, Aristotle paved the way for a far better understanding of the structure of man.

But it is to Alexandria that we turn with particular satisfaction, for here, within the quiet shades of its wonderful museum, the foundations of a real human anatomy first were laid. Part of the equipment of the museum, which included the famous library, an astronomical observatory, a chemical laboratory, a botanical and a zoölogical garden, was a room set apart for dissection. There, Herophilus and Erasistratus wrought the particular glory of the Alexandrian school, so far as anatomy is concerned, by zealously laboring to reveal the structure of man by actual observation. The generosity of their patrons in providing an adequate supply of bodies was extended, according to the statements of Galen, to the use of living condemned malefactors for vivisection. In the light of recent critical review, however, Galen's testimony is to be regarded as exaggerated and unfounded.

As the writings of neither Herophilus nor Erasistratus have been preserved, all that is now known of the anatomical accomplishment of these ancient investigators is to be gleaned from the occasional references of Galen and other writers. From these it is certain that Herophilus was esteemed as an illustrious physician, and for a long time was quoted as a foremost anatomical authority. He probably dissected more—men as well as monkeys—than any of his predecessors or contemporaries and contributed many important facts. The anatomy taught by Herophilus and Erasistratus, while profoundly impressed by often erroneous and fanciful physiological theories, had the merit of being based upon the findings on the human subject and showed, on the whole, a marked advance over preceding teachings. Opportunities for still farther promoting real anatomical learning did not long continue, for gradually the prac-

tice of human dissection fell into disrepute and was abandoned, and after two hundred years was unknown, subtile theories and discussions taking the place of information founded upon facts.

With the decline of the Alexandrian School, where for three centuries the torch of knowledge burned so brightly, came the rapid decadence of science until its extinguishment was completed by the Arabian conquest. Meanwhile, the temporary ascendency of Roman influence brought about the appropriation of much of the medical learning of the Greeks and the student, tracing the further development of anatomy, must turn to the writers of the Roman Empire. Not that he will find the virile anatomy of Herophilus and Erasistratus transplanted and thriving in new soil, for human dissection had been abandoned and, with rare exceptions, writers were content to transcribe descriptions without verification, or, at most, with supposed confirmation from the lower animals.

Passing over the succeeding three centuries, our attention is arrested by the conspicuous figure of one, who, of all the ancients, most merits the title of anatomist—Claudius Galenus. Born the 130th year of the Christian era, his writings have exerted the most profound influence that the history of medicine has recorded. Dedicated by his father to the healing art at the age of seventeen, Galen's studies carried him to the feet of the most renowned teachers of his day, including those of the Alexandrian School, from whom he gathered the nucleus of the vast store of medical erudition that distinguished his later years. The anatomical notations of Galen—and these are many—are of interest less as the personal contribution of this author, than as reflecting the status of this branch of medicine at that time, for it is conceded that Galen's writings embodied the results of all that was then regarded as most trustworthy. Although deeply influenced by the current physiological misconceptions, Galen offers the first comprehensive account of the structure of the human body; an account, which for over fourteen centuries, until the advent of Vesalius, was the inspiration of anatomists and, by most of them, was regarded as

infallible. With the death of Galen, at the ripe age of seventy, began the downfall of anatomy among the ancients, soon to be followed by its complete neglect, amidst the general decay of science, during the long years of ignorance and supersition under Saracen dominion.

But the embers of the science, that had burned so brightly at Alexandria, began to flicker and rekindle at Salernum, where, from the seventh to the fourteenth century the renown of its school of medicine attracted thousands of students. Here, where medical diplomas were first issued to student candidates, women also were professors and shared with men the duties of imparting instruction. The candidate was required to defend theses from Aristotle, Hippocrates and Galen and to take the sacred oath. "He then received a ring, a wreath of laurel and ivy, a book, the kiss of peace from his professors and the rank of Doctor in Philosophy and Medicine."

The importance of anatomy was once more recognized at Salernum, and for several centuries anatomical instruction was based on dissections. These dissections were not, however, of human bodies, but of the lower animals, as monkeys, bears and pigs, the latter being especial favorites since their organs were held to resemble most closely those of men. Such exercises were considered so important that Copho, a Salernian professor of the eleventh century, wrote a treatise, *Anatomia Porci*, devoted to the dissection of the pig.

The restoration of human dissection was soon to find a firmer footing, for in 1240 Frederick II, King of the Two Sicilies, and later Emperor of Germany, decreed that a human body should be dissected at Salernum at least once in five years, and, in his efforts to improve the preparation and status of those ministering to the afflicted, stipulated that the physicians, and especially the surgeons of the kingdom, should attend these dissections.

The next noteworthy event in the history of anatomy is the revival of human dissection at Bologna. In 1314 Mondino dei Luzzi inaugurated the first public demonstrations on the human cadaver for the instruction of medical students at this venerable

seat of learning. Where for centuries only pigs, monkeys and dogs had served, Mondino now substituted the body of a woman and laid the foundation of a science, which, quickened and expanded by the genius of Vesalius, was destined to become one of the glories of the Renaissance.

The methods of instruction followed by Mondino, and subsequently for generations, may not be without interest. The actual wielding of the knife being considered as incompatible with professorial dignity, the cutting and separation of the various organs were relegated to the lowly barber, who used a large scimiter-shaped knife and his hands. The professor sat upon a raised seat and expounded the text, while a demonstrator, staff in hand, indicated on the body the particular structures under consideration. In this manner, at third hand and at convenient long range, the professor proceeded to instruct his students concerning parts of the body, which he himself probably had never touched, much less closely examined, the questionable skill of the barber being responsible for their display.

In 1316 Mondino issued a treatise on anatomy, which remained in manuscript form for more than one hundred and sixty-five years, the first printed edition appearing in 1478. Originally it consisted of only twenty-two leaves and was without illustrations. After the introduction of wood engraving in the latter part of the fifteenth century, a few crude wood cuts were added, and the text expanded to forty pages. During the hundred years that the book, in its printed form, held sway, it passed through no less than twenty-five editions, and was the authorized anatomical text in all the Italian universities.

The auspicious revival of human dissection under Mondino did not long endure, and after his death, in 1326, such demonstrations occurred only after long and uncertain intervals. Permission to dissect the human body was granted only in rare instances, and the necessity for human dissection was not again recognized until the sixteenth century. By reason of such denial and the consequent lack of opportunity for critical study, the prolonged influence of Mondino is explained, for,

deprived of the stimulus of observing nature, generation after generation was content to accept without question the teachings set forth in the *Anathomia Mondini*.

And of what brand was the anatomy taught by Mondino? His book was largely a compilation from the writings of Galen, but so corrupted by Arabic misconceptions and nomenclature that, notwithstanding his vicarious participation in dissections, his descriptions were often so distorted as to mirror but imperfectly the Galenic text. Notwithstanding its many shortcomings and errors, Mondino's work contained much of value and continued to be the accepted text-book, upon which anatomists based their lectures and wrote commentaries. The considerations which induced Mondino to write were, as he tells us, "First, that one may help his friends; second, that he may exercise his best mental powers; third, that he may be saved from oblivion incident to old age." The last desideratum was signally achieved by Mondino's writings.

The half century preceding the great work of Vesalius, in 1543, added little to the real advancement of anatomy, for, although some important discoveries were made, anatomists generally were so dominated by Mondino's influence that they were content to follow, without verifying. This period, however, is of particular interest as bringing the first printed illustrations after the introduction of the art of wood engraving. These crude attempts to represent anatomical subjects were inspired, to a considerable extent, by manuscript sketches, which were based sometimes on nature, but more often on the anatomical descriptions given by the classical and Arabian writers, and were, therefore, largely traditional or imaginary. The earliest known printed anatomical illustrations are those of the *Fasciculus Medicinae* of Ketham, dating from 1491. These were soon followed by those of Helain, Grüniger, Peyligk, Hundt, Reisch, Schott and Phryesen. Some of these illustrations were in the form of loose sheets and were displayed in barber shops and bath houses. While most of these representations are crude and often caricatures of nature, those by Phryesen show a

marked improvement, especially in the sketches depicting the brain.

Meanwhile, some of the great artists of the period—Michelangelo, Raphael, Leonardo da Vinci and Dürer—were studying anatomy with startling results. Especially da Vinci deserves recognition as an anatomist, for the details of his seven hundred and more anatomical drawings, including sketches of almost every part and organ, testify to an accuracy to be gained only by dissection of the human body. Confirmation of such study, however, is supplied by Leonardo himself, when he assured Beatis, in 1510, that he had dissected not less than thirty human bodies, both male and female. Made primarily for his own benefit, da Vinci's drawings were not published, and therefore failed to serve the cause of science; had they become then known, the influence of Galenic anatomy would have ended a hundred years sooner.

The next anatomist claiming attention is Berengario da Carpi, who published, in 1521, extended commentaries on the text of Mondino and added twenty-one illustrations, supposedly based on dissections, but showing a marked dependence on preceding drawings and tradition. Notwithstanding the more than one hundred human bodies said to have passed under his tireless hand, his descriptions, by quill or pencil, fail to convince that this industry led to commendable results. Although Berengario's text was largely a compilation, based on Galenic and other sources, and his representations were full of inaccuracies, as his skeleton with thirteen ribs, nevertheless his illustrations marked a distinct advance over previous efforts.

Reviewing the preceding fragmentary sketch, two epochs stand out conspicuously. The first reached its zenith in the Alexandrian School, when Herophilus and Erasistratus introduced human dissection; then followed Galen, who, while probably never dissecting a human body, was able to collect and record all that then was regarded as most trustworthy. Succeeding this period of the classical writers, after the elapse of a thousand years, came the second epoch, inaugurated by the

revival of human dissection by Mondino; the efforts of subsequent anatomists slowly led to the status of anatomy represented by Berengario. Although advanced by the observations made, from time to time, on the structures of man, much then taught harked back to Galen. The potent spell of tradition and the disinclination to apply the test of direct examination had to be overcome before anatomy could become a real science. But the time was at hand when the scalpel of Vesalius was to strike off the shackles forged by the traditions of fourteen centuries; when facts, substantiated by independent study, were to be substituted for theories and disputations.

Andreas Vesalius was born at Brussels on December 31, 1514. The stars being consulted, gave favorable reply. Whatever advantage may be claimed for heredity was surely his, for his family was long identified with medical learning. His great-great-grandfather, Peter Wesalius—for such was the early spelling of the family name—wrote a treatise on some of the works of Avicenna and, at great cost, had copies made of all the then most useful medical works. Andreas' grandfather wrote commentaries on the Arabian Rhazes and on the *Aphorisms* of Hippocrates, as well as notable treatises on mathematics. The father of the anatomist was apothecary to Charles V, whom he accompanied on his journeys and military expeditions. In 1538 he presented Vesalius' first anatomical plates to the Emperor, and so, perhaps, paved the way for his son's later entrance at court. The mother of Vesalius exerted a strong influence upon the intellectual development of her son, in whose future she had an abiding faith, believing him destined for great things.

When a mere lad, Vesalius was drawn to anatomy and sought enlightenment from the available works. He soon discovered that the true road led, not to books, but to intimate contact with Nature; so we find him, while still a boy, dissecting mice, rats and moles, with an occasional dog or cat. Impelled by an overpowering desire to investigate, Vesalius determined to study medicine, and, with that end in view, went to Paris in 1533, when scarcely nineteen years of age.

At that time medical science was brilliantly taught in Paris by Jacobus Sylvius, Jean Fernel and Guinterius of Andernach. Sylvius, who by reason of his methodical presentation and eloquence held high reputation, was the especial favorite, and to him came students from every part of Europe, his hearers sometimes numbering more than four hundred. His chief failing was a blind veneration for the ancient writers. He declared Galen's anatomy was infallible and the work, *De usu partium*, divine, beyond which further progress was impossible. Sylvius taught from the classical works and never pointed out the contradictions and errors of the Galenic text. Guinterius, too, was a confirmed classicist, and employed his knowledge of the ancient languages in translating the Greek writers into Latin.

Human dissections were seldom introduced, and when, at uncertain intervals, a cadaver was brought in, the students profited only to the extent of witnessing the superficial and inadequate demonstrations made by unskilled and ignorant barbers. The ambition of Vesalius to master the real anatomy could not be realized through Paris professors, but the determination to raise anatomy from its fallen station so dominated the young Belgian student that, remembering the early lesson, he turned again to Nature's book. The pages, however, were not easily opened, for human material was scarce. In his quest he visited the cemeteries, where lay heaps of human bones, and soon gained an astonishing proficiency in osteology. His diligent study won recognition and Vesalius was asked to conduct the next public demonstration, which he did to the great satisfaction of his audience. On the next occasion, when he was again requested to officiate, the customary services of the barber were set aside, for Vesalius undertook the entire demonstration with is own hands, explaining with unprecedented clearness parts commonly neglected.

After three years of unremitting industry, his medical studies at Paris were interrupted by war, and Vesalius returned to Louvain. Here, he soon found opportunity to conduct a public dissection, the first held in that city for eighteen years, which,

while primarily for the benefit of medical students, contributed to his own fuller equipment for his chosen life work. While in Louvain he acquired a skeleton by a strenuous exploit. As Vesalius, in company with a medical friend, visited the gallows outside the town in search of bones, he spied a skeleton, which had been picked almost clean and was still held together by the ligaments. Such a prize was not to be lost; so, supported by his friend, Vesalius climbed the gallows and secured the extremities, which he carried home. To obtain the remaining parts, he stole without the walls as evening closed and, by night and alone, reclimbed the gallows and, from among the ghastly company, sought out and removed the coveted parts. The following morning he carried them through a different gate, into the city and home.

Towards the close of 1536, Vesalius journeyed to Venice, where in contrast to the limited opportunities for acquiring practical experience then afforded by Paris, much was offered to the student of medicine and anatomy. In Venice Vesalius busied himself, as Roth tells us, along various lines of medical work. He performed autopsies, thus gaining new opportunities for anatomy, and did not disdain to practice minor surgery with his own hands, setting leeches and opening veins, particularly the popliteal, which the barbers did not venture to touch. By a fortuitous meeting he renewed acquaintance with his talented countryman, van Calcar, the artist, who, before many months, was to furnish drawings for Vesalius' first anatomical plates. The last of his student days Vesalius spent in Padua, where he received the doctorate, and shortly after, on December 6, 1537, the appointment as Professor of Surgery, with the right to teach anatomy in the famous University of Padua.

The young professor, still less than twenty-three years of age, at once directed his energy to improve the anatomical course, and set for himself the task of presenting the structure of the human body with the greatest possible completeness and the strictest regard for actuality. He continued the plan, begun at Louvain, of combining the functions of professor,

demonstrator and dissector. The ignorant barbers were relegated to menial duties, and, when additional hands were needed, the students were called to assist.

Let us follow Vesalius as he taught. The amphitheater in which the instruction was given, was built of wood, tastefully decorated and well appointed, and seated comfortably five hundred persons. The audience included learned professors, distinguished laymen and students, who crowded about the anatomist, beside the table, anxious to assist when bidden. After some introductory remarks as to the importance of anatomy and the correct way of learning it, the instruction began with the divisions of the body and the discussion of the tissues, such as bone, cartilage, muscle, fat and glands, all of which were clearly demonstrated on a prepared dog or sheep. Now, the human subject was brought in and, after the bones were described, the dissection was undertaken. When, as was often the case, two bodies were available, the demonstration was by systems. On the first cadaver all the muscles and ligaments, with a general survey of the organs, were exhibited; the second one was devoted to the detailed presentation of the blood-vessels, the nerves and the viscera. During his discourse, Vesalius frequently made explanatory sketches, sometimes drawing the outlines of the bones on the body itself to illustrate the relations of the skeleton to the overlying parts.

The classical text was the basis of the instruction; but, although presenting Galen's views, the latter's descriptions were amplified and amended, for Vesalius did not hesitate to question the heretofore undisputed authority by pointing out the many discrepancies disclosed by the keen eye and industrious scalpel of the young anatomist. In contrast to the superficial character of the previous public dissections, which were usually finished in a few days, the course given by Vesalius lasted more than three weeks, sometimes including morning and afternoon sessions, entailing no inconsiderable physical and mental strain on the enthusiastic teacher.

That the rapidly growing reputation of Vesalius as an anatomist bore fruit is instanced by the invitation to repeat his demonstrations at Bologna, the seat long distinguished for anatomical learning. In response, Vesalius held two public dissections in 1539 and 1540, at which the brilliant success of Padua was duplicated to equally large and distinguished audiences.

Vesalius sought, in every way, to advance the study of anatomy and to facilitate dissection by the students themselves. First he articulated and set up a human skeleton for his students; than made good his promise to them by publishing, in 1538, a series of anatomical plates, *Tabulae Anatomicae*, as well as preparing a revised edition of Guinterius' *Institutionum*, which should serve as a suitable text to the plates. While justly holding that nothing can replace actual preparations, Vesalius recognized the value of adequate illustrations as an important aid. The *Tabulae* comprised six plates, of which three, representing the skeleton, were splendidly rendered by van Calcar, and the remaining and simpler plates, relating to the organs and blood-vessels, were drawn by Vesalius himself. The *Tabulae* did not pretend to completeness, but were designed to assist the student in recalling what he had seen at the public demonstrations.

During the succeeding five years, from 1537 to 1542, Vesalius busied himself with tireless energy in various fields of anatomy, not only of man, but of the lower animals, particularly monkeys, as well. It was these comparative studies that proved to Vesalius that Galen, himself, had never dissected a human body, since many of Galen's descriptions agreed with what was found in dogs and apes, but not in man. Although beginning his studies with a profound regard for Galenic anatomy, as his experience widened, from oft repeated dissection of human remains, this regard was supplanted by distrust.

Vesalius had already won distinction as an admittedly accomplished anatomist, and his plates had gained the compliment implied by unauthorized editions and translations. Confident in the correctness of his observations, and urged by faith in his

mission to advance anatomy, Vesalius concluded that the time was ripe to give to the world the results of his years of study in a form worthy the importance of the subject. He, therefore, set to work, and in the short space of two years completed the manuscript of his great work, the *Fabrica*, before he was twenty-eight years old. Moreover, only a few days later he finished the *Epitome*, an abridgment which was prepared especially for students. Within the same month the manuscript of both books, together with the wood cuts, was sent from Venice to Basel, where the then celebrated publisher, Johannes Oporinus, was entrusted with the printing. Having obtained leave of absence in Padua, Vesalius went to Basel to superintend the setting-up and press-work of his precious contributions. While in Basel, where we may believe his days were well filled with the concerns of book-making, additional demands were made on his energy to hold a public dissection, the first one that had taken place in that city for twelve years. It may be of interest to note that, even today, the remains of the skeleton obtained from this dissection are preserved in the University of Basel as a precious memento of the great anatomist.

In June, 1543, the two works of Vesalius left the press. The larger, *De Humani Corporis Fabrica*, is an impressive volume and contains the most complete description of the human body the world, till then, had seen. It was the first clear and comprehensive presentation of the subject, being the most admired and studied, as well as the most imitated and plundered, of Vesalius' writings. The smaller book, the *Epitome*, was complementary to the larger, simplifying the elaborate text of the *Fabrica*, which was designed for the expert, well versed in the lore of Galen, to whom Vesalius was anxious to reveal the true anatomy.

The *Fabrica*, upon which alone the reputation of its author might securely rest, is a noble volume of 701 folio pages, printed in excellent style, of which 654 pages were devoted to text and illustrations. The latter are well executed wood cuts, made in Venice, from unsigned drawings, probably of van Calcar, whose

skillful pencil produced the *Tabulae anatomicae* five years before. The circumstance of van Calcar being a favorite pupil of Titian gave rise to the belief, credited for two hundred years, that the drawings were from the hand of the master himself. But the fact that Titian was over sixty years of age when the *Fabrica* appeared, and was busily engaged in executing lucrative commissions, renders it highly improbable that the great artist should have turned from the more congenial task of depicting saints and goddesses to draw malodorous dissections.

Of the three hundred and odd illustrations, more than twenty of which fill the folio pages, the most striking are the three skeletons and the fourteen muscle pictures. Vesalius held distinctly in mind the services that anatomy should render art, and, therefore, calls the attention of the artist especially to the "muscle-men," which display beautifully the superficial muscles and their relations. An analysis of the *Fabrica* is entirely beyond the present purpose, suffice it to say that the deeper and more hidden parts and organs received their full share of attention, and although the treatment of some structures, notably the vascular and nervous systems, contains errors that show the influence of current beliefs, the anatomy pictured by Vesalius is, for his time, wonderfully correct. The text of the *Fabrica* is clear and concise, and indisputably proves the soundness of Vesalius' corrections of the many errors daily taught by his contemporaries.

The *Epitome* was by no means only an abridgment of the more elaborate work. While written especially for the beginner and, therefore, presenting merely the essentials, it is astonishing how much of anatomy is given in its twenty-three folio pages. Many of the illustrations differ from those of the *Fabrica*. The muscle figures show, on one side of the body, the superficial layers, and on the other the deeper ones, the muscles being represented in their natural position and order, thus making the pictures of especial interest to the surgeon. Seven of the illustrations of the *Epitome* do not appear in the *Fabrica*, five being of the muscles and two representing the nude male and female figures.

The final plate appears in duplicate and depicts the blood-vessels, heart, lungs, liver and kidneys, and in addition contains partial figures of the digestive tract and the uro-genital organs. The component figures of these plates are intended, as Vesalius explicitly directs, to be cut out and applied to the muscle and nerve pictures, thus anticipating the elaborate "dissectible manikins," that even today make a bid for popular favor.

The immediate effect of the publication of the *Fabrica* was a bitter controversy, in which the opposing factions were the supporters of Galen, on the one hand, and the progressive anatomists who accepted Vesalius, on the other. Among the first group, none was more bitter against the new anatomy and its author than Sylvius, Vesalius' old teacher, whose scornful abuse of his talented pupil reflected the bigoted and envious hatred of a sordid soul. Sylvius' fanatical belief in Galen's infallibility led him to assert, that while Vesalius might be right in his descriptions of the body at that time, yet Galen was equally correct, since the intervening centuries had undoubtedly wrought changes in man's structures.

But opposition and adverse criticism came also from those at home. Columbus, a former pupil and seeming friend, who held public demonstrations at Padua during the absence of Vesalius, took advantage of his temporary position to ridicule and to belittle his teacher, to whose generous instruction he owed all the anatomical knowledge that he had acquired. Although on his return to Padua Vesalius promptly refuted the imputations of incompetence and ignorance that Columbus had made, yet the seeds of dissension had been sown and the undermining of his influence had begun. The pleasant days of uninterrupted work, surrounded by sympathetic companions, had passed; the golden time of accomplishment had ended. To make the situation more unendurable, a few months later, Vesalius learned that certain physicians had expressed to the emperor and other high personages a most unfavorable opinion as to the value of the *Fabrica* and the new anatomy. They declared Vesalius incompetent to practice medicine; that he

was merely a surgeon, not a qualified physician, and understood nothing of medicine.

Deeply wounded by the disloyalty and ingratitude of his former friends and pupils, and disgusted with the stupidity and blindness of those for whose enlightenment he had so earnestly labored, Vesalius, in a fit of melancholy and doubt, threw his unpublished manuscripts and books into the fire and determined to leave Italy and to accept the post of physician to Charles V, which had been already proffered. Whether his invitation to the Spanish court had been promoted by the dedication of the *Fabrica* to the emperor is uncertain, but, be that as it may, in 1544 he went to Madrid, exchanging the activities of the investigator for the duties of court physician.

His new position, entailing as it did, attendance upon Charles, on the journey or on the battlefield, afforded Vesalius opportunities for wider experience in practical medicine, in which his interest had always been keen and to which much of his writing had been devoted. The years of court service brought to Vesalius a well merited reputation as a practitioner, whose knowledge not only of anatomy, but of pathology and therapeutics as well, stamped him as one of the most learned physicians of his day.

But had the old enthusiasm for investigation been entirely quenched? Was the torch that in the early days had so illuminated the anatomist's path never to be relighted? After the succession of Philip II, Vesalius found his duties as court physician more irksome and he chafed under the enforced abstinence from scientific pursuit in a land lacking in sympathy and opportunity for anatomical investigation. His discontent was heightened by the receipt of the work of his pupil and friend, Fallopius, who had been called to the chair of anatomy of Padua in 1551. Fallopius' book aroused anew the ambition of Vesalius—the hope that he might once more delve into the mysteries of the human body; that he might again read from Nature's page. He turned with home-sick gaze towards Italy, as the Land of Promise.

As a matter of fact, we find Vesalius, in the spring of 1564,

again in Venice, consorting with prospective publishers, distinguished physicians and old friends. Vesalius was about to undertake a journey to Jerusalem, but from that journey he was never to return. He was shipwrecked on the Island of Zante, where, being broken in health, he died of exhaustion the 15th day of October, 1564.

The reason for the journey to Jerusalem has remained an unsolved question. Among the explanations given, the one that has gained wide credence was based on remarkable circumstances. Vesalius had under his professional care, so letters from Spain had it, an important personage, whose disease was obscure. On the patient's death, Vesalius requested permission from the relatives to hold an autopsy. This being granted, upon opening the thorax the heart was found still feebly contracting. The family not only charged Vesalius with murder but, in order to secure severe punishment, denounced him to the Inquisition for his godlessness. The Inquisition favored a sentence of death, but, through the intercession of the emperor himself, this penalty was commuted to a journey to Jerusalem as a penance. Whether the truth was revealed by the preceding account, or whether Vesalius sought in the visit to the Holy City respite from the harassing and vexations disputes in which he had long been involved, will probably never be decided. So ended, pitiably indeed, the career of the great anatomist before he had attained the age of fifty.

Although the bitter attacks on Vesalius were not silenced by his death, being continued by such eminent men as Eustachius and Fabricius and the less important adherents of Galen, with ever increasing voice was heard the favorable verdict of those awakening to the significance of the new anatomy. Among these supporters were Vidius, Botallius, Arantius and others, whose names will ever be associated with their achievements. Apart from the specific discoveries made by Vesalius, Medicine and, indeed, Science in general, are indebted to his genius for substituting facts for theories and emphasizing that truth is most surely served by observation—contributions that today

seem trite and commonplace, but which, when defended by the young professor at Padua, were unappreciated amidst the dim gropings of progress through the maze of contradictory traditions. Stimulated by the methods of accurate study insisted on by Vesalius and freed by his battles from the restraints of authority, the anatomists of the succeeding century worked diligently and to good purpose. The introduction of the microscope, first by Kircher, followed by Leeuwenhoek and Malpighi, gave a new insight into the ultimate make-up of the body. It was Malpighi who, by his discovery of the capillary blood-vessels, welded the last link in Harvey's demonstration of the circulation and laid low the time-honored misconceptions concerning the path followed by the blood. So little by little, stone by stone, has arisen the splendid superstructure of modern Anatomy, built upon the foundations to which Vesalius devoted his energies and talents. As with the author of the *Fabrica*, so with his successors—neither personal ambition nor pecuniary gain, but the satisfaction of glimpsing something of Nature's secrets, of adding to the sum of knowledge, has been the real compensation and reward for years of unselfish labor.

A little more than a year ago marked the four hundreth anniversary of the birth of Vesalius. Let this afternoon's sketch, incomplete as it has been, be regarded as a belated tribute to the memory of the great Reformer of Anatomy.

PUBLIC OPINION AS VIEWED BY EMINENT POLITICAL THEORISTS

By Clyde Lyndon King
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"Public opinion in a democracy," said Mr. Justice Hughes, when Governor of the State of New York, "wields the scepter. Whether it be used to crucify truth and sanctify falsehood or for the ends of social justice—whether officers and agents should be successful in the administration of our great public trusts, whether funds and properties shall be effectively employed for the welfare of the people, must depend upon the intelligence of public opinion."

More recently the president of one of our leading railroads, in commenting upon a decision of the Interstate Commerce Commission, remarked that the appeal of the railroads was to the intelligent public opinion of this country and he seemed to have no little confidence in the outcome of that appeal. The amount of money spent in publicity campaigns of all kinds during these present years in and of itself is ample proof of an abiding faith in the wisdom and justice of the decisions of the public. With such an attitude toward public opinion, it would appear to be worth our while to go back over the outstanding works of political theorists with a view to determining their attitude toward public opinion and toward the sanity and wisdom of public judgments.

At the outset, we are met with a seeming barrier in such an inquiry as this because the discussion of public opinion in terms of public opinion is confined largely to the last century. However, the essence of the matter must have been in the minds of the political theorists of all times. For certainly one phenomenon of social life which must necessarily attract the thinker of any period is the extent to which the rulers of a state

are bound by the opinions of the governed. Said the philosopher Hume:

"As force is always on the side of the governed, the governors have nothing to support them but opinion. It is, therefore, on opinion only that government is founded; and this maxim extends to the most despotic and most military governments, as well as to the most free and most popular. The Soldan of Egypt, or the Emperor of Rome, might drive his harmless subjects, like brute beasts, against their sentiments and inclinations, but he must at least have led their mamelukes of praetorian bands, like men, by their opinion."

For our purposes, I shall define public opinion as the social judgment reached upon a question of general or civic import after conscious, rational public discussion. Professor Giddings has defined public opinion as "the judgment of a self-conscious community upon any subject of general interest." Professor Cooley refers to it as "an aroused, mature, organic social judgment," while to Tolstoi it is "the convergence of the invisible, intangible, spiritual forces of humanity."

By public opinion, then, we have in mind the conscious judgment reached by the people of a state upon any subject of general importance. Public opinion is not the mob howling in the street; it is not merely a people indignant; it is not a facile, shallow, popular impression of the moment; it is something more than a preponderant opinion, or a general opinion or a public judgment; it is a mature, social judgment reached after experiences have been recounted, hopes and fears expressed and results weighed.

We will find the political theorists of various times referring to these judgments as the "will of the state" or as the "conclusions of the majority," but the constant idea after all is the soundness or want of soundness in the opinions held by the majority of the individuals in a state on a matter of public import.

The questions before us, therefore, resolve themselves into these three:

1. To what extent have eminent political theorists put confidence in the judgments of the masses?

2. How would those political theorists who do not believe that the opinions of the masses are worthy or sound, plan the machinery of state so as to safeguard government from these opinions?

3. How do those political theorists who believe in the sanity of social judgments justify that confidence and by what processes would they give opportunity for the expression of those judgments in governmental matters?

I have chosen for this purpose the two great Greek philosophers, Plato and Aristotle; the two theorists, Locke and Rousseau, whose works were most influential upon our early Colonial and Revolutionary statesmen; two recent English writers, who have expressly written upon this subject, Mr. A. V. Dicey and the Hon. James Bryce; for brief comment, two American sociologists, Professors Franklin H. Giddings and Edward A. Ross; and a book just from the press by Professor Robert Michels, of the University of Basle.

Plato, the first systematic political philosopher to look critically upon social relations, in writing his "Republic," built upon the broad foundations of philosophy, ethics and politics. His life was set in parlous time for Athens, and little could he find to approve in the corrupt and selfish rulers of his state. He therefore created the ideal republic, the attainment of which he well knew would be difficult if not impossible.

Plato tells us that the only way we may set for ourselves standards of government is to set for ourselves the ideal in government. In this sense, it is full worth our while to ferret out by what process Plato thinks to maintain an orderly state, and just how he so arranges his model republic as to get model judgments from his rulers and high civic standards from his citizens. For Plato leaves to the multitudes only the wisdom to agree, and that agreement is assured through education, to leave all public matters to their rulers.

Plato gets at the essential virtues in the state by inquiring as

to the essential virtues in individuals, alleging both to be identical. These virtues he finds to be: wisdom, courage, temperance and justice. Wisdom, finds Plato, is "a kind of knowledge, for not by ignorance, but by knowledge, do men counsel well." Knowledge "advises, not about any particular thing in the state, but about the whole, and considers how a state can best deal with itself and with other states." This knowledge is to be found among the philosopher kings. And as wisdom thus presides in the ruling part of the state, the whole state "will be wise."

The courage of the state is to be embodied in that "part which fights and goes to war on the state's behalf" and consists in a proper "opinion about the nature of things to be feared and not to be feared." This necessitates a special class of guardians or soldiers. Through their education these soldiers, composed of men and women, as are all the other classes, are to be taught the "opinion" they are to hold, "respecting things to be feared, what they are, and of what nature." They are to be educated in music and gymnastics carefully devised to "prepare them to take the dye of the laws in perfection, and the color of their opinion about dangers and of every other opinion is to be indelibly fixed by their nurture and training, not to be washed away by such potent lyes as pleasure—mightier agent far in washing the soul than any soda or lye; or by sorrow, fear, and desire, the mightiest of all other solvents. And this sort of universal saving power of true opinion in conformity with law about real and false dangers," concludes Plato, "I call and maintain to be courage."

The third virtue of the state, temperance, is not peculiar to one class as are the first two, but is common to all classes. Plato happily defines temperance to be the result he is after: acquiescence on the part of many in the judgments in matters of state reached by the few.[1]

[1] Temperance he says does not "operate like courage and wisdom, which by residing in particular sections of the State, make it brave and wise respectively; but spreads throughout the whole in literal diapason, producing a unison between the weakest and the strongest and the middle class, whether you measure by the standard of intelligence, or bodily strength, or numbers, or wealth, or anything else of the kind."

Temperance is that "unanimity which we described as a concord between the naturally better element and the naturally worse, whether in a state or in a single person, as to which of the two has the right to govern." This harmony Plato proceeds to secure, as so many others born to the ruling class would like to do, by dividing his citizens up into acquiescent castes.

This he does through his definition of justice. "Every individual," says Plato, "ought to have some one occupation in the state which should be that to which his natural capacity is best adapted." "To do one's own business in some shape or other is justice." Plato puts this same fact in another way when he says that "to mind one's own business and not be meddlesome is justice."

Plato, therefore, would divide his ideal society into classes such as the rulers and guardians on the one hand, and, on the other, the cobblers, carpenters, traders, potters, shoemakers, weavers, builders, farmers and artisans—all of whom are to be content to remain in their own class. However, these castes are not to be limited entirely to those born into them. Children of one class may have the ability of citizens of another class.

But the parents and children are not to bother themselves on this matter. The rulers are to have that gift of selection which the modern eugenist needs to complete his philosophy. "Citizens, we shall say to them in our tale, you are brothers, yet God has framed you differently. Some of you have the power of command, and in the composition of these he has mingled gold, wherefore also they have the greatest honor; others he has made of silver, to be auxiliaries; others again who are to be husbandmen and craftsmen he has composed of brass and iron; and the species will generally be preserved in the children. But as all are of the same original stock, a golden parent will sometimes have a silver son, or a silver parent a golden son. And God proclaims as a first principle to the rulers, and above all else, that there is nothing which they should so anxiously guard, or of which they are to be such good guardians, as of the purity of the race. They should observe what elements mingle

in their offspring; for if the son of a golden or silver parent has an admixture of brass and iron, then nature orders a transposition of ranks, and the eye of the ruler must not be pitiful towards the child because he has to descend in the scale and become a husbandman or artisan, just as there may be sons of artisans who having an admixture of gold and silver in them are raised to honor, and become guardians or auxiliaries. For an oracle says that when a man of brass or iron guards the state, it will be destroyed."

These four virtues of the state and of the individual—wisdom, courage, temperance, and justice—are to be preserved through looking well to motives.

The guardians are to be deprived of all motives "to do mischief to the other citizens" by depriving them of all private property and by compelling them to live in common.[2] Selfish motives in all other men are to be eliminated through "a community of women, a community of children and of education in all its branches; and in like manner a community of pursuits in war and in peace." Women are to have equal privileges with men, even to be rulers themselves, "so far as their natures can go." All men are to refrain from "being dazzled by the congratulations of the crowd into multiplying infinitely the bulk of his wealth which will bring him endless trouble."[3] "Indeed, if we follow my advice, believing the soul to be immortal, and to possess the power of entertaining all evil, as well as all good,

[2] "No one should have a dwelling or storehouse in which all who please may not enter. Whatever necessaries are required by temperate and courageous men, who are trained to war, they should receive by regular appointment from their fellow-citizens, as wages for their services, and the amount should be such as to leave neither a surplus on the year's consumption nor a deficit; and they should attend common messes and live together as men do in a camp: as for gold and silver, we must tell them that they are in perpetual possession of a divine species of the previous metals placed in their souls by the gods themselves, and therefore have no need of the earthly ore; that in fact it would be profanation to pollute their spiritual riches by mixing them with the possession of mortal gold, because the world's coinage has been the cause of countless impieties, whereas theirs is undefiled: therefore, to them, as distinguished from the rest of the people, it is forbidden to handle or touch gold and silver, or enter under the same roof with them, or to wear them on their dresses or to drink out of the precious metals."

[3] "He will be glad to taste and partake of those (honors) which will make him a better man; whereas he will shun in private and in public those (honors) which he thinks likely to break up his existing condition."

we shall ever hold fast the upward road, and devotedly cultivate justice combined with wisdom; in order that we may be loved by one another and by the gods, not only during our stay on earth but also when, like conquerors in the games collecting the presents of their admirers, we receive the prizes of virtues."

Motives of all thus purified and kept constant through education, it remains only to choose wisely those rulers who will make the judgments and only sound judgments for the state. Plato moves to this point with zeal. "You must contrive for your future rulers another and a better life than that of a ruler, and then you may have a well-ordered state; for only in the state which offers this will they rule who are truly rich, not in silver and gold, but in virtue and wisdom, which are the true blessing of life. Whereas, if they go to the administration of public affairs, poor and hungering after their own private advantage, thinking that hence they are to snatch the chief good, order there can never be; for they will be fighting about office, and the civil and domestic broils which thus arise will be the ruin of the rulers themselves and of the whole state."

The natural bent of children is to be ascertained by an early education.[4] Then are to follow "labors, lessons, dangers." He who is most at home in all of these will "be enrolled in a select number." Then at the age of twenty the best of this select number "will be promoted to a higher honor, and the sciences which they learned without any order in their early education will now be brought together." Then at the age of thirty those who "show comprehensive, dialetical minds, and those who are most steadfast in their learning and in their military and other appointed duties" will be "elevated to higher honors." Then after four to six years of diligent study the best of these are to be tried out in the experiences of life to see whether "they are drawn in all manner of ways by temptation" and "whether they will stand firm or flinch." When these have

[4] Inasmuch as "bodily exercise when compulsory does no harm to the body but knowledge which is acquired under compulsion obtains no hold on the mind," this early education is to be "a sort of amusement."

reached fifty years of age, "those who still survive and have distinguished themselves in every action of their lives and in every branch of knowledge come at last to their consummation; the time has now arrived at which they must raise the eye of the soul to the universal light which lightens all things, and behold the absolute good; for that is the pattern according to which they are to order the state and the lives of individuals, and the remainder of their own lives also; making philosophy their chief pursuit, but, when their turn comes, toiling also at politics and ruling for the public good, not as though they were performing some heroic action, but simply as a matter of duty; and when they have brought up in each generation others like themselves and left them in their place to be governors of the state, then they will depart to the Island of the Blest and dwell there; and the city will give them public memorials and sacrifices and honor them, if the Pythian oracle consent, as demigods, but if not, as in any case blessed and divine."

And finally Plato gives us the exact process by which a seasoned opinion will ever characterize these half-divine governors of the state. First from among the children of the soldier classes are to be noted "those who in their whole life show the greatest eagerness to do what is for the good of their country, and the greatest repugnance to do what is against her interests." For "the simple and moderate desires which follow reason, and are under the guidance of mind and of true opinion, are to be found only in a few, and those the best born and the best educated." These will then be watched at every age in order that we may see whether they "preserve their resolution," and to see whether they are deprived of truth against their will, either by "theft or force or enchantment." For some men, says Plato wisely (and this is as true of the twentieth century American as of the early Greek) "are changed by persuasion and others forget; arguments steal away the hearts of one, and time of the other; and this I call theft." Those change their opinion by force who do so under "the violence of some pain or grief," while "the enchanted are those who change their minds either

under the softer influence of pleasure or the sterner influence of fear." And hence the opinions of the young rulers are to be tried out by "theft, force and enchantment" and he who "is not deceived is to be selected and he who fails in the trial is to be rejected."

And thus is peace and happiness assured to all, and wisdom and sound judgment to the rulers. And these rulers make all judgments as to the needs and functions of the state and as to the work of the masses. "Until philosophers are kings, or the kings and princes of this world have the spirit and power of philosophy, and political greatness and wisdom meet in one, and those commoner natures who pursue either to the exclusion of the other are compelled to stand aside, cities will never have rest from their evils,—no, nor the human race as I believe,—and then only will this our state have a possibility of life and behold the light of day."

Plato's utopianism was soon to have its corrective in the realism of Aristotle's "Politics." For to the realist to set one's political haven in another world is to compromise it.

"Man is naturally a political animal,"[5] and "the city is a natural production." These are the principles upon which Aristotle erects his philosophy as to the soundness of the judgments of the multitude and as to the wisdom of following the collective opinion in matters of state.

"A city contains in itself, if I may so speak, the end and perfection of government, first founded that we might live, but continued that we may live happily."[6] "He who first founded

[5] "Man is an animal naturally formed for society, and that, therefore, when he does not want any foreign assistance, he will of his own accord desire to live with others; not but that mutual advantage induces them to it, as far as it enables each person to live more agreeably; and this is indeed the great object not only to all in general, but also to each individual. But it is not merely matter of choice, but they join in society also even that they may be able to live, which probably is not without some share of merit, and they also support civil society even for the sake of preserving life, without they are grievously overwhelmed with the miseries of it; for it is very evident that man will endure many calamities for the sake of living as being something naturally sweet and desirable."

[6] "For which reason every city must be allowed to be the work of nature, if we admit that the original society between male and female is; for to this as their end all subordinate societies tend, and the end of everything is the nature of it. For what ever being is in

civil society, was the cause of the greatest good; for as by the completion of it man is the most excellent of all living beings, so without law and justice he would be the worst of all."

Law and justice are attainable only through the organized state.

"Justice," says Aristotle, "is the fundamental virtue of political society since the order of society cannot be maintained without law, and laws are instituted to declare what is just." "The only just sovereigns, therefore, are God and the laws; especially those unwritten, moral, and universal laws, founded in nature, reared and perfected by education and custom." "The end and object of all just government is the good of the governed."

And what share is the governed entitled to have in the making of these laws and in determining the polity of the state?

Aristotle answers this question in his argument showing why sovereignty should reside with the people. "The people at large," he says, "how contemptible soever they may appear when taken individually, are yet, when collectively considered, not, perhaps, unworthy of sovereignty."

"Considered collectively, the people form a complex animal, with many feet, with many virtues; each member contributing something, more or less valuable, to the perfection of the whole body. The moral and intellectual excellence of the multitude thus differ from those of a wise and virtuous man, as the beauty of a fine picture from the beauty of individuals."

The many, although individually inferior, are collectively superior to the select few; just as "there are some subjects in which the artist himself is not the sole or best judge, viz., all subjects in which the results produced are criticised equally well by persons who are not masters of the art. Thus it is not the builder alone whose function it is to criticise the merits of the house; the person who uses it, that is, the householder, is

its most perfect state, that certainly is the nature of that being whether it be a man, a horse, or a house; besides, whatever produces the final cause and the end which we desire must be best; but a government complete in itself, is that final cause and what is best."

actually a better judge and similarly a pilot is a better judge of a helm than a carpenter, and one of the company of a dinner than the cook."

Aristotle holds that virtue is "a mean between two extremes," that "the happy life is the life which is unimpeded in the exercise of virtue" and that, therefore, "the possession of fortune's gifts in an intermediate degree is the best thing possible." "For this is the condition in which obedience to reason is easiest."

Therefore, the statesmen ought always to strengthen the middle class and to render it more powerful than either extreme. For "it is a state composed largely of the middle class which enjoys the best political constitution." Moreover, "the only states capable of good administration are those in which the middle class is numerically large and stronger, if not, than both the other classes, yet at least than either of them, as in that case the addition of its weight turns the scale and prevents the predominance of one extreme or the other." "All the world over . . . there is nobody so thorougly trusted as an arbitrator, and the middle class occupies a position of arbitration between the rich and the poor."

Hence it is that Aristotle devotes such a large portion of his book to the discussion of education. Hence his attitude toward charity,[7] toward the education of women[8] and toward the division of labor.[9]

[7] "The public savings ought not to be squandered away in temporary and fruitless donatives, but accumulated to such an amount that when distributed to the industrious and deserving poor, they may enable them to purchase and cultivate a few acres of land of their own (which is incomparably the best use of public bounty), and to acquire the materials and instruments necessary for carrying on manufactures and commerce."

[8] "Nothing proves more ruinous to a state than the defective education of the women; since wherever the institutions respecting one-half the community are faulty, the corruptions of that half will gradually taint the whole."

[9] "In proportion as labor is divided, arts are perfected; and the various branches of industry are all of them best cultivated when the same individual is strictly confined to the same branch of art. In matters of civil government, the same principle is applicable; but justice prohibits, that, in such matters, this principle should always be actually supplied." . . . The principle cannot be applied to extent of community of wives and children as Plato held. "The more minutely labor of every kind is subdivided, the more perfectly and the more promptly each man will perform his assigned task, and that government only is firmly supported which associates deserving citizens to its functions and its honors."

Aristotle, therefore, grants to the people full control over their legislative bodies and seems to recommend that the deliberative in its turn be given a control over the executive and judicial, such is the actual working system in the British government of today. "The deliberative power properly constitutes the sovereignty, since the proper office of magistrates and judges consists in obeying its will, and in executing its orders."

It is a safe conclusion, therefore, that Aristotle believes that the collective judgments are sound and that the opinion of the many should find due expression in government. To this end he gives to the people full control over the legislature, the legislature in turn to be supreme over the executive and over the judiciary.

John Locke's political philosophy as reflected in his "Two Treatises on Civil Government," was most influential upon the thoughts and judgments of our early colonial and American statesmen and political leaders. In the principles of his general philosophy, as well as in his political philosophy, there is much with a direct bearing upon the question before us. He denied the doctrine of "innate ideals" and declared to the contrary that there was no body of perfect knowledge of which the mind is possessed from the first. Ideas, and hence political and social institutions, which are but ideas given physical form, must change as there can be no established or ultimately fixed ways of life. Man is, therefore, a rational being, since truth was not born with him.

One of the first of the rational acts of man was to get out of the state of nature into the state of civil society. Locke devotes the first of his treatises to proving that the rulers now on earth could deprive not "the least shadow of authority" from that which had been held to be the fountain of all power: "Adam's private dominion and paternal jurisdiction." In his second treatise he shows that, on the contrary, the origin of the state and the existence of kings and other governors lie only in the natural rational compact that man made when in the state of nature. And this he did in order to get away from the incon-

veniences[10] he was having in the state of nature.[11] Men are naturally in a state of nature "and remain so[12] till, by their own consents, they make themselves members of some political society."[13]

This compact made government, not society. Men in the

[10] "The great and chief end, therefore, of men uniting into commonwealths and putting themselves under government, is the preservation of their property, to which in the state of nature there are many things wanting.

"Firstly, there wants an established, settled, known law, received and allowed by common consent to be the standard of right and wrong, and the common measure to decide all controversies between them. For though the law of nature be plain and intelligible to all rational creatures, yet men, being biased by their interest, as well as ignorant for want of study of it, are not apt to allow of it as a law binding to them in the application of it to their particular cases.

"Secondly, in the state of nature there wants a known and indifferent judge, with authority to determine all differences according to the established law. For every one in that state being both judge and executioner of the law of nature, men being partial to themselves, passion and revenge is very apt to carry them too far, and with too much heat in their own cases, as well as negligence and unconcernedness, make them too remiss in other men's.

"Thirdly, in the state of nature there often wants power to back and support the sentence when right, and to give it due execution. They who by any injustice offended will seldom fail where they are able by force to make good their injustice. Such resistance many times makes the punishment dangerous, and frequently destructive to those who attempt it."

[11] "Men living together according to reason without a common superior on earth, with authority to judge between them, is properly the state of nature. But force, or a declared design of force upon the person of another, where there is no common superior on earth to appeal to for relief, is the state of war."

"The state of war is a state of enmity and destruction," a "sedate, settled design upon another man's life."

[12] "To those that say there were never any men in the state of nature, I will not only oppose the authority of the judicious Hooker (Eccl. Pol., lib. i. sect. 10), where he says 'the laws which have been hitherto mentioned'—*i. e.*, the laws of nature—'do bind men absolutely, even as they are men, although they have never any settled fellowship, never any solemn agreement amongst themselves what to do or not to do; but for as much as we are not by ourselves sufficient to furnish ourselves with competent store of things needful for such life as our nature doth desire, a life fit for the dignity of man, therefore, to supply those defects and imperfections which are in us, as living single and solely by ourselves, we are naturally induced to seek communion and fellowship with others; this was the cause of men uniting themselves as first in politic societies.' But I, moreover, affirm that all men are naturally in that state, and remain so till, by their own consents, they make themselves members of some politic society, and I doubt not, in the sequel of this discourse, to make it very clear."

[13] "Those who are united into one body and have a common established law and judicature to appeal to, with authority to decide controversies between them and punish offenders, are in civil society with another." "And this is done wherever any number of men, in the state of nature, enter into society to make one people one body politic under one supreme government; or else when any one joins himself to, and incorporates with any government already made. For by so doing he thereby authorizes society 'to make laws for him as the public good of the society shall require.' "

state of nature had a threefold purpose in establishing government: to secure common judges, to make choice of their governors, and to enunciate the laws. "I easily grant," says Locke, "that civil government is the proper remedy for the inconveniences of the state of nature, which must certainly be great where men may be judges in their own case, since it is easy to be imagined that he who was so unjust as to do his brother an injury will scarce be so just as to condemn himself for it."

"But the state of nature has the law of nature to govern it," which obliges everyone. This law of nature if "Reason, that common rule and measure God hath given to mankind." This law is "as intelligible and plain to a rational creature and a studier of that law as the positive laws of the commonwealth, nay, possibly plainer; as much as reason is to be understood then the fancies and intricate contrivances of men, following contrary and hidden interests put into words."

"The obligations of the law of nature cease not in society, but only in many cases are drawn closer, and have, by human laws, known penalties annexed to them to enforce their observation. Thus the law of nature stands as an eternal rule to all men, legislators as well as others. The rules that they make for other men's actions must, as well as their own and other men's actions, be conformable to the law of nature, *i. e.*, to the will of God, of which that is a declaration, and the fundamental law of nature being the preservation of mankind, no human sanction can be good or valid against it."

For the expression of the law of reason into the written laws of the commonwealth men in their compact created a government of three departments: the legislative, the executive[14] and the federative. Of these the legislative is supreme.[15]

[14] Locke says as to the ordinance power of the executive: "This power to act according to discretion for the public good, without the prescription of the law and sometimes even against it, is that which is called prerogative." . . . "A latitude left to the executive to do many things of choice which the laws do not prescribe."

[15] "These are the bounds which the trust that is put in them by the society and the law of God and nature have set to the legislative power of every commonwealth, in all forms of government. First, they are to govern by promulgated established laws, not to be varied in particular cases, but to have one rule for rich and poor, for the favorite at

Locke thus bases his entire conception of the powers and duties of government upon the rational judgment of those members of the state of nature who created civil society by the original compact. The law of nature is the law of reason. And since the law of reason is man-made and not a law with which men are born to save them from error, and since the law of reason is to be the guiding law in civil society, Locke bases his entire doctrine of government upon the ability of the individuals in society to reach collectively wholesome social judgments. For these judgments are based upon reason. And these judgments will not be arbitrary, for reason "teaches all mankind, who will but consult it, that being all equal and independent, no one ought to harm another in his life, health, liberty or possessions; for men being all the workmanship of one omnipotent and infinitely wise Maker; all the servants of one sovereign Master, sent into the world by His order and about His business; they are His property, whose workmanship they are made to last during His, not one another's, pleasure."

Moreover, the creation of civil society means that at any time the majority in that society "have a right to act and control the rest." For "Every man, by consenting with others to make one body politic under one government, puts himself under an obligation to every one of that society to submit to the determination of the majority, and to be concluded by it; or else this original compact, whereby he, with others, incorporates into one society, would signify nothing, and be no compact if he be left free and under no other ties than he was in before in the state of nature."

Moreover, the people must judge as to whether the prince, the legislature or other agent of government does that which is contrary to the compact. "For who shall be judge whether his trustee or deputy acts well and according to the trust reposed in

court, and the countryman at plough. Secondly, these laws also ought to be designed for no other end ultimately but the good of the people. Thirdly, they must not raise taxes on the property of the people without the consent of the people given by themselves or their deputies. . . . Fourthly, legislative neither must nor can transfer the power of making laws to anybody else, or place it anywhere but where the people have."

him but he who deputes him, and must, by having deputed him, have still a power to discard him when he fails in his trust? If this be reasonable in particular cases of private men, why should it be otherwise in that of the greatest moment, where the welfare of millions is concerned and also where the evil, if not prevented, is greater and the redress very difficult, dear, and dangerous?"

Absolute monarchy is inconsistent with civil society because the absolute prince is in a state of nature. Hence Locke would restrain "any exorbitances" of those to whom authority had been given by balancing the power of government through placing several parts of it in different hands.

The people are to keep immediate control over the legislative just because it is the department that is supreme in the state. "The power that every individual gave to the society when he entered into it can never revert to the individuals again, as long as the society lasts, but will always remain in the community, because without this there can be no community, no commonwealth, which is contrary to the original agreement."

"The freedom then of man, and liberty of acting according to his own will, is grounded on his having reason, which is able to instruct him in that law he is to govern himself by, and make him know how far he is left to the freedom of his own will." "For law, in its true notion, is not so much the limitation as the direction of a free and intelligent agent to his proper interest, and prescribes no farther than is for the general good of those under that law."

Locke refutes the arguments that the judgments of men will not be in the line of reason because the people will be easily aroused by demagogues to make biased judgments. On this point, he says: "Nor let any one say that mischief can arise from hence as often as it shall please a busy head or turbulent spirit to desire the alteration of the government. It is true, such men may stir whenever they please, but it will be only to their own just ruin and perdition. For till the mischief be grown general, and the ill designs of the rulers become visible,

or their attempts sensible to the greater part, the people, who are more disposed to suffer than right themselves by resistance, are not apt to stir. The examples of particular injustice or oppression of here and there an unfortunate man moves them not. But if they universally have a persuasion grounded upon manifest evidence that designs are carrying on against their liberties, and the general course and tendency of things cannot but give them strong suspicions of the evil intention of their governors, who is to be blamed for it? Who can help it if they, who might avoid it, bring themselves into this suspicion? Are the people to be blamed if they have the sense of rational creatures, and can think of things not otherwise than as they find and feel them? And is it not rather their fault who put things in such a posture that they would not have them thought as they are?"

In substance, Locke believes in the wisdom of the judgments of the public and would have those judgments find complete expression through the legislature.

"The force and liberty of each individual being the principal instruments of his own preservation, how is he to engage them in the common interest without hurting his own, and neglecting the obligations he lies under to himself?"

This is the query Rousseau puts to himself for answer in his "Social Contract." He states his purpose again in these words, "To find that form of association which shall protect and defend, with the whole force of the community, the person and property of each individual and in which each person, by uniting himself to the rest, shall nevertheless be obedient only to himself, and remain as fully at liberty as before."

This ideal he believes to be attainable only through the social contract. The exact phrasing of this contract is as follows: "We, the contracting parties do jointly and severally submit our persons and abilities to the supreme direction of the general will of all; and in a collective body, receive each member into that body as an indivisible part of the whole." This act of association "converts the several individual contracting parties

into one moral collective body, composed of as many members as there are votes in the assembly, and receives also from the same act its unity and existence."[16]

Each person of mature years enters into this compact by agreement or by tacit consent. Every "new generation should be at liberty to admit or reject its authority."[17]

He who enters into this compact admits that he may be compelled "to pay obedience to the general will—by the force of the whole body. And this is in effect nothing more than that he may be compelled to be free."

"These clauses, well understood, are all reducible to one, viz.: the total alienation of every individual, with all his rights and privileges, to the whole community. For, in the first place, as every one gives himself up entirely and without reserve, all are in the same circumstances, so that no one can be interested in making their common connection burdensome to others."

The legislature is to be the organ by which the body politic is to make known its general will. "The laws are, strictly speaking, only the conditions of civil society. The people who submit to them should therefore be the authors of them, as it certainly belongs to the associating parties to settle the conditions on which they agree to form a society." . . . "A people must necessarily be desirous of their own good, but they do not always

[16] "This public personage, which is thus formed by the union of all its members, used formerly to be denominated a city and at present takes the name of a republic or body-public. It is also called, by its several numbers, a state, when it is passive; the sovereign, when it is active; and simply a power when it is compared with other bodies of the same nature. With regard to the associates themselves, they take collectively the name of the people, and are separately called citizens, as partaking of the sovereign authority; and subject, as subjected to the laws of the state. These terms, indeed, are frequently confounded, and mistaken one for the other; it is sufficient, however, to be able to distinguish them when they are to be used with precision."

[17] "Were it possible also for a man to alienate himself he could not in the same manner dispose of his children who, as human beings, are born free; their freedom is their own, and nobody hath any right to dispose of it but themselves. Before they arrive at years of discretion, indeed, their father may, for their security, and in their name, stipulate the conditions of their preservation; but he cannot unconditionally and irrevocably dispose of their persons; such a gift being contrary to the intention of nature, and exceeding the bounds of paternal authority. It is requisite, therefore, in order to render an arbitrary government lawful, that every new generation should be at liberty to admit or reject its authority, in which case it would be no longer an arbitrary government."

see in what it consists. The general will is always in the right, but the judgment by which it is directed is not always sufficiently informed." Through the legislature this judgment is to be informed.

The legislator is, however, not to make laws, he is but to give expression to the laws as they exist; that is, to put the general will into words. For "the laws are only the records of our own wills." Hence just because the legislature "acts in concert with nature," it is possible for all individuals "to be free and at the same time subject to the laws."

"But if the legislator, deceived in his object, should assume a principle different from that which arises from the nature of things, . . . the laws would insensibly lose their force, the constitution would alter, and the state continue to be agitated till it should be totally changed or destroyed, and nature have resumed its empire."

In order to make sure that the legislator has spoken only the general will, laws must be referred to the people for approval. "Because, according to the fundamental compact, it is the general will only that is obligatory on individuals; and it is impossible to be assured that any particular will is conformable to the general, till it be submitted to the free suffrage of the people."

"But it may be asked, How can a man be free, and yet be obliged to conform to the will of others? How can the members of an opposition be called freemen who are compelled to submit to laws which they have not consented to? I answer, that his question is not properly stated. The citizen consents to all laws passed by a majority, though some of them in particular may have passed contrary to his inclination; nay, he consents to those by which he is punishable for the breach of any one. The constant will of all the members of a state is the general will, and it is this alone that makes them either citizens or freemen. When a law is proposed in the assembly of the people, they are not precisely demanded, whether they severally approve or reject the proposition; but whether it be conformable or not

to the general will, which is theirs as a collective body. Each person, therefore, in giving his vote declares his opinion on this hand, and on counting the votes, the declaration of the general will is inferred from the majority. When a law thus passes contrary to my opinion, it proves nothing more than that I was mistaken, and that I concluded the general will to be what it really was not. So that, if my particular advice had been followed, it would have been contrary to my will, which, as a citizen, is the same as the general, and in that case I should not have been free. This argument supposes, indeed, that all the characteristics of the general will are contained in the plurality of votes, and when this ceases to be the case, take what course you will, there is an end of liberty."

Rousseau then lays down these "general maxims" by which the proportion of popular votes necessary to carry a measure shall be regulated.

In the first place the social contract is the only law "which, in its own nature, requires unanimous consent."[18] The second maxim is "that the more grave and important the deliberations, the nearer ought the determination to approach to unanimity." The third maxim is, "that the more expedition the affair requires, the less should unanimity be insisted upon." In deliberations where the matter should be immediately determined the majority of a single vote should be sufficient. The second of these maxims to Rousseau seems more applicable to permanent laws," the third "to matters of business."

Rousseau puts as the basis of the whole social system the moral and legal equality of all individuals. "Instead of annihilating the natural equality among mankind, the fundamental

[18] "For civil association is the most voluntary act in the world: every man being born free, and master of himself, no one can lay him under restraint, on any pretense whatever, without his own consent. To affirm that the son of a slave is born a slave, is to affirm he is not born a man.

"If there be any persons, however, who oppose this contract itself, their opposition does not invalidate that contract; it only hinders their being comprehended therein, and they remain aliens in the midst of citizens. When a state is formed, a consent to its institution is inferred by the residence of the party; to submit to residence in any country, is to submit to its sovereignty."

compact substitutes, on the contrary, a moral and legal equality, to make up for that natural and physical difference which prevails among individuals, who though unequal in personal strength and mental abilities, become thus all equal by convention and right."[19]

Rousseau addresses himself particularly to the importance of public opinion. After discussing the three kinds of laws: fundamental law, civil law, and penal law, he adds a fourth and more important than all the rest, "and which are neither engraven on brass or marble but in the hearts of the citizens, forming the real constitution of the state. These are the laws which acquire daily fresh influence, and, when others grow old and obsolete, invigorate and revive them; these are the laws which keep alive in the hearts of the people the original spirit of their institution, and substitute insensibly the force of habit to that of authority. The laws I here speak of are manners, customs, and, above all, public opinion; all unknown or disregarded by our modern politicians, but on which depends the success of all the rest. These are the objects on which the real legislator is employed in secret, while he appears solely to confine himself to those particular regulations which compose only the preparatory center of the vault, of which manners, more slow in their progress, form in the end the immovable arch."

These are the fundamental principles which Rousseau works out in answer to his query, "whether the nature of society admits of any fixed and equitable rules of government, supposing mankind to be such as they are, and their laws such as they might be made," in the search for which he "endeavored constantly to join the considerations of natural right and public interest, so that justice and utility may never be disunited."

Rousseau, it must be stated, does not have in mind a pure democracy where officers are chosen by lot, but rather a republic

[19] "This equality, indeed, is under some governments merely apparent and delusive, serving only to keep the poor still in misery, and favor the oppression of the rich. And, in fact, the laws are always useful to persons of fortune, and hurtful to those who are destitute, whence it follows that a state of society is advantageous to mankind in general, only when they all possess something, and none of them have anything too much."

where the laws are declared by legislators chosen by the people and in which these legislators refer the laws that they declare back to the electorate for approval or rejection. He does not have in mind absolute equality, but only equality in law and equality in opportunity. Back to Rousseau goes the cry, "liberty, fraternity and equality."

Mr. A. V. Dicey, in his interesting book on "Law and Public Opinion in England," declares that it is only in England that law depends upon opinion, and in England only during the last century. He is not exactly clear as to just what he has in mind by the term public opinion. He says that this term "when used in reference to legislation is merely a short way of describing the belief or conviction prevalent in a given society that particular laws are beneficial, and, therefore, ought to be maintained, or that they are harmful and, therefore, ought to be modified or repealed." In the very next paragraph he refers to public opinion "as the speculative views held by the mass of the people as to the alteration or improvement of their institutions."

He believes it is only under peculiar conditions of an advanced civilization that opinion dictates legislative change. "In many Eastern countries opinion—which is better described as traditional or instinctive feeling—has for ages been, in general, hostile to change and favorable to the maintenance of inherited habits. There, as in the West, opinion, in a very wide sense of that word, rules; but such aversion to change as for ages keeps a society within the limits of traditional action, is a very different thing from the public opinion which in the England of the nineteenth and twentieth centuries has demanded constant improvements in the law of the land."

Mr. Dicey makes a real contribution to the discussion of public opinion when he answers the argument that the opinions of men as to laws is in accordance with their own selfish interests rather than in accordance with any conception of what the law ought justly to be.

It is to be granted that in the needs of legislation men are guided in the main by their real or apparent interest. "So

true is this, that from the inspection of the laws of a country it is often possible to conjecture, and this without much hesitation, what is the class which holds, or has held, predominant power at a given time."[20]

But howsoever much men may vote their immediate interests, it cannot be held that they are guided only by their interests, for they are guided equally by the opinion of others. It is this interplay between the opinion of others and the strictly selfish interests of one's own concerns that makes public opinion the guiding force of a country. "The citizens of a civilized country, such as England, are for the most part not recklessly selfish in the ordinary sense of that word; they wish, no doubt, to promote their own interests—that is, to increase their own pleasures and to diminish their own discomforts, but they certainly do not intend to sacrifice, to their own private advantage or employment, either the happiness of their neighbors or the welfare of the state. Individuals, indeed, and still more frequently classes, do constantly support laws or institutions which they deem beneficial to themselves, but which certainly are in fact injurious to the rest of the world. But the explanation of this conduct will be found, in nine cases out of ten, to be that men come easily to believe that arrangements agreeable to themselves are beneficial to others. A man's interest gives a bias to his judgment far oftener than it corrupts his heart."[21]

And finally Dicey points out forcibly that to say public opinion is influential in determining what the laws are to be and how

[20] "No man could cast a glance at the laws and institutions of the middle ages without seeing that power then went with ownership of land. Wherever agriculturists are predominant you will find during the nineteenth century, first the middle classes, then the artisans of our towns, and lastly the country laborers, had obtained an increase of political power. The connection, however, between legislation and the supposed interests of the legislators is so obvious that the topic hardly requires illustration."

[21] "It is well to insist upon the true relation between self-interest and belief, because ardent reformers, and notably Bentham and his disciples, have at times misunderstood it, and have used language which implied that every opponent of progress was, if not a fool, then a rogue, who deliberately preferred his own private advantage to the general benefit of mankind, whereas in reality he will be found in most cases to have been an honest man of average ability who has opposed a beneficial change not through exceptional selfishness, but through some intellectual delusion unconsciously created by the bias of a sinister interest."

they shall be enforced is not to say that there would always be a tendency to change laws, for the force of public opinion may be negative as well as constructive.

"When we talk of legislative public opinion we should not forget that such opinion may bear a merely negative character, and operate not by making laws, but by forbidding their enactment."[22]

Bryce devotes several chapters in his justly famous "American Commonwealth" to the discussion of public opinion in America. He finds that public opinion rules in America as in no other country.

A leading reason for this Bryce finds to be our check and balance system, and the multiplicity of division of authority among our governing bodies. He refers not only to the division of power between the States and the nation, but more particularly to the division of power among the branches of government both in the states and the nation. He notes "that the ordinary functions and business of government, the making of laws, the imposing of taxes, the interpretation of laws and their execution, the administration of justice, the conduct of foreign relations, are parcelled out among a number of bodies and persons whose powers are so carefully balanced and touch at so many points that there is a constant risk of conflicts, even of deadlocks."

This dividing of the government up into more or less petty irresponsible authorities has made it necessary for public opinion to get back of that branch or those branches of government that are in accord with public opinion, in order to compel those branches of the government not in accord with public opinion to yield to those that are. Without this compelling power of public opinion, we would have no governmental action and no

[22] "It is, in short, a force which may act either as it does nowadays, in favor of innovation, or, as it did in the early part of the nineteenth century, in favor of conservatism. In England, indeed, periods of legislative activity have always been exceptional. The experience, at any rate, of democratic countries where the constitution provides a regular mode of appeal from the legislature to the people, proves that the voice of the people may be just as ready to check as to stimulate the energy of parliamentary law-makers."

continuity in policy. "Public opinion must, therefore, be more frequently invoked and more constantly active in America than in other countries." "The efforts made in 1787 to divide authority and, so to speak, force the current of the popular will into many small channels instead of permitting it to rush down one broad bed, have really tended to exalt public opinion above the regular legally appointed organs of government. Each of these organs is too small to form opinion, too narrow to express it, too weak to give effect to it. It grows up not in Congress, not in state legislatures, not in those great conventions which frame platforms and choose candidates, but at large among the people. It is expressed in voices everywhere. It rules as a pervading and impalpable power, like the ether which passes through all things. It binds all the parts of the complicated system together, and gives them whatever unity of aim and action they possess."

To be sure he gives other reasons for the ruling power of public opinion in America such as our want of distinction in social classes, our acceptance of leadership from whatever class it may come, and because we do not look at our legislatures as the sovereign power of the nation, regarding the people rather to be the center of sovereignty. But none of these forces seems to Bryce to account for the dominance of public opinion so much as our check and balance system of government.

The sociologists and social psychologists of the twentieth century have accepted public opinion as one of the constructive social forces. Of these I shall choose but two for comment: Professor Franklin H. Giddings, of Columbia University, and Professor E. A. Ross, of the University of Wisconsin.

Professor Giddings classes together, under the name of the social mind, the common feeling, the general desire, the moral sense, the public opinion and the general will of the community. He finds the genesis of public opinion in deliberate, rational discussion. The essential steps in the genesis of public opinion he states to be the evolution of social self-consciousness, the evolution of social memory and the evolution of social values,

The result is "rational social choice, by means of which a society that is conscious of itself as a community is able, in a measure, to shape its career." In social self-consciousness followed by discussion lies the genesis "of a true public opinion which may be defined as the judgment of a self-conscious community upon any subject of general interest."

"The genesis of public opinion obviously depends upon intellectual contact and communication. Where intercourse is as nearly non-existent as it is among the Cumberland mountaineers of Tennessee, there is no public opinion. Where it is as perfect as it was in rural New England a generation ago, public opinion may reach its highest development. Notwithstanding a scattering distribution of the population, every family, by means of the church, the town meeting, the lyceum and the newspaper, kept itself intelligently informed upon all events of interest in the nation and in the world. As a rule, however, a high development of public opinion is found where population is relatively dense. Of not less importance is the right of all classes to initiate discussion. Where public meetings can be convened only by administrative process there is no true public opinion. Therefore, in societies that are politically organized true public opinion is dependent upon the maintenance of liberal constitutional government. It is dependent also upon the general diffusion of education, and upon such relations of justice and sympathy between the well-to-do and the poor that ingenuous expression can be the natural habit of all classes. The spirit rather than the form of republicanism is necessary. The public opinion is more highly developed in England than in France. Fatal to it is the semi-criminal democracy that has disgraced and misgoverned American cities."

Professor Ross refers by the general term public opinion, to public judgments, public sentiments and those public actions that affect conduct.[23] He analyzes the sources of public opinion.

[23] "In the spontaneous reaction of the community against conduct that displeases it, it is possible to distinguish different forces and different sanctions. Public judgment is the opinion the public pronounces upon an act as to whether it is good or bad, noble or

And giving to leaders of thought and of men the part in making social judgments properly due to them he finds that public opinion is a force of growing and promising importance. To Professor Ross "a scrutiny of the course of public opinion in a healthy community shows us not an amorphous crowd, but an organic combination of people. Not only is there reciprocal influence of man on man, but in this universal give-and-take we find some men giving out many impulses and receiving few, while others receive many impulses and give out few. Thus arises the contrast of influencers and influenced, leaders and led, which does so much toward explaining how minds of weight and worth come to their own under a popular regime."

The merits of public opinion are: "It has a wide gamut of sanctions. It is flexible. It is penetrating. It is preventive. It is prompt. It is cheap." Its defects are its indefiniteness, its passional character, its short memory, its divided jurisdiction, its frequent impotence and its want of adequate technique.

To Professor Ross signs are not wanting that in the future an increasing restraint will be exercised through public opinion, and that this kind of control will gain at the expense of other kinds. Among the forces making toward this end are these: this form of coercion is suited to the type of man created by modern life; the growing economic interdependence and the closer interweaving of private interests mean that the individual gives hostages to the community for his good behavior; there are more frequent contacts of men for forming and focusing the opinion of the public.

By three processes can public opinion be made an increasingly better agent for the "righteous protection of social welfare."

The first of these is a general improvement in character and

ignoble. Public sentiment is the feeling of admiration or abhorrence, respect or derision, expressed by the public with regard to an act. Public action comprises those measures, other than mere manifestations of opinion or sentiment, taken by the public in order to affect conduct. Any or all of these will be referred to by the general term 'Public Opinion.' To these three forces roughly correspond the sanctions of opinion, the sanctions of intercourse and the sanctions of violence."

intelligence.[24] The second is a general acceptance of the principles of law or right which guide opinion and cause it to play smoothly in certain grooves.[25] "Law itself reacts powerfully on the public, teaching it to frown on offences like malpractice or blackmail or intimidation, that it does not resent instinctively. On the other hand, the right to worship 'according to the dictates of one's conscience,' the right to free speech and opinion, the right to eat, dress and live as one pleases, and, in general, the right to be unmolested, save when others are concerned—these principles that have struck root in the public conscience are so many barriers against the intolerance of the majority."

The third is the ascendency of leadership. "These knots of influential men, which in time spontaneously arrange themselves into higher and lower, constitute the nerve centers or ganglia of society. They are the rallying points of public opinion, and although even these leaders may be bad or addle-pated, the mere existence of such a psychic organization shows that the popular consensus is by no means the Walpurgis-night of feeling and folly it is often said to be."

Professor Ross does not believe by any means that there can be sane discussion on every subject. "In areas where, after all, feeling or instinct, not reason, decides, discussion can do little to accelerate the issue.[26]

[24] "The feeling of the many reflects the feeling of the average person, and if he is cool and reasonable in his private resentments, he will be so in his sympathetic and corporate resentments. A schooled, informed, thinking public is far fitter to exercise a beneficent control than a people that vents its wrath against America by stoning the statue of its discoverer."

[25] "These slow-won, time-hallowed maxims are bits in the mouth of the mob and reins in the hands of the wise. They virtually endow the multitude with memory and equip it with experience. Stern old Hebrew words about 'false witness,' and 'unclean hands,' and 'selling the righteous for silver,' and 'making the ephah small and the shekel great,' are lamps to a groping people."

[26] "De gustibus non est disputandum. Barren are discussions of Italian opera and German opera, aestheticism, Whitman's poetry, Whistler's 'arrangements,' race amalgamation. For here the matter is one of taste, and a common basis is lacking. The best type of discussion is that between parties who agree as to ends and differ only as to means, because we have feelings about ends but are cold-blooded in choosing means. . . . When means or methods are in question, we appeal to the judgments; when ends are in question,

"Sometimes, as in the struggle between two prejudices, tastes or prestiges, both disputants wrangle; but, when a merit is pitted against a prestige or a sentiment, one side argues while the other vituperates."[27]

"Political Parties" is the title and "A Sociological Study of the Oligarchical Tendencies of Democracy" the sub-title of a recent informing book by Robert Michels, Professor of Political Economy and Statistics in the University of Basle. The professor clearly has a thesis to prove and marshals his facts to prove it. This thesis is, as indicated in the sub-title, that the tendencies of democracy are toward oligarchy; or, to put it more concretely, that not only is socialism impossible, but that even a socialistic policy is impossible. The facts, arguments and ideas that the author brings to his work are significant whether or not mistaken.

The two major premises in his argument are (1) that leaders are indispensable in democracies, and not only in democracies but in all democratic organizations as in social life itself, and (2) that the inevitable tendency is for all leaders to assert autocratic control. As a corollary of these premises is the doctrine that "organization, based as it is upon the principle of least effort, that is to say upon the greatest possible economy of energy, is the weapon of the weak in their struggle with the strong." "But organization means oligarchy whether it be the oligarchy of popularly chosen leaders or the oligarchy of a politically dominant minority class." From out of this inevitable oligarchy, according to our author, come the decisions we erroneously refer to, as the judgments of the masses, public opinion, or the will of the state.

These propositions are so vital to the interests of all of us as

we aim at the feelings. Thus, the prohibitionist tries to inspire disgust for the saloon. His opponent endeavors to arouse the resentment against 'interference with personal liberty.' "

[27] "This is plainly seen in the debates on the social recognition of negroes, the recognition of the labor unions, the regulation of corporations, the taxation of site values, and women suffrage. In the discussion of vivisection, compulsory vaccination, the segregation of vice, the legal control of prostitution, the census-taking of disease, etc., one side appeals to reason, the other to sentiment."

to warrant a careful examination of some of the countless details brought out to substantiate them in the 400 pages of the book.

Technical, administrative and psychological causes and intellectual factors combine to necessitate the choosing out from the midst of any group recognized leaders to whom large powers must be delegated. "If Peter wrongs Paul it is out of the question that all of the other citizens should hasten to the spot to undertake personal examination of the matter in dispute, and to take the part of Paul against Peter. By parity of reasoning in the modern democratic party it is impossible for the collectivity to undertake the settlement of all the controversies that may arise. Hence the need for delegation, for the system in which delegates represent the mass[28] and carry out its will."

The psychological reasons for leadership are even more important than the technical and administrative reasons. First among these the sentiments which Michels refers to invidiously as the "political gratitude of" and "the cult of veneration among" the masses.

Some of the reasons for this attitude of the led toward the leaders are to be found in the personal qualities of successful leaders, qualities which are not necessarily all assembled in every leader. "Among these, the chief is the force of will which reduces to obedience less powerful wills. Next in importance come the following: A wider extent of knowledge, which impresses the members of the leader's environment; a Catonian strength of conviction, a force of ideas often verging on fanaticism, and which arouses the respect of the masses by its very

[28] "We live in a time in which the idea of co-operation has become so firmly established that even millionaires perceive the necessity of common action. It is easy to understand, then, that organization has become a vital principle in the working class, for in default of it their success is a priori impossible. The refusal of the worker to participate in the collective life of the class cannot fail to entail disastrous consequences. In respect of culture and of economic, physical and physiological conditions, the proletarian is the weakest element of our society. In fact, the isolated member of the working classes is defenseless in the hands of those who are economically stronger. It is only by combination to form a structural aggregate that the proletarians can acquire the faculty of political resistance and attain to a social dignity. The importance and the influence of the working class are directly proportional to its numerical strength. But for the representation of that numerical strength organization and co-ordination are indispensable." (Pp. 21-22.)

intensity; self-sufficiency, even if accompanied by arrogant pride, so long as the leader knows how to make the crowd share his own pride in himself; in exceptional cases, finally, goodness of heart and disinterestedness, qualities which recall in the minds of the crowd the figure of Christ, and reawaken religious sentiments which are decayed but not extinct." "The quality, however, which most of all impresses the crowd is the prestige of celebrity." Moreover, wise decisions can best be made in small groups. "The individual disappears in the multitude, and therewith disappears also personality and sense of responsibility."[29]

All will probably agree as to this need for and value of leaders. As I shall point out later, confidence in leaders can be made the foundation stone in an efficient democracy. But Mr. Michels superposes on the necessity for leadership the doctrine that it is the inevitable tendency for all leaders to become oligarchical, superimposing their will upon the many instead of being the avenue through which the many carry out their will. "The modern party," he says, "is a fighting organization in the political sense of the term, and must as such conform to the laws of tactics. Now the first article of these laws is facility of mobilization." Centralization guarantees the rapid formation of resolutions. "An extensive organization is per se a heavy piece of mechanism, and one difficult to put in operation. A fighting party needs a hierarchical structure. In the absence of such a structure, the party will be comparable to a savage and shapeless negro army, which is unable to withstand a single well-disciplined and well-drilled battalion of European soldiers."

The increase in the power of the leaders "is directly proportional with the extension of the organization. . . . Where organization is stronger we find that there is a lesser degree of

[29] "It is a fact of every-day experience that enormous public meetings commonly carry resolutions by acclamation or by general assent, whilst these same assemblies, if divided into small sections, say, of fifty persons each, would be much more guarded in their assent. Great party congresses, in which are present the elite of the membership, usually act in this way. Words and actions are far less deliberately weighed by the crowd than by the individuals or the little groups of which this crowd is composed. The fact is incontestable —a manifestation of the pathology of the crowd."

applied democracy." "Reduced to its most concise expression, the fundamental sociological law of political parties (the term 'political' being here used in its most comprehensive significance), may be formulated in the following terms: 'It is an organization which gives birth to the dominion of the elected over the electors, of the mandataries over the mandators, of the delegates over the delegators. Who says organization, says oligarchy.' "

Such is the tendency not only in labor unions and socialist parties, for it is the tendencies and events in these organizations which Professor Michels uses as his laboratory material. Everywhere the tendency is for the representative to dominate over the represented.[30]

Upon this hypothesis that the tendency is for leaders to become oligarchical, Mr. Michels builds his next hypothesis, namely: these oligarchical leaders tend toward conservatism and away from responsiveness to the people. He measures liberalizing tendencies with conservative tendencies and finds that the latter will usually prevail.

First and foremost among these liberalizing tendencies is the idealism of the leaders and members of forward looking movements. Not only is there this enthusiasm for the work, but "the average leader of the working-class parties is morally not lower, but on the whole higher in quality than the average leader of the other parties."

Again, the mere fact of universal suffrage requires that the conservative leaders urge solutions and arguments acceptable to democracy. The very fact that this is done, even if it is done to "fool the people," must help to liberalize what is con-

[30] "We are not here concerned, however, with the causation of the oligarchy which prevails in the trade unions. It suffices to point out how little difference exists between the tendencies of proletarian oligarchies and those of such oligarchies as prevail in the life of the state—governments, courts, etc. It is interesting to note that in Germany, as elsewhere, the socialist leaders do not hesitate to admit the existence of a well-developed oligarchy in the trade union movements, while the leaders of the trade unions, in their turn, draw attention to the existence of an oligarchy in the socialist party; both groups of leaders unite, however, in declaring that as far as their own organizations are concerned, these are quite immune to oligarchical infection." (Pp. 146.)

sidered to be safe and sane and wise policies.[31] Solidarity in labor interests is another liberalizing factor.

With this solidarity in interests recognized, the laborers, as a class, can bring to their aid "the compelling power of persuasion." Another liberalizing force of no little importance is the natural tendency for leaders to struggle for ascendency. The very concentration of power and influence because of the oligarchical tendencies of the leaders gives to new leaders or younger leaders an opportunity by championing causes more acceptable to the many to gain for themselves ascendant leadership. This is a psychological fact which we find in America as well as elsewhere. Indeed, the readiness with which leaders in all political parties take advantage of factional fights, through championing popular causes the recognized leaders had been neglecting, to oust the old boss is one of the main forces in industrial and social progress.

Such, to our author, are the chief liberalizing forces. In enumerating the sources that make for conservatism, however, Mr. Michels reaches the conclusion that these forces will outweigh the liberalizing forces.

As a first conservative force he notes the little interest among the masses in public affairs. "The majority is content, with Stirner, to call out to the state, 'Get away from between me and

[31] But let Mr. Michels make this point in his own language. As is his wont, his words are invidious, but they need not conceal the deep significance of the point he is making. "A conservative candidate who should present himself to his electors by declaring to them that he did not regard them as capable of playing an active part in influencing the destinies of the country, and should tell them that for this reason they ought to be deprived of the suffrage, would be a man of incomparable sincerity, but, politically, insane. If he is to find his way into parliament he can do so by one method only. With democratic mien he must descend into the electoral arena, must hail the farmers and agricultural laborers as professional colleagues, and must seek to convince them that their economic and social interests are identical with his own. Thus the aristocrat is constrained to secure his election in virtue of a principle which he does not himself accept, and which in his soul he abhors. His whole being demands authority, the maintenance of a restricted suffrage, the suppression of universal suffrage wherever it exists since it touches his traditional privileges. Nevertheless, since he recognizes that in the democratic epoch by which he has been overwhelmed he stands alone with this political principle, and that by its open advocacy he could never hope to maintain a political party, he dissembles his true thoughts, and howls with the democratic wolves in order to secure the coveted majority." (P 6.)

"The conservative spirit of the old master-caste, however deeply rooted it may be, is forced to assume, at least during times of election, a specious democratic mask." (P. 7.)

the sun!' Stirner makes fun of all those who, in accordance with the views of Kant, preach it to humanity as a 'sacred duty' to take an interest in public affairs. Let those persons who have a personal interest in political changes concern themselves with these. Neither now nor at any future time will 'sacred duty' lead people to trouble themselves about the state, just as it is by 'sacred duty' that they become men of science, artists, etc. Egoism alone can spur people to an interest in public affairs, and will spur them—when matters grow a good deal worse."

Part of this want in interest rises in the fact that oppression is not recognized as such. "For decades, and even for centuries, the masses continue to endure passively outworn political conditions which greatly impede legal and moral progress. . . . The classes, representing a past economic order, continue to maintain their social predominance only because the classes representing the present or future economy have as yet failed to become aware of their strength, of their political and economic importance, and of the wrongs which they suffer at the hands of society. Moreover, a sense of fatalism and a sad conviction of impotence exercise a paralyzing influence in social life. As long as an oppressed class is influenced by this fatalistic spirit, as long as it has failed to develop an adequate sense of social injustice, it is incapable of aspiring towards emancipation. It is not the simple existence of oppressive conditions, but it is the recognition of these conditions by the oppressed, which in the course of history has constituted the prime factor of class struggles."

As important as the indifference of the average individual toward participation in his government is what the author believes to be the universal tendency to conform to "aristocratic prejudice." To illustrate this tendency he refers to the inhabitants of our own country. "The North Americans, democrats," he says, "living under a republican régime and knowing nothing of titles of nobility, by no means delivered themselves from aristocracy when they shook off the power of

the English crown. . . . Even at a time when the youthful democracy and the freedom of America had only just been sealed with the blood of its citizens it was difficult (so we learn from Alexis de Tocqueville) to find a single American who did not plume himself with an idle vanity upon belonging to one of the first families which had colonized American soil. So lively was 'aristocratic prejudice' among these primitive republicans."

Even of more importance than these forces is the fact that, while the interest between the possessing and the non-possessing class seems to be growing wider, the interests between groups of non-possessors are likewise becoming more divergent, with the result that there can be no agreement among the very groups that ought to be the basis of a liberalizing party. "In the contemporary working class there is already manifest a horizontal stratification. Within the quatrième état we see already the movements of the embryonic cinquième état. One of the greatest dangers to the socialist movement, and one which must not be lightly disregarded as impossible, is that gradually there may come into existence a number of different strata of workers, as the outcome of the influence of a general increase of social wealth, in conjunction with the efforts made by the workers themselves to elevate their standard of life. . . . This struggle . . . for the feeding-ground is waged with ever-increasing intensity."

But even if these groups were united they must choose between gaining their immediate ends or gaining a permanent advantage in the distant future, and the inevitable pressure is to sacrifice future possibility for present actuality.

The very difficulty of mobilizing the voters, however, gives to leaders of liberalizing movements a desire to preserve the status quo. "As soon as the new leaders . . . have succeeded (in the name of the injured rights of the anonymous masses) in overthrowing the odious tyranny of their predecessors and in attaining to power in their turn, we see them undergo a transformation which renders them in every respect similar to

the dethroned tyrants. Such metamorphoses as these are plainly recorded throughout history. In the life of monarchical states, an opposition which is headed by hereditary princes is rarely dangerous to the crown as an institution. In like manner the opposition of the aspirants to leadership in a political party, directed against the persons or against the system of the old leaders, is seldom dangerous. The revolutionaries of today become the reactionaries of tomorrow."

After his review of these and similar forces Professor Michels concludes that "The democratic currents of history resemble successive waves. They break ever on the same shoal. They are ever renewed. This enduring spectacle is simultaneously encouraging and depressing. When democracies have gained a certain stage of development, they undergo a gradual transformation, adopting the aristocratic spirit, and in many cases also the aristocratic forms, against which at the outset they struggled so fiercely. Now new accusers arise to denounce the traitors; after an era of glorious combats and of inglorious power, they end by fusing with the old dominant class; whereupon once more they are in their turn attacked by fresh opponents who appeal to the name of democracy. It is probable that this cruel game will continue without end."

It is worthy of note, however, that many of the same arguments used by Mr. Michels can be used just as effectively to prove the possibility of an efficient democracy. The corner stone of any efficient democracy must be the ascendency of leaders—leaders to be sure in whom their respective groups have confidence. Because of this choice of leaders democracy is transformed into a form of government by the best, intellectually, materially and morally. Professor Michels himself admits that "democracy ends by undergoing transformation into a form of government by the best, into an aristocracy. At once materially and morally, the leaders are those who must be regarded as the most capable and the most mature," and he has in mind here labor leaders of labor unions and party leaders of democratic parties.

Moreover, democratic organizations do have permanency and stability in their leaders and permanency in leaders is another essential to efficient democracy. For instance, the Webbs have pointed out that in England the stability of the officials of the labor organizations is superior to those of the employees of Civil Service. This permanency in leadership is made all the more possible and certain when democratic parties are sufficiently well organized to pay their workers.

The real danger seems to lie in overworking leaders rather than in that fickleness of mind which is supposed to characterize great majorities. The fidelity of leaders is also admitted and praised by our author.

It is, therefore, not impossible to unite freedom and authority when those in authority have the confidence of the masses or come from their own numbers. And hence it may be upon these very tendencies that to Professor Michels proves only oligarchical tendencies in democratic organizations that we are to get the sane and wholesome social judgment prerequisite to sustained democracies.

The last word has not been said on this subject. But certainly it is one worthy of more attention by those interested in what government does or does not do and how and why it performs its functions. The actual working structure and the active functions of government must both be based upon the way we collectively make up our minds, whether as groups or communities, and upon the exact process by which our judgments, once reached, are expressed in law and in custom. Like the child who could not see the town for the houses, we have been unable to see the real public judgment-making forces for the details in a busy life.

MUSIC

By Hugh A. Clarke
Professor of the Science of Music

After much thought, I have concluded that the best way in which I can treat of my subject, "Music," is to try to tell you of the changes that have come about in the views of composers and hearers concerning the functions of music, especially the changes that are taking place in our day.

The development of music moved very slowly until the seventeenth century and was confined, almost exclusively, to the development of vocal music. The little instrumental music that existed was composed of dance tunes. These dances were finally collected into suites, ever becoming more elaborate, until finally they gave birth to the sonata form, and "absolute" music came into existence.

One of the most striking characteristics of the early vocal music is the absence, often displayed, of congruity between the words and their musical setting. This is well illustrated by two men, wide asunder as the poles in their musical endowments, Palestrina and Hans Sachs. Palestrina set the Lamentations of Jeremiah to music, including the headings of the chapters. Hans Sachs wrote music to the words, "In Genesis, the ninth and twentieth, you will find how Jacob fled from his brother Esau and escaped."

The requirements of the opera were the chief means in bringing about a change in this respect, especially after the reforms brought about by Gluck in the highly artificial form of the Italian opera.

The conviction took possession of composers that it was the function of music, when united with words, to heighten the expression and the meaning of the words, not to display the acquirements of the singer.

The idea then grew that the instrumental accompaniment of the voices might have some share in expressing the meaning of the words. This union reaches perfection in the work of Mozart, Beethoven, Weber, Mendelssohn, and a few others.

This is a case in which the greater must serve the lesser. It is an easy thing for the orchestra to overwhelm the voice, but in so doing it departs from its proper function.

In our day a new conception of the relative rôles of the voice and the orchestra has grown up, namely, that the main part of the expression belongs to the orchestra, the voice part becoming merely a sort of commentary to help the hearer to an understanding of the orchestra's exposition.

This mistake in the function of the orchestra is, owing to the prevalent belief that has obtained of late, that music can tell a story almost, if not quite, as well as language.

In its crudest form, this belief in the power of music to describe is exhibited in attempts to reproduce natural noises. Nearly all composers, even the greatest, have been misled by this idea—Bach, Haydn, Beethoven. It is easily done, but always with the result of reducing the music to commonplace. It is easy to imitate thunder, with drums and double basses, literally, but what is the analogy between lightning and a squeal from the piccolo?

The chief sponsor for this kind of music, known as program music, was Berlioz, a man of remarkable talents, but not a genius. Liszt was captured by the idea and invented the name of symphonic poem for music of this kind. The name captured the fancy of composers and they all write symphonic poems and ransack mythology and philosophy for titles to their lucubrations.

Someone will say that music must develop, but it does not follow that change and development are synonymous. Change may mean reversion to a more primitive state. The forms used by the great composers were the result of centuries of development. Counterpoint, harmony, not to mention the improvements in the construction of instruments and the skill

of the players, all had to come before the perfecting of the form.

The genius of Haydn, Mozart, Beethoven, found the symphonic form adequate to the expression of their loftiest conceptions, and many succeeding writers, as Brahms, Schumann, Mendelssohn, Dvorak, Tschaikowsky, have things worth saying in this form. The thing is, it requires genius of a high order to fill the form with a worthy content. It is a very much easier task to string together a number of themes, which may be beautiful in themselves, but which are not welded together into a consistent whole.

It may be laid down as an axiom that the chief object of all art is beauty, even when dealing with the most violent actions or emotions. Art, especially the art of music, should make beauty its chief concern. It is well to leave something to the imagination of the hearer. Art gains in effectiveness by this reticence.

Composers should take to heart Hamlet's advice to the actor: "In the very torrent-tempest, and, I may say, whirlwind of passion, you must acquire and beget a temperance that may give it smoothness."

In the tempest and torrent of his passion the modern composer o'erleaps the boundaries of temperance, and has recourse to mere noise and cacophony. He is also always in the extreme in this passion; has apparently forgotten all the milder emotions that used to find expression in music. In his mad search for new effects he has invented a scale of whole tones which sets at defiance every recognized principle of harmony and acoustics; has even invented machines to imitate the noise of wind and thunder, and we are asked to believe that this is development of the art of music.

Music has no power for definition; true, it may be sad, mournful, joyful, martial or may have other emotional characters, but without the program it cannot tell the hearer whether the sadness was caused by the death of a dear friend or by a bad toothache.

In one of his whimsical humors Beethoven wrote at the head of one of his movements in a string quartet, "Rage over the loss of a groschen."

To the receptive hearer good music speaks its own message, to which no amount of commentary may add, but, on the other hand, may darken.

I said a few moments ago that when orchestra and voices were united that the greater should serve the lesser.

The poem in this case should be paramount, and the proper function of the music is to emphasize the meaning of the words, a function which it can perform with irresistible force, but always in the second place.

This raises the question: Is it a gain or the reverse to add, at the end of a symphony, voices to the orchestral mass; does it not put a limit to the otherwise limitless expression of the absolute music; did Beethoven add to the grandeur of the ninth symphony by ending it with Schiller's "Hymn to Joy?" For one, I cannot help feeling that the interest falls off with the entrance of the voices. Mendelssohn was wise, when writing his "Hymn of Praise," in not making the vocal part an integral part of the symphony, but so independent that symphony and cantata may be performed separately.

The desire to be descriptive has brought several conventionalties into music; for example, boats always sail in six-eight time. The mention of horses always necessitates the adoption of rapid triplets in the orchestra, which, unfortunately, do not represent the rhythm of the gallop.

It is a trite saying that the character of a race is reflected in its folksong, but it must be a homogeneous race; without this homogeneity no true folksong can exist. All genuine folksong came into existence before the great world movements took place that have, in great measure, modified the character of all races. I think that this lack of homogeneity is a sufficient answer to the question, Have we, or will we ever have, an American folksong?

If, for a thousand years we stop the influx of immigrants

from every race on the face of the earth, a homogeneous American race might be developed, and an American folk-music. But even so, we might miss it. Folk-music had its origin before people were sophisticated by knowledge, but modern facilities for intercommunication are such that any new thing that makes its appearance in art, soon spreads all over the world and does its part in modifying existing views.

The statement is often made that the great composers drew largely from the national folksong in the writing of their most important works; but it is nearer the truth to say that the national characteristics that caused the folksong are reproduced in the great composer.

Thus German seriousness, French gaity and Italian sensuousness have all received their most perfect expression in the music of the great composers of these nationalities.

True, many modern composers avowedly make use of folksong, but this is done with a deliberate purpose.

Another much debated question is, Shall we ever have an American School of Composition? It is possible, but not probable, for the reason given, viz.: the lack of homogeneity, if my contention is true, that the great composer is just the supreme illustration of the characteristics of his race.

True, some supreme genius may arise who can cut himself loose from all that has been done in music, and reveal to us some undreamed of avatar of beauty in the art of music.

For the present, we have every reason to be content with the work our ever increasing list of composers is producing; this work is of necessity eclectic, but none the less valuable on that account.

In conclusion, a word may be said in defense of modernism. It has enlarged the boundaries and swept away some of the pedantries that hampered music, and when time has sifted out its extravagancies it may prepare the way for the coming of the longed for great composer who has a new message to deliver.

PARACELSUS

By Thomas Potter McCutcheon, Jr.
Assistant Professor of Chemistry

The authority of the past has little weight with the workers in the modern sciences. The entire structure of chemistry: theories, methods, results, obtained by the most painstaking experimentation, even the fundamentals, such as the atomic and molecular hypotheses, are subject to constant scrutiny, revision and amendment. The scientist cares little who said this or that, if only he may be able to attain a closer approximation to the truth.

On the other hand, the study of the development of a science from the historical standpoint has definite value; is indeed indispensable to one who would do serious work. No one can understand and appreciate the tendencies and movements in scientific research today until he has acquired a thorough knowledge of the origin and growth of these same tendencies and movements by a patient and laborious perusal of the literature of his specialty. And the study of the past, with its stories of difficulties overcome and epoch-making discoveries achieved in the face of apparently insurmountable difficulties, sends the student back to his own work with a new enthusiasm and a sobering sense of his own responsibilities and possibilities.

With these thoughts in mind, I have ventured to ask you to consider with me a period lying near the beginning of the sixteenth century when, properly speaking, there was no science of chemistry, but only an art of alchemy and magic. In order to focus these remarks, I have chosen the name of Paracelsus, because he stands forth as the most famous and interesting, if the most perplexing and incomprehensible, exponent of the Hermetic art, and because his life and work seem to mark a

distinct and important epoch. In what follows I shall attempt to set forth briefly, the life, beliefs and teachings of a medieval chemist.

The materials for a life of Paracelsus are not too plentiful and often of more than doubtful authenticity. The generally accepted story is as follows: Phillipus Aureolus Theophrastus Paracelsus, Bombast of Hohenheim (as he characterized himself), was born in 1493 in Einsiedeln, a small town not far from Zürich, and still the object of pious pilgrimages. "Paracelsus" was assumed to indicate his superiority to Celsus, the reputed physician of antiquity, and the title Bombast of Hohenheim, indicating connection with a noble family residing for many generations at the Castle of Hohenheim near Stuttgart, may be merely a romance.

His father was a physician of repute and gave him the rudiments of an education. Entering the University of Basle at the age of sixteen, he pursued the study of alchemy, surgery and medicine. His education was continued under the celebrated Johann Trithemius of Spanheim, Abbot of St. Jacob at Würzburg, one of the greatest adepts in alchemy, astrology and magic, and from him he received his initiation and training in the pursuit of the occult.

There is little reason to believe that Paracelsus profited from the learning current at the universities of his day. Although he tells us in the preface to the Chirurgia Magna that he visited the universities of Germany, France and Italy, and assures us that he was the bright ornament of these institutions, there is no evidence that he ever received a degree.

On the contrary he often poured reproach and contempt upon the academicians and all their works:

"The knowledge to which we are entitled is not confined within the limits of our own country, and does not run after us, but waits until we go in search of it. No one becomes a master of practical experience in his own house, neither will he find a teacher of the secrets of nature in the corners of his room. Those who remain at home may live more comfortably,

and grow richer than those who wander about, but I neither desire to live comfortably nor do I wish to become rich. Happiness is better than riches, and happy is he who wanders about, possessing nothing that requires his care. He who wants to study the book of Nature must wander with his feet over its leaves. Books are studied by looking at the letters which they contain; Nature is studied by examining the contents of her treasure vaults in every country. Every part of the world represents a page in the book of Nature, and all the pages together form the book that contains her great revelations."

Accordingly, for ten years he became a wanderer on the face of the earth. A somewhat extended visit to the mines and laboratory of the wealthy Sigismund Fugger, in the Tyrol, gave him first hand acquaintance with the mineralogy and practical metallurgy of his day. While it was rumored that weightier matters occupied much of their time, the great secret of transmutation being the object of their labors. Spain, Portugal, England, Germany, Sweden, Russia, were visited, and he is even said to have penetrated to Tartary and India, where the great masters and adepts unfolded to him the esoteric learning of the East, and finally, on coming to Constantinople in 1521, he received the Philosopher's Stone. It is at least certain that he received valuable information from sources that his learned contemporaries largely overlooked. He had not only associated with physicians, surgeons and alchemists, but also had consorted with executioners, barbers, shepherds, Jews, gipsies, midwives, fortune-tellers, teamsters and vagabonds. He confessed that he had not opened a book in ten years.

"I began to study my art by imagining that there was not a single teacher in the world capable of teaching it to me, but that I had to acquire it myself. It was the book of Nature, written by the finger of God, which I studied—not those of the scribblers, for each scribbler writes down the rubbish that may be found in his head; and who can sift the true from the false? My accusers claim that I have not entered the temple

of knowledge through the 'legitimate door.' But which one is the truly legitimate door? Galenus and Avicenna or Nature? I have entered through the door of Nature; her light and not the lamp of an apothecary's shop, has illuminated my way."

Meanwhile his fame as an authority in all matters pertaining to magic, alchemy and medicine grew apace. It was noised abroad that he had performed marvelous cures and that he accepted and successfully treated cases abandoned as hopeless by the most eminent physicians. His return to Switzerland, in 1525, was in the nature of a triumph, and two years later the City Council appointed him professor of physic, medicine and surgery at the University of Basel. His first lectures produced a tremendous sensation and were thronged by crowds of enthusiastic students. This can be readily understood when we learn that he violated an immemorial tradition by discarding the Latin language, then the vehicle of communication in all learned circles, and addressed his hearers in the rude but vigorous Swiss-German dialect. To make certain that the break with the past was complete, he publicly burned the treatises of Galen and Avicenna, the renowned physicians of antiquity, in a brazen dish.

"After me, ye, Avicenna, Galenus, Rhases, Montagnana and others! You after me, not I after you, ye of Paris, Montpellier, Suevia, Meissen and Cologne, ye of Vienna and all that come from the countries along the Danube and Rhine. It is not for me to follow you, because mine is the monarchy. Come out of the night of the mind! The time will come when none of you shall remain in his dark corner who will not be an object of contempt to the world, because I shall be the monarch, and the monarchy will be mine."

The lectures of the professors of medicine in the Middle Ages were almost entirely repetitions of and disquisitions upon the doctrines and opinions of the ancient worthies, whose names I have already mentioned. Paracelsus insisted that his students must go to Nature and study her operations. In the hospitals, by the side of the sick and the dying, by the obser-

vation of the effects of mineral and plant essences upon patients, by a thorough knowledge of the processes going on in the human body; from such sources was the truth to be won by hard and persevering labor. In the course of an address to his colleagues, he uncovered a dish containing some of the waste products of the human metabolism. The assembled doctors regarded this act as an insult to their dignity and departed precipitately. "If you will not hear the mysteries of putrefactive fermentation, you are unworthy of the name of physicians," were the words hurled after them by Paracelsus. The chemists and medical men of our own time have heeded the advice of the Great Hermetic Physician, and have studied these same despised decomposition products very closely. No field of physiological chemistry has yielded richer results than that of the nitrogenous substances and the compounds resulting from their disintegration, found in the animal body, and within a decade Emil Fischer has been able to gain a clear insight into the nature of these bodies and even to synthesize in his laboratory, compounds which closely resemble albumen in composition and complexity.

In a word, Paracelsus taught a laboratory method, and in this aspect his spirit was very modern. Probably very few of his remedies are now to be found in the pharmacopeia, and his theories, shot through as they doubtless were, with mysticism and superstitition, have long since rested in oblivion; but whenever men acted upon his advice and experimented with their own hands and framed their own conclusions, then they have been treading the paths which have led, after many windings, to the Temple of Modern Science.

You will understand that the stay of Paracelsus in Basle was not monotonous, but very brief. He began by deriding the medical profession and continued by securing the passage of an act designed to prevent adulterations of drugs, to the great detriment of all dealers in this class of goods. Having thoroughly aroused the animosity of all the branches of the healing art, he increased the displeasure of the City Fathers

by insisting on the payment of a fee by a certain rich man, high in political life, whom he had saved from death. He was forced to leave the city secretly and by night to avoid unpleasant complications.

This disgraceful affair occurred in July, 1528, and Paracelsus again resumed the wandering life, often followed by many disciples and gaining new fame by his cures. In 1530 he visited Nürnburg and was denounced as a charlatan and impostor. He requested the City Council to place some incurable patients at his disposal that he might refute these accusations. He was able to cure some of elephantiasis in a short time, and thoroughly vindicated himself. It is said that documents witnessing to these things may still be seen in the archives of the city.

He was still fated to be a wanderer and records exist of his visits to Munich, Regensburg, Prag, Zürich and many other places. Finally he was invited to Salzburg by the Duke Ernst of Bavaria, and there found a final rest from his travels.

But not for long. On the 24th of September, 1541, he died, after a short illness, at the age of forty-eight years, and was buried in the graveyard of St. Sebastian, where his monument may still be seen.

> "How very full
> Of wormwood 'tis, that just at altar service,
> The rapt hymn rising with the altar smoke,
> When glory dawns and all is at the best,
> The sacred fire may flicker and grow faint
> And die for want of a wood-piler's help!
> Thus fades the flagging body, and the soul
> Is pulled down in the overthrow."

The accounts of his death are conflicting, a frequently repeated version being that he was set upon by some ruffians in the pay of certain medical men who were jealous of his success, and that death resulted from a fracture of the skull.

How shall we estimate the character of this man and what witnesses shall we call in to establish the truth? A breaker of idols of the past, a fearless antagonist, a ruthless violator of

convention, a man to whom nothing was common or unclean, with an unbounded faith in himself, it was certain that he would stir up enemies at every step and his foes did not hesitate to pour forth the phials of wrath upon him. He has been called an impostor and charlatan, a mountebank, swollen with pride and conceit, a dealer in necromancy and the black arts, in the practice of which he was aided by his familiar spirit, whom he always carried about with him, securely imprisoned in the hilt of his long sword. In the words of Hudibras:

> "Bumbastus kept a devil's bird
> Shut in the pummel of his sword,
> That taught him all the cunning pranks
> Of past and future mountebanks."

A more grievous indictment was that of habitual overindulgence in alcoholic stimulants. It is told to his discredit that he never ventured to lecture when sober, and that he spent his nights in pot-houses, carousing with the "scum of mankind."

It has always seemed to me that the enormous number, as well as the general quality, of his literary productions, was a sufficient refutation of the charge of drunkenness. The English translations of his writings on alchemy alone fill two large volumes, while the general edition published at Cologne, in 1590, comprised fifty treatises on medicine, eight on natural history and philosophy, twenty-five on magic and fourteen on various subjects.

These writings are by no means of easy interpretation. They are full of highly technical expressions, found only in works on alchemy, and only one thoroughly trained in the language and thought of mysticism, Kabalism and Neo-Platonism could hope to gain a more than superficial knowledge of their contents. They impress one as anything but the ravings of a diseased mind, and the method of writing, so that he who reads may not understand, is common enough among mystics. Here and there sentences are intelligible enough:

> "No temple is ever built where the devil does not have his chapel:
> No chapel where he has not his altar."

"The true and effective power against all evil spirits is the will. If we love the source of all good with all our heart, mind and desire, we may be sure never to fall into the power of evil; but priestly ceremonies—the sprinkling of water, the burning of incense and the singing of incantations—are the inventions of clerical vanity, and they, therefore, take their origin from the source of all evil."

"When every simpleton is made a doctor and every trifler poses as a chemist, this accounts for science not being brought out into the open light."

"A man who wholly belongs to himself cannot belong to anything else. Man has power of self-control and no external influence can control him if he exercises this power."

"Ah, Charles the German, where is your treasure? Where are your philosophers? Where your doctors? Is your heaven reversed? Have your stars wandered out of their course, and are they straying in another orbit since your eyes are smitten with blindness? If your artists only knew that their prince Galen was sticking in hell, from whence he has sent letters to me, they would make the sign of the cross upon themselves with a fox's tail."

"Lo then, you wormy and lousy Sophist, since you deem the monarch of Arcana a mere ignorant, fatuous and ignorant quack, I determine in my present treatise to disclose the honorable course of procedure in these matters, the virtue and preparation of the celebrated Tincture of Philosophers, for the use and honor of all who love the truth."

Paracelsus has not lacked defenders and ardent admirers. His generosity was even admitted by his enemies. He treated hundreds of cases among the poor without exacting the smallest fee. He was free from any desire for wealth and no charges of immorality have been brought against him. We are assured that his seemingly egotistical and self-laudatory speeches were the language of inspiration. Nominally a member of the Church, he never concerned himself greatly with ecclesiastical matters, although he once declared that he would have gone

further with reform than Luther. He is an interesting example of the class of mystics or theosophists known as Neo-Platonists, and believed that it is possible for the human soul to unite itself directly with the Divine Center of the Universe and derive its wisdom from that source. Consequently, he paid little attention to outward aids and observances.

> "There is an inmost center in us all,
> Where truth abides in fullness; and around
> Wall upon wall, the gross flesh hems it in,
> This perfect, clear perception—which is truth.
> A baffling and perverting carnal mesh
> Binds it, and makes all error: and to Know
> Rather consists in opening out a way
> Whence the imprisoned splendour may escape,
> Than in effecting entry for a light
> Supposed to be without."

Let us admit then that any final appraisement of the character of Paracelsus is rendered impossible by the contradictory nature of the materials at our disposal, and try rather to learn something of his curious theories and beliefs, his chemical knowledge and methods, and perhaps a glimpse of his medical system. To this end I must tell you something of magic and alchemy. By magic we understand, not the vulgar art of conjuring, but the ancient and transcendental science, which promised to its initiates an exact and absolute knowledge of Nature and her laws, complete illumination, perfect wisdom and powers essentially divine.

This was the science and religion of Zoroaster and the Magi, the fire-worshipers of the East, who were familiar with the secrets of the Astral Light and able even to chain the more material lightning and transmit the electric current in ways now unknown. A modern writer on magic says:

"Let us now reconstruct in thought the great metropolitan cities of Assyria, Babylon and Nineveh; let us restore to their proper place the granite colossi; let us formulate the massive temples, held up by high elephants and sphinxes; let us raise once more those obelisks from which dragons look down with

shining eyes and wings outspread. Temples and palaces tower above these wondrous piles. Forever concealed, but manifested also forever by the fact of their miracles, the priesthood and the royalty, like visible divinities of earth, abide therein. The temple is surrounded with clouds or glows with supernatural brilliance at the will of the priests; now it is dark in the daylight and again the night is enlightened, the lamps of the temple spring of themselves into flame; the gods are radiant; the thunders roll, and woe to that impious person who may have invoked on his own head the malediction of the initiates. He is slain as if by the bolt, blasted by fire from heaven. What religion and what power! How mighty are the shadows of Nimrod, of Belus, of Semiramis. What mysteries have been put to sleep in these sepulchres of past nations; and are we better than children when we exalt our enlightenment and our progress without recalling these startling memorials?"

This was the knowledge that Abraham carried with him from Babylonia and transmitted by the Hebrews to Egypt; it became the Secret Service of the brotherhoods and priesthood of that country, whose ruined temples still suffice to inspire awe in the beholder.

From Egypt Moses carried the knowledge with him and the Jewish Priesthood became its repository, where it crystallized in the form of a body of secret doctrine, handed down by word of mouth, and known as the Kabala. And here it will be well to pause a moment and glance at the meaning of this term, for Paracelsus was a thoroughgoing Kabalist. "The first duty of a physician is to study the Kabala, without which he must every moment commit a thousand blunders." "Learn the Kabalistic Art, which includes under it all others."

The Kabala was an esoteric and mystical method of interpretation of the Hebrew Scriptures, based on symbology and employing numerical devices for the solution of cyphers that were held to abound in such books as Ezekiel and Daniel. The philosophy of the Kabalists was essentially pantheistic

and, in common with magic, it claimed for its initiates power to exact obedience from all natural forces and ability to communicate with spirits of all grades. These powers were conferred when the initiate had learned to pronounce correctly the names of the Deity, said to be seventy-two in number, and this art was known as the Keys of Solomon. The origin of this curious system is lost in antiquity, and the tradition that it was communicated to Adam will be as acceptable as another. A detailed discussion of magic would be out of place in this hour. In Greece the legends of Orpheus and Jason, the Eleusinian Mysteries, and the mathematical system of Pythagoras might be studied with profit in this connection, in Rome, in India, with its systems of breathing exercises and autohypnotic methods of inducing a state of ecstasy, in Medieval Europe, among savage races, in every land and among all peoples the student of the occult arts can find his materials.

An especially interesting example of this tendency in historical times occurred in Alexandria in the third century, where the followers of Plato made practically the last stand for paganism against Christianity. Hypatia, the daughter of Theon, was the most brilliant and touching personality of this epoch, and her story and its ending are familiar to everyone. This school, known as the Neo-Platonic, numbered certain eminent churchmen among its followers, among others Synesius of Cyrene, who successfully combined a lovable personality, a knowledge of pagan lore and strong Kabalistic tendencies with his ecclesiastical duties. The Neo-Platonists achieved a synthesis of Kabalism, Magic, Platonic doctrines, much paganism and Christianity, and we may safely assign to Paracelsus a place in their ranks.

You will now be able to understand the statement that Paracelsus claimed to be an adept in magic and an initiate of the higher mysteries. And by this initiation you will understand, not a mere ceremonial initiation such as is conferred today by Freemasonry with its elaborate rites, based, as some claim, on the ritual of the ancient brotherhoods, but the

attainment of powers transcending the human. I will leave it to your own judgment to decide whether such a science ever existed. Its critical discussion properly belongs to the student of the history of human thought, and not to a chemist.

The ban has long since been pronounced against all practices of the occult arts, but they still make a powerful appeal, and the human eye is incurably eager to look upon Isis, veiled or unveiled.

Let us turn to the somewhat more tangible subject of Alchemy. The earliest extant writings on this subject were found during the excavation of a home of a magician in Thebes and now rest in the Library of the Museum of Leyden. There Berthelot, the eminent French chemist, found over a hundred manuscripts written on papyrus, twenty-four on linen and one on leather. Some of these MSS. are written in Egyptian with a Greek interlinear, three are bilingual and twenty are in Greek alone. Berthelot transcribed and copied with great pains those of greatest interest, and gave them to the world in several interesting and valuable volumes. These MSS. relate to magic, astrology and alchemy, and seem to be similar to the books on magic which were destroyed according to the account in the Book of Acts, and to the collection burned by the Emperor Diocletian. Three treatises relate especially to alchemy. In them we find the symbol of the serpent biting its tail, well known in the alchemistic writings; magic alphabets; the symbols of the sun and the moon applied to plants and to gold and silver. Gnostic ideas prevail. Lead, tin, copper, silver and gold are mentioned, and much space is devoted to alloys. Still more interesting to us, the multiplication and fraudulent imitation of gold is specifically described, and twenty receipts given for carrying out the process. Tin, copper, iron and mercury are employed, and in two descriptions a dose of asemon (an alloy of silver and gold) is added as a ferment. Beyond question this is the most ancient treatise on alchemy, and proves beyond question that the art of making gold was

practised in the third century A. D. and flourished in Alexandria and the adjacent parts of Egypt for several centuries.

Where, then, shall we look for the beginnings of the chemical science? Berthelot says:

"Chemistry is not a primitive science like geometry and astronomy; it is constructed from the débris of a previous scientific formation; a formation half chimerical and half positive, itself found on the treasure slowly amassed by the practical discoveries of metallurgy, medicine, industry and domestic economy. It has to do with alchemy, which pretended to enrich its adepts by teaching them to manufacture gold and silver, to shield them from diseases by the preparation of the panacea, and, finally, to obtain for them perfect felicity by identifying them with the soul of the world and the universal spirit."

The alchemists did not hesitate to assign a more definite origin to their art. Zosimos, of Alexandria, assures us that the Sacred Scriptures tell of a tribe of angels who were led astray by women in days of old, and captivated by their betrayers. "Taught them all the operations of nature. Offence being taken at this, they remained out of Heaven because they had taught mankind all manner of evil and things which could not be advantageous to their souls. Chema is the first of their traditions respecting these arts. The book itself they call Chema, hence their art is called Chemia."

The passage referred to is found in the sixth chapter of Genesis:

"And it came to pass, when men began to multiply on the face of the earth, and daughters were born unto them, that the sons of God saw the daughters of men, that they were fair: and they took them wives of all that they chose."

Let us look more closely at the alchemical doctrines and see what grounds Paracelsus had for his belief in the possibility of transmutation and other marvels. And let me remind you in passing that the ignoble greed for gain was not the only motive that inspired the search for the "Great Medicine,"

although it is to be feared that not all the alchemists attained the lofty ideals of one of their number, who said: "Would to God that all men might become adepts in our art, for the gold, the great idol of mankind, would lose its value and we should prize it only for its scientific teaching."

In the writings of Paracelsus are found constant references to the name of Hermes Trismegistos—the Thrice Great, whose name is still a commonplace under such guises as "hermetic." This admirable person is alleged to have flourished in Egypt in very early times, and to have been an arch-adept in magic and master of all who followed the alchemical art. Alexander the Great was fortunate enough to discover his tomb, and on opening it found within a tablet made of emerald, on which was an inscription cut with a sharp instrument in Phoenician characters. While it is true that some doubt is cast on this story by the fact that the earliest version of the inscription is found in a Latin translation of about the seventh century A. D., it gives such an admirable idea of the alchemistic style of composition that I will read it in full:

1. I speak not fictitious things, but what is true and most certain.

2. What is below is like that which is above, and what is above is similar to that which is below, to accomplish the miracles of one thing.

3. And all things were produced by the meditation of one being, so all things were produced from this one thing by adaptation.

4. Its Father is Sol; its Mother Luna; the wind carried it in its belly, the earth is its nurse.

5. It is the cause of all perfection throughout the whole world.

6. Its power is perfect, if it be changed into earth.

7. Separate the earth from the fire, the subtile from the gross, acting prudently and with judgment.

8. Ascend with the greatest sagacity from the earth to heaven, and then descend again to earth, and unite together

the powers of things superior and things inferior. Thus you will possess the glory of the whole world; and all osbcurity will fly far away from you.

9. This thing has more fortitude than fortitude itself; because it will overcome every subtle thing, and penetrate every solid thing.

10. By it this world was formed.

11. Hence proceed wonderful things, which in this wise were established.

12. For this reason I am called Hermes Trismegistos, because I possess three parts of the philosophy of the whole world.

13. What I had to say about the operation of Sol is completed.

The line just quoted—"What is above is as that which is below, and what is below is as that which is above," may be regarded as the fundamental axiom, an epitome of alchemy.

"This natural world is only an image and material copy of a heavenly and spiritual pattern; the very existence of this world is based upon the reality of its celestial archetype. Thus the sage sees heaven reflected in nature as in a mirror, and he pursues this art, not for the sake of gold or silver, but for the love of the knowledge which it reveals; he jealously conceals it from the sinner and the scornful, lest the mysteries of heaven should be laid bare to the vulgar gaze."

The alchemists believed in the unity of the universe, and the derivation of matter from a primary form was a corollary. This concept has appealed to men in all ages, and many eminent modern scientists have been attracted by it although Mendelyeff speaks contemptuously of the time when "it was convenient to admit the existence of many gods and a unique matter."

The essential unity of matter being postulated, it was but a step to the belief that one kind could be transformed into another. Beneath the various forms which substances assume, there must lie an unchangeable essence. To find this secret unit was the quest of alchemy. Most of the changes we notice

were regarded as affecting only the superficial wrappings of this hidden entity. Water, air, earth and fire were considered the more closely clinging vestments. Cold, heat, moisture, dryness, were coverings more easily removed. Stephanus, of Alexandria, said, "It is necessary to deprive matter of its qualities in order to draw out its soul." Substances were things in themselves, distinct from their properties. The goal was attained when the principles common to many substances had been removed and the one thing, the heavenly rain, the water of paradise, the virgin and blessed water of the old dragon appeared. Then the adept had in his grasp the Stone of Wisdom, "youthful and ancient, weak and strong, life and death, visible and invisible, hard and soft, most high and most low, light and heavy." All transmutations were possible, the keys of life and death were in his hand.

We must avoid confusing the elements of the alchemist with modern theories like the Atomic Hypothesis of Dalton. Sulphur and mercury played an important rôle as elements in the Middle Ages. The elementary sulphur and mercury, of which the metals were believed to be composed, were not the elements now designated by those names, forms of matter, which have not been simplified, but rather principles or properties, which can be removed or added. We shall not be far wrong in saying that sulphur was the principle of combustibility and also of color, and was thought to be present in metals because most of them can be changed into earthy substances by the action of fire; and that mercury represented the metallic principle par excellence and conferred fusibility, malleability and lustre. An excess of sulphur was the cause of the imperfections of the baser metals, while the isolation of the "philosophical mercury" was held to be essential for the attainment of the "magnum opus." A third element, "salt," was added later, this being the principle of fixity and solidification and endowed substances with the power to resist fire. The sulphur-mercury-salt theory was energetically supported by Paracelsus and won a large following.

I must not omit to point out that alchemy was closely associated with astrology (a logical consequence of the theory of the unity of the cosmos). The growth of each metal was presided over by a particular planet, and times and seasons were scrupulously observed in executing alchemical operations. Thus gold was ruled by the sun, silver by the moon, copper by Venus, and the symbols of the planets were generally used to represent the metals in hermetic treatises.

The stars in their courses hastened or retarded the growth and perfection of the metals in the bowels of the earth, and the medium through which the alchemists sought to assist nature in her operations was the Philosopher's Stone. Unfortunately the nature of this admirable and enigmatical substance has been so carefully guarded by the few who were let into the secret, that I can offer you very few particulars as to its nature. All the alchemists assure us that a very small quantity of the "Medicine" could transmute a very large amount of the base metal. A chemist might think of it as a catalytic agent. It was confidently asserted that one part of this "precious medicine" would change a million parts of mercury into gold—"better than gold from the mines." It was generally described as a glassy substance of a pale yellow color. Let me give you a method for its preparation which, in the hands of a person of the requisite spiritual endowment, is said to lead infallibly to the desired result.

Process for making Philosopher's Stone, *Bibliotheca Chemica:*

1. Prepare a quantity of spirit of wine, so free from water that it is wholly combustible, and so volatile that when a drop of it is let fall it evaporates before it reaches the ground. This constitutes the first menstruum.

2. Take pure mercury, revivified in the usual manner from cinnabar; put it into a glass vessel with common salt and distilled vinegar; agitate violently, and when the vinegar acquires a black color pour it off and add new vinegar; agitate again, and continue these repeated agitations and additions

until the vinegar ceases to acquire a black color from the mercury; the mercury is now quite pure and very brilliant.

3. Take of this mercury four parts; of sublimed mercury, prepared with your own hands, eight parts; triturate them together in a wooden mortar with a wooden pestle, till all the grains of running mercury disappear. This process is tedious and rather difficult.

4. The mixture thus prepared is to be put into an aludel or sand-bath, and exposed to a subliming heat, which is to be gradually raised till the whole sublimes. Collect the sublimed matter, put it again into the aludel, and sublime a second time; this process must be repeated five times. Thus a very sweet and crystallized sublimate is obtained; it constitutes the salt of wise men, and possesses wonderful properties.

5. Grind it in a wooden mortar, and reduce it to a powder; put it into a glass retort and pour upon it the spirit of wine (No. 1) till it stands about three fingers' breadth above the powder; seal the retort hermetically, and expose it to a very gentle heat for seventy-four hours, shaking it several times a day; then distil with a gentle heat and the spirit of wine will pass over, together with the spirit of mercury. Keep this in a well-stoppered bottle, lest it should evaporate. More spirit of wine is to be poured on the residual salt, and after digestion it must be distilled off as before, and this process must be repeated till the whole salt is dissolved and distilled over with the spirit of wine. You have now performed a great work. The mercury is now rendered in some measure volatile, and it will gradually become fit to receive the tincture of gold and silver. Now return thanks to God who has hitherto crowned your wonderful work with success; nor is this great work involved in Cimmerian darkness, but clearer than the sun, though preceding writers have imposed upon us with fables, hieroglyphics and enigmas.

6. Take this mercurial spirit, which contains our magical steel in its belly, put it into a glass retort to which a receiver must be well and carefully luted; draw off the spirit by a very

gentle heat, there will remain in the bottom of the retort the quintessence or soul of mercury; this is to be sublimed by applying a stronger heat to the retort that it may become volatile. This is our fountain, our luna, in which the king and queen may bathe. Preserve this precious quintessence of mercury, which is very volatile, in a well-shut vessel for further use.

7. Let us proceed now to the operation of common gold, which we shall communicate clearly and distinctly, without digression or obscurity; then from vulgar gold we may obtain philosophical gold, just as from common mercury we obtained, by the preceding processes, philosophical mercury.

In the name of God then, take common gold, purified in the usual manner by antimony, convert it into small grains, which must be washed with salt and vinegar till it be quite pure. Take one part of this gold and pour on it three parts of the quintessence of mercury; as philosophers reckon from seven to ten, so we also reckon our number as philosophical, and we begin with three and one; let them be married together like husband and wife, to produce children of their own kind, and you will see the common gold sink and plainly dissolve. Now the marriage is consummated; now two things are converted into one; thus the philosophical sulphur is at hand, as the philosophers say, the sulphur being dissolved the stone is at hand. Take, then, in the name of God, our philosophical vessel, in which the king and queen embrace each other as in a bed chamber, and leave it until the water is converted into earth, then peace is concluded between water and fire, then the elements have no longer anything contrary to each other; because when the elements are converted into earth they no longer oppose each other, for in earth all elements are at rest. For the philosophers say, "When you shall have seen the water coagulate itself, think that your knowledge is true, and that your operations are truly philosophical." The gold is now no longer common, but ours is philosophical on account of our processes: at first exceecingly fixed, then exceedingly

volatile, and finally exceedingly fixed, and the whole science depends upon the change of the elements. The gold at first was a metal, now it is a sulphur, capable of converting all metals into its own sulphur. Now our tincture is wholly converted into sulphur, which possesses the energy of curing all diseases: this is our universal medicine against all the most deplorable diseases of the human body; therefore return infinite thanks to Almighty God for all the good things which he has bestowed upon us.

9. In this great work of ours two modes of fermenting and projecting are wanting, without which the uninitiated will not easily follow our process. The mode of fermenting is as follows: Take of our sulphur above described one part, and project it upon three parts of very fine gold fused in a furnace; in a moment you will see the gold, by the force of the sulphur, converted into red sulphur of an inferior quality to the first sulphur; take one part of this and project it upon three parts of fused gold, the whole will be again converted into a sulphur or a friable mass; mixing one part of this with three parts of gold, you will have a malleable and extensible metal. If you find it so, well; if not add other sulphur and it will again pass into sulphur. Now the sulphur will be sufficiently fermented or our medicine will be brought into a metallic nature.

10. The mode of projecting is this: Take of the fermented sulphur one part and project it upon ten parts of mercury, heated in a crucible, and you will have a perfect metal; if its color is not sufficiently deep, fuse it again and add more fermented sulphur, and thus it will acquire color. If it becomes frangible, add a sufficient quantity of mercury and it will be perfect.

Thus, friend, you have a description of the universal medicine, not only for curing diseases and prolonging life, but also for transmuting all metals into gold. Give, therefore, thanks to Almighty God who, taking pity on human calamities, has

at last revealed this inestimable treasure, and made it known for the common benefit of all.

In addition to recipes like the above, which occur frequently enough in the writings of Paracelsus and many other alchemical writers, full of hard sayings and utterly impossible of experimental execution, if we are to understand them in anything like a literal sense, many interesting accounts have come down to us of transformations carried out in the presence of reputable witnesses and vouched for by men who combined a reputation for honesty with a scientific training. Let me retell one of these old stories, the speaker being a doctor of medicine and physician to the Court at the Hague:

"On the 27 December, 1666, in the forenoon, there came to my house a certain man, who was a complete stranger to me, but of an honest, grave countenance, and an authoritative mien, clothed in a simple garb like that of a Mennonite.

"After we had exchanged salutations, he asked me whether he might have some conversation with me. He wished to say something to me about the pyrotechnic art, as he had read one of my tracts, in which I hinted a suspicion whether the great Arcanum of the Sages was not, after all, a gigantic hoax. He, therefore, took that opportunity of asking me whether I could not believe that such a grand mystery might exist in the nature of things, by means of which a physician might restore any patient whose vitals were not irreparably destroyed. I answered: 'Such a medicine would be a most desirable acquisition for any physician: nor can any man tell how many secrets there may be hidden in Nature; yet, though I have read much about the truth of this art, it has never been my good fortune to meet with a real Master of the Alchemical Science.' I also inquired whether he was a medical man. In reply he described himself as a brass-founder. After some further conversation the artist Elias (for it was he) thus addressed me: 'Since you have read so much in the works of the alchemists about this stone, its substance, its color and its wonderful effects, may I be allowed the question, whether you have not

yourself prepared it?' On my answering his question in the negative, he took out of his bag a cunningly worked box, in which there were three large pieces of a substance resembling glass, or pale sulphur, and informed me that here was enough of the tincture for the production of twenty tons of gold. When I had held the precious treasure in my hand for a quarter of an hour (during which time I listened to a recital of its wonderful curative properties), I was compelled to restore it to its owner, which I could not help doing with a certain degree of reluctance. After thanking him for his kindness in showing it to me, I then asked him how it was that his stone did not display that ruby color which I had been taught to regard as characteristic of the Philosopher's Stone. He replied that the color made no difference, and that the substance was sufficiently mature for all practical purposes. My request that he give me a piece of his stone (though it were no larger than a coriander seed) he somewhat brusquely refused, adding, in a milder tone, that he could not give it me for all the wealth I possessed, and that not on account of its great preciousness, but for some other reason which it was not lawful for him to divulge.

"When my strange visitor had concluded his narrative, I besought him to give me a proof of his assertion by performing the transmutatory operation on some metals in my presence. He answered, evasively, that he could not do so then, but that he would return in three weeks and that, if he then was at liberty to do so, he would show me something that would make me open my eyes. He appeared punctually to the promised day, and invited me to take a walk with him, in the course of which we discoursed profoundly on the secrets of Nature in fire, though I noticed that my companion was very chary in imparting information about the Grand Arcanum. At last I asked him point blank to show me the transmutation of the metals. I besought him to come and dine with me, and to spend the night at my house. I entreated, I expostulated, but in vain. He remained firm. I reminded him of his promise. He retorted that his promise had been conditional

upon his being permitted to reveal the secret to me. At last, however, I prevailed upon him to give me a piece of his precious stone—a piece no larger than a grain of rape seed. He delivered it to me as if it were the most princely donation in the world. Upon my uttering a doubt whether it would be sufficient to tinge more than four grains of lead, he eagerly demanded it back. I complied in the hope that he would exchange it for a larger piece; instead of which he divided it in two with his thumb, threw away one-half and gave me back the other, saying, 'Even now it is sufficient for you.' Then I was still more heavily disappointed, as I could not believe that anything could be done with so small a particle of the medicine. He, however, bade me take two drachms, or half an ounce of lead, or even a little more, and to melt it in the crucible, for the medicine would certainly not tinge more of the base metal than it was sufficient for. I had to be satisfied with what he had given me, and my chief difficulty was about the application of the tincture. I confessed that when I held his ivory box in my hand, I had managed to extract a few crumbs of his stone, but that they had changed my lead, not into gold, but only into glass. He laughed, and said that I was more expert at theft than at the application of the tincture. You should have protected your spoil with yellow wax, then it would have been able to penetrate the lead and to transmute it into gold!

"He left me with a promise to return at nine o'clock the next morning. But at the stated hour on the following day he did not make his appearance; in his stead, however, there came, a few hours later, a stranger, who told me that his friend the artist was unavoidably detained, but that he would call at three o'clock in the afternoon. The afternoon came; I waited for him till half-past seven o'clock. He did not appear. Thereupon my wife came and tempted me to try the transmutation myself. I determined, however, to wait till the morrow, and in the meantime ordered my son to light the fire, as I was now almost sure that he was an impostor. On the morrow, how-

ever, I thought that I might at least make an experiment with the piece of tincture which I had received; if it turned out a failure, in spite of my following his directions closely, I might then be quite certain that my visitor had been a mere pretender to a knowledge of this art. So I asked my wife to put the tincture in wax, and I myself, in the meantime, prepared six drachms of lead. I then cast the tincture, enveloped as it was in wax, on the lead; as soon as it was melted there was a hissing sound and a slight effervescence, and after a quarter of an hour I found that the whole mass of lead had been turned into the finest gold. Before this transmutation took place the compound became intensely green, but as soon as I had poured it into the melting pot it assumed a hue like blood. When it cooled it glittered and shone like gold. We immediately took it to the goldsmith, who at once declared it to be the finest gold he had ever seen, and offered to pay fifty florins an ounce for it.

"The rumor, of course, spread at once like wildfire through the whole city, and in the afternoon I had visits from many illustrious students of this art. I also received a call from the master of the Mint and some other gentlemen, who requested me to place at their disposal a small piece of the gold in order that they might subject it to the usual tests. I consented, and we betook ourselves to the house of a certain silversmith, named Brechtil, who submitted a small piece of my gold to the test called 'the fourth.' Three or four parts of silver are melted in the crucible with one part of gold, and then beaten out into thin plates, upon which some strong aqua fortis is poured. The usual result of this experiment is that the silver is dissolved, while the gold sinks to the bottom in the shape of a black powder, and after the aqua fortis has been poured off the gold melted once in again the crucible, resumes its former shape. When we now performed this experiment we thought at first that one-half of the gold had evaporated; but afterwards we found that this was not the case, but that, on the contrary, two scruples of the silver had undergone a change into gold.

"Then we tried another test—that which is performed by means of a septuple of antimony. At first it seemed as if eight grains of the gold had been lost, but afterwards, not only had two scruples of the silver been converted into gold, but the silver itself was greatly improved, both in quality and malleability. Thrice I performed this infallible test, discovering that every drachm of gold produced an increase of a scruple of gold, but the silver is excellent and extremely flexible. Thus I have unfolded to you the whole story from beginning to end. The gold I still retain in my possession, but I cannot tell you what has become of the artist Elias. Before he left me on the last day of our friendly intercourse, he told me that he was on the point of undertaking a journey to the Holy Land. May the Holy Angels of God watch over him wherever he is, and long preserve him as a source of blessing to Christendom! This is my earnest prayer on his and on our behalf."

The story, just related, was widely disseminated under various forms during the Middle Ages. The appearance of the stranger, the air of mystery, the description of the stone, the remarkable catalytic powers of the medicine, the furnace and crucibles, the testing of the gold, the wealth of circumstantial detail, even the pious conclusion, are common features of many versions.

It has been pointed out that alchemical expressions are still common enough in every-day life. We speak of copper and silver as good conductors of electricity, or say that phosphorus will steal oxygen from the air, thereby imputing moral qualities to the elements when we mean to describe properties which are merely mechanical.

Paracelsus described many other wonderful things besides the Great Elixir, which not only transmuted metals, but prolonged life when drunk in wine. An alloy of the seven metals—gold, silver, mercury, copper, iron, tin and lead, when made under the proper planetary influences, was known as electrum, one of the most valuable things known to the occult sciences. A vessel made of it would immediately reveal the presence of a

poison put into it because it would begin to sweat on the outside. Amulets, charms and finger-rings could be made of it which would protect the wearer against diseases and all evil influences. During his travels in Spain he met a person who possessed a bell made of the electrum, weighing about two pounds, and by ringing the bell the owner could cause all kinds of spirits and apparitions to appear and they would obey his commands. Before using the bell he always wrote characters or words on the inside. Then he rang the bell and the spirits appeared in such shapes as he ordered them to take. He refused to tell the secret of the words and characters, but Paracelsus meditated on the matter and found out all about it himself.

He tells us that mirrors can be made from the electrum magicum, in which may be seen past or future events, absent friends or enemies, and what they are doing.

The mystics would have us believe that the writings of Paracelsus on alchemy must not be understood as referring to operations on the material plane, but must be interpreted in a transcendental sense; that the operations with mercury and sulphur, with alembics, retorts and pelicans are allegories representing profound spiritual truths. The transmutation of metals symbolized the salvation of man, the change of his base material nature into spiritual gold. Without denying the possibility of a double meaning in the Hermetic Art, let me quote again from Paracelsus:

"These (the alchemists) do not give themselves up to ease and idleness. But they devote themselves diligently to their labors, sweating whole nights over fiery furnaces. These do not kill the time with empty talk, but find their delight in their laboratory."

And just here lies the significance of alchemy to modern chemistry. Gradually a wide knowledge of chemical compounds was gained and experience in laboratory methods, and on this foundation, largely empirical and wholly lacking in quantitative methods, our science has been reared. An enumeration of the substances, methods of manipulation and apparatus

known to an alchemist of the fifteenth century would require more than the entire time at my disposal. Let it suffice to say that work was carried out upon much larger quantities of material than are at present employed in scientific researches; that time was regarded as an important factor in bringing about the desired changes, so that operations were frequently repeated (as, for example, distillation); that much attention was paid to changes of color in the material operated upon, but that weighing, except in the roughest way, was unknown, so that the conclusions drawn were hazy, illogical, often erroneous; in a word, unscientific. We must acknowledge the debt to Paracelsus and his countless co-workers for the invaluable treasure of experimental facts which they accumulated; but we must admit that the alchemists, in the words of one of their own number:

"In their searches after truth, are not unlike the navigators of Solomon's Tarshish fleet, who brought home from their long and tedious voyages not only gold and silver and ivory, but apes and peacocks, too; for so the writings of several (for I say not all) of your hermetic philosophers present us, together with divers substantial and noble experiments, theories, which either like peacock's feathers make a great show, but are neither solid nor useful; or else like apes, if they have some appearance of being rational, are blemished with some absurdity or other that, when they are attentively considered, make them appear ridiculous."

I shall not attempt an extended inquiry into the standing of Paracelsus as a physician. In his "Philosophia Sagax" he gives us his views of the constitution of man, as follows:

1. The elementary body—physical body.
2. The Archeus—vital force.
3. The sidereal body—astral body.
4. The animal soul—the instinctive mind-subconscious.
5. The rational soul—the intellect.
6. The spiritual mind.
7. The man of the new Olympus—the spirit.

Some of these ideas have been grossly misinterpreted, making the ideas of Paracelsus verge on the ridiculous. For example, the Archeus has been described as a demon residing in the stomach and dealing out health and disease to its involuntary host at pleasure, whereas our Hermetic Physician really describes the Archeus, or Liquor Vitae, as an essence equally distributed in all parts of the human body if the latter is in healthy condition, the invisible nutriment from which the visible body draws its strength.

Some of his theories of disease and methods of treatment are exceedingly curious. The Archeus is the essence of life, but the principle in which this essence is contained and which serves as its vehicle, is called Mumia. "Man possesses a magnetic power by which he may attract certain effluvia of a good or evil quality in the same way as a magnet will attract particles of iron." Consequently, the Mumia may be extracted from the diseased part of a person by a magnet and transferred to a plant, a process very beneficial to the patient. This is called the transplantation of diseases. "Many diseases may be cured by employing the warm blood of the patient as a magnet for the Mumia. The blood may be extracted by venesection or cupping, and made to run into lukewarm water or milk, and this is given to a hungry dog to eat. The process may be repeated several times until the patient recovers." It has been claimed that Paracelsus was the real discoverer of animal magnetism, now associated with the name of Mesmer.

Tartar, the principle of all maladies which proceed from the thickening of the juices, and produce deposits such as the stone and gravel; his application of the Kabala and astrology to medicine, his pantheistic belief in spirits and vampires and their relations to disease, are all matters which the curious can easily read for themselves in any history of medicine. What concerns us here is that Paracelsus insisted that the changes in the animal body were chemical changes, and that a knowledge of chemistry was indispensable to the medical man.

By a bold step he replaced the old disgusting concoctions by simple mineral and vegetable remedies. He applied copper sulphate, corrosive sublimate or bichloride of mercury, sugar of lead, preparations of antimony, dilute sulphuric acid and tinctures of iron. He used preparations of gold for paralysis, fevers and palpitation of the heart, tin compounds for jaundice and worms, corals for rumbling in the stomach and melancholy, mercury for venereal diseases, and seems to have been acquainted with laudanum.

It would be difficult to prove that Paracelsus discovered or used any of these substances for the first time; difficult to prove that he made any discovery of first rate importance. The matter has been argued at great length and has not been finally settled. I regard its solution as of relatively little importance. A greater honor is his: he first pointed out the path along which chemistry was destined to proceed; at first as a companion of medicine, finally to the position of an independent science.

Paracelsus wrote a "Book Concerning Long Life" (it is certain that a person would require a long life to comprehend it), and claimed to be acquainted with the elixir itself. If he did not profit by his knowledge, he has at least achieved an immortal reputation.

"And here on earth
Shall splendor sit upon thy name forever.
Sun! all the heaven is glad for thee: what care
If lower mountains light their snowy phanes
At thine effulgence, yet acknowledge not
The source of day? Their theft shall be their bale:
For after ages shall retract thy beams,
And put aside the crowd of busy ones
And worship thee alone—the master-mind,
The thinker, the explorer, the creator!
Then, who should sneer at the convulsive throes
With which thy deeds were born, would scorn as well
The sheet of winding subterraneous fire
Which pent and writhing, sends no less at last
Huge island up amid the simmering sea."

I like to travel back in thought to the small and doubtless badly ventilated lecture room in Basle, with its tiers of wide benches packed with quaintly gowned professors and students from every walk of life; the rich, the poverty stricken, the mendicant (for the Swiss universities have ever freely opened their doors to every class and nationality), all held breathless by the fiery torrent hurled at them in their own tongue and spellbound by the magnetic and dominating personality of the speaker. No one present could ever forget the terrible earnestness, the sincerity, the impression of concentrated will-power, even as they could never forget the marvelous dome-shaped skull of the Bombast of Hohenheim.

And lastly, we may turn to the squalid room in the tavern at Salzburg, where the Hermetic Physician lay ready to make the final experiment, worn out by years of struggle and misunderstanding, eaten up by his own fire, and listen to his last words as interpreted by Browning, from whose poem I have already quoted:

> "Meanwhile, I have done well, though not all well.
> As yet man cannot do without contempt;
> 'Tis for their good, and therefore fit awhile
> That they reject the weak, and scorn the false,
> Rather than praise the strong and true in me;
> But after, they will know me. If I stoop
> Into a dark tremendous sea of cloud,
> It is but for a time; I press God's lamp
> Close to my breast; its splendor, soon or late,
> Will pierce the gloom; I shall emerge one day."

CARICATURE AND MORAL CRITICISM

By Louis William Flaccus
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Caricature has made an appearance in every age; it has played to many leads, enjoyed varying fortunes—drawing a laugh or a fine—and taken many shapes. In literary form it may be seen in the grotesque creations of an Aristophanes or a Rabelais, in the farce of Molière, the satire of Swift, the novels of Dickens. In pictorial dress—where does it not show itself? on coins and vases; on playing-cards, fans, and snuff-boxes; in gargoyles and the little heads and figures hidden away among the detail work of medieval churches; in broadsides; in the large, crowded prints which were displayed a hundred years ago in Miss Humphrey's shop in London, and whose like may still be seen on Market Street or Filbert Street; in books and magazines; and in the mass of Sunday supplements and daily cartoons which is borne along by that greatest of all floods—the flood of printer's ink.

It is impossible to give within the space of a lecture, or for that matter within the covers of a book, more than a very small part of this material wealth and variety of caricature. It is vast as the City of London; endless to walk about in. If it were my purpose merely to entertain you with the spectacle of life as it is given by the caricaturist, I should ask you to walk about as you might in a big city, or an amusement park, idly and curiously. I should invite you into the House of Mirth where concave and convex mirrors catch and distort likenesses in surprising ways, show you the Topsy-Turvy House, or if you tired of these, ask you into the House of Savage Rebuke. Everywhere there would be strong contrasts and strange mixtures, and you would see not a little

of the unpleasant and disgusting, for caricature is not at all squeamish, and the coarseness of some of its finest geniuses could hardly be matched. It would all be like a variety entertainment, which satisfies a very irresponsible curiosity.

But it is not my purpose to entertain you in this fashion. I am not to act showman to the caricaturist, tumble his puppets out of their boxes, attach them to their wires, jerk them about, and then explain why they are funny. My subject is "Caricature and Moral Criticism;" and so I shall for the most part allow the caricaturist to manipulate his own puppets, sit back, and, with a wide interest in art and a special interest in moral matters, watch for any moral criticism, comment, or judgment discoverable in what he presents, with a view to looking into the sort of moral criticism he gives. But don't for a moment imagine that I fail to see that there are ballets, reviews, and burlesques as well as Morality Plays on this puppet stage.

Caricature is a term loosely used, and with time this looseness seems to have become incorrigible. In such cases it is much the wiser plan to start with a set of clues instead of a ready-made definition. Etymology often furnishes the proper clue; and, etymologically, to caricature means to *charge*, to load. If I were to stop with this first general clue, I should be like a man who is given the free run of a strange house; and my lecture would be nothing but an aimless opening and shutting of doors. There are many ways of loading a gun, many ways of firing it; it may be aimed at many targets, and fired in any one of many moods. To examine various *charges* then would seem to be the next thing required. The charge may be *sensuous and imaginative;* it may be *intellectual;* it may be *moral;* it may be, and commonly is, a varying mixture of at least two of these.

First, an object may be charged *sensuously and imaginatively*. Attend first of all to the visual appearance of some object and then distort it. The distortion may be unintentional as in a child's drawing of a house, or it may be intentional,

as in a painting by Cézanne or Van Gogh. Simple intentional distortion is not yet caricature; it must be playful, and there must be added by way of a *charge* a hinted resemblance to something human, which the imagination in turn works on and amplifies. Sketch the fronts of a number of houses, shift the lines of roof, walls, doors, and windows ever so slightly, and you can make them wink, smile, or frown at you in a most ludicrous manner. They have become funny in becoming humanized. Your intellect, still insisting that they are houses, is laughed out of court; your senses seem to take a perverse delight in endowing lines and spaces with a capricious human life; and your imagination is ever ready to join in and complete the game. Or take a little pot-bellied laundry stove, put your hand on it and press down until all the lines are awry and it is more pot-bellied still; then draw it red hot and attach to it tiny waving arms and kicking legs—and you will have suggested a stumpy individual fuming with rage. Such a tacking on of arms and legs is one of the earliest, simplest, and most usual ways of humanizing inanimate objects. One need not turn over many pages of caricature to see boxes, bales, kettles, or books dancing or jumping about. *Alice in Wonderland* and Rackham's Humpty Dumpty are matter in point. An animal may likewise be made funny by the twisting of lines and a human charge. Doyle has drawn some very funny lions and dogs, with all the fun in the eyes and mouth; Bush has succeeded quite as well with birds, pigs, and cats; and the animals so popular on our extravaganza stage, made up as they are of a head and yards of skin with most capricious impersonators as a stuffing, are funny just because of their extravagantly human antics.

But the sensuous and imaginative charging is most interesting when the object is the human figure. The simplest device is the changing of its size to that of a pigmy or a giant. Less simple is a combination of a huge head and a puny body: a trick known to the Greeks and very successfully used by Doré, Léandre, and Gill. Less simple and quite as common

is the playful distortion of features and bodily lines, at which Max Beerbohm is an adept. The head is sharpened or flattened to absurd shapes, the nose is lengthened or shoved into itself, the eyes are at cross purposes, or the knees knock together —and so, endlessly. Often such distortions become standardized as so much stock-in-trade; examples are the elongated Uncle Sam, the short, round John Bull, the teeth of Roosevelt, the bayonet moustache ends of the German Emperor, the uglinesses and awkwardnesses drawn so skilfully by Gillray, Rowlandson, Gulbransson, and Heine.

Such a sensuous charging of inanimate objects, animals, and humans must be recognized, and caricature must not be reduced to purely intellectual or moral terms. Why it is we take such an eager and strong delight in a playful confusion of Nature's handiwork, it is hard to say, for there is no satisfying theory of spontaneous fun. But there are in laughter: a bit of freedom, a bit of creative delight, and a grain or two of malice. Our ordinary world is fairly rigid; things are smoothed down and ordered to an irritating degree; there are humdrum responsibilities in the way of seeing and imagining. We are at times tempted to give this orderliness the slip and to disport ourselves freely in a world of topsy-turvyism. Add to this a creative delight, direct on the part of the distorter, sympathetic on the part of him who enjoys the distortion. For, after all, our well ordered world is potentially unstable, breaking out now and then into freakish uglinesses and irregularities. As long as nothing serious is at stake we like to anticipate and aggravate such uglinesses. When we feel that we can imaginatively make nature break out here or there at will, can turn things topsy-turvy and then quite as readily put them back on their feet, pull a nose to ridiculous lengths and have it snap back as if it were made of rubber, we feel ourselves in a holiday mood—irresponsible and playfully creative, and, one must add, with a tinge of malice to our fun, for the distortions of caricature are of the nature of depreciations.

But to return to our main responsibilities—there may be, in the second place, an *intellectual charging*.

In many caricatures the point to the fun lies in an idea suggested either in the drawing itself or by means of a verbal phrase which serves as a tag or label. Such intellectual play may or may not be combined with sensuous distortion. In one of Hellé's drawings a carpenter is setting down in front of the weeping widow a coffin with this remark: "I have made it of oak; it ought to last him a lifetime." Here all the fun is found in the preposterous inversion of ideas; there being practically no sensuous distortion. Not so, however, with certain German cartoons of King Ferdinand of Bulgaria, which appeared in the nineties, at a time when Ferdinand had been taken from the Austrian army and appointed Prince by the Powers. The caricaturists fixed on two things: Ferdinand's long nose and his ambition to become king. Of these the first lends itself to sensuous, the second to intellectual exploitation. In one cartoon two men are helping him carry his nose; in another he is chained to the Russian Bear by a nose-ring; in another he is poking his nose into the Macedonian Witches' Cauldron.

One of the best merits a longer description. Imagine a square black space; then draw within it an ordinary white dinner plate in such a way as to leave only the four corners unfilled. Next put in the upper right-hand corner part of an officer's cap and one side of the face, with a large eye almost jumping from its socket. Draw from here across the plate to the lower corner an enormous nose, bulking more and more and ending in a grotesque clubbiness. Place part-way up that nose a small black snail, on the move, a royal crown on its back. Attach two doggerel lines with a pun on long nose and disappointment. This caricature speedily carries you beyond the distorted nose to an idea: the idea of Ferdinand's royal ambition. There is no moral comment, but there is intellectual sport grouped about the contrast between greed and the disappointing trickiness of Austrian and Russian

diplomacy. The situation is manufactured, for who would naturally put a snail and a nose together, or saddle a snail with a crown? but intellectually the invention is a happy one, for nothing could give a better idea of greed and of the long road to kingship than this combination of nose, crawling snail, and popping eye.

Morally charged caricatures may be readily separated from such sensuously, imaginatively, and intellectually charged cartoons. When King Leopold is alluded to as Cleopold, or is represented as saying to Cléo de Mérode: "Your way of doing your hair has made you famous, and you have made me famous," there is simply intellectual play. When Philipon, Daumier, and others persistently and to their own damage drew Louis Philippe's head in the shape of a pear, there was back of this sensuous distortion ridicule sharpened by moral criticism. Or when Thomas Nast drew Tammany as a stout figure with a money bag for a head and a dollar mark for a face, there was bitter moral disapproval back of the fun.

Two German cartoons, which appeared in the early nineties on the subject of militarism, make the distinction clear. The first gives a scene in school. Children of six or seven are drilling in uniform to the drumbeat of the janitor, or sitting on a cannon looking at a large map of fortifications, while a teacher, spectacled and armed from top to toe, is pointing their geography lesson with a lance. There is nothing here but play, *jeu d'esprit*. The other cartoon is morally pointed. The scene is the court of an ancient castle. Spiked to the walls flanking it on either side are skulls, and filling the opening is a dragon's head with a soldier's helmet marked Militarism. His monstrous teeth have met through the body of one man, and will soon close on another, who is reading a proclamation —most ineffective of defences! In the foreground stands a confident figure; he is rolling up his workman's sleeves and preparing to swing a huge mallet, marked Socialism.

The sensuous, intellectual, or moral charging of caricature does not depend on the subject matter; the caricaturist may

treat the most serious matter in a spirit of banter, or he may take a trifle and turn it into a sermon. It might be well, in order to get at closer grips with moral criticism in caricature, to consider some of the stock subjects and stock methods in the staging of the farces, melodramas and morality plays. The selection can be but fragmentary; it may, however, be suggestive. Fashions, social types, foibles, politics, feminism, war—such is a partial list of great variety.

The *pageantry of fashion*, with its follies, its sudden starts and sudden collapses, offers endless material of the lighter sort. Here I find little intellectual and less moral charging. The so-called indecencies of dress are sometimes pictured in a serious mood, as in one of Goya's etchings, or in some French and English cartoons of about 1800, but such instances are exceptional. As a rule the caricaturist hints in an amused way at caprice, at the follies and fripperies of dress; and delights to distort what is already distorted: head dresses, sugar loaf hats, shoes curled at the toes, enormous starched collars, huge sleeves, hobble skirts and crinolines. Some of Leech's cleverest drawings are of this kind.

Then there is what might be called the *type* cartoon. Certain types of life and character are exploited sympathetically or satirically, or with a whimsical mixture of both.

To the caricaturist, life, especially social life, is of a crazy quilt pattern, and he may select as material for his art either the color patches or the craziness. There are phases of life which have a color and an expressiveness of their own; and there is hardly a caricaturist of note who fails to give these, either in single woodcuts or lithographs or in what might be called color patch series. Popular sports and amusements such as the dance, the masquerade, the bull-ring, the theater, the seaside, the hunting-field, the gaming-table furnish much of the material. When there is a sympathetic use of local color *with no charge*—as in Goya's *Bull-Ring* Series or in the ballet girls of Degas—one can hardly speak of caricature; but that term is rightly applied to Callot's *Balli*, or *Dancers*,

Gavarni's *Masqueraders*, Rowlandson's sketches of rustic amusements and Leech's of cross-country riding and hunting, the Latin Quarter caricatures of Guys, the French champagne and tinsel sketches, Phil May's *Gutter Snipe* Series, and Daumier's *Pleasures of the Exposition* cartoons. Other material is gained by following the lines which, criss-crossing at all sorts of angles, turn life into a crazy quilt with a sharp mosaic of red, blue, yellow, and drab. In every complex society there are such patches; group is set sharply against group, and each group develops its own picturesque life, its own foibles and vices, its own raggedness or rich stodginess. The caricaturist sees his chance: sympathetically or critically he gives the life of the beggar as Callot and Gavarni did; the life of the underworld, as Guys and Rops did; student life and debtor's life at Clichy, as Daumier did; or country and city standards and habits, in the widely different manner of Leech, Beardsley and Gibson.

One step farther—and *type characters* disclose themselves. The group color soaks into the individual and marks not only his dress, manner of speech, and bearing, but his interests, his likes and dislikes, his way of living, his way of taking life. Caricature steps in, and in a spirit of banter or moral reproof draws this individual who is nothing but his class; draws his class vanities and professional mannerisms. Molière has given frank caricatures of the jargon and the airs of doctors; Dickens has done as much for the lawyer, the schoolmaster, and for flashily dressed young men like Dick Swiveller. Daumier in his *Robert Macaire* Series has made the swindler and confidence man immortal; he has caught the twist of the art student, the actor, the art critic. Best of all, perhaps, he has pictured, truthfully and without a grain of malice, the little shut-up soul of the hopelessly commonplace man. Where could you get, except in the choruses of classical operas, a more ludicrous combination of sham nobility and ugliness than in the cartoon *You are, O man, like unto the gods!?*

Type caricature rarely cuts deep in its social satire; moving

along the surfaces of life and character, it exploits chiefly follies and cleavages which are not destructive; and it is surprising to see how much in the way of folly or group patches society can comfortably and safely carry.

But when folly turns to vice, or the hardening and narrowing of character spells selfishness, cruelty, costly stupidity, there may be caustic moral criticism, as in Daumier's lawyers and politicians, Forain's bankers, Rops's human débris. A small painting of Daumier's is called, with direct reference to Molière's farce, *Le Malade Imaginaire*, The Man who Imagines Himself Sick. It ought to have been named The Doctor who Imagines a Dying Man Well; a look of horror distorts the doctor's face as he feels the man's pulse and realizes his mistake. Only a genius could have replaced Molière's good-natured slap at imagined ailments and medical jargon with this thrust at the destructive stupidity of some doctors. Or, with a stronger moral purpose still, the caricaturist may uncover the festering mass of corruption to be found in such character types as: wastrels, money sharks, huntresses of men, boss politicians, gamblers with souls for counters, hard users and hypocrites.

Related to *type* caricature, which exploits sympathetically or satirically special groups and their special foibles and vices, there is another class which exploits sympathetically or satirically the individual who attempts to shake himself free of his own group and to swing over to that of another. The social upstart is of this sort; so is the bourgeois whose ambition it is to be an art critic; so are Winkle the sportsman, Tupman the middle-aged portly Romeo, and the goodly company of amateur actors in A Midsummer Night's Dream. Feminism may be selected for purposes of illustration.

Feminism, as a movement, groups itself about four ideals: sex equality, industrial freedom, political freedom, intellectual and artistic freedom. It is rightly regarded, by friend and foe alike, as an attempt on the part of woman to swing herself free of certain group influences and standards which have

hitherto shaped her and made of her—a womanly woman. That phrase—a womanly woman—is used either in disapproval of an ideal compounded of sex attraction, weakness, and masculine brutality, or by way of cautioning against becoming freakish, déclassé, and careless or contemptuous of what is of real value in a woman's life.

One might imagine that where the issues are so grave and the relation to happiness and welfare so direct caricature, in commenting pictorially on feminism, would become especially earnest and significant. But the facts are quite otherwise: the great bulk of such caricature plays in an amusing way with the idea and its variants, leaving moral matters untouched. The tide of this fun—to chronicle facts truthfully—runs against feminism, for the world of caricature is a man's world. The plea for sex equality is countered with the charge of sex tyranny. Daumier shows a robust Helen slinging Paris across her shoulder and making off with him; and there are endless caricatures of the *jumping-jack* and *puppet* variety, in which woman pulls the strings. Goya's vigorous etching *There They Go Plucked!* gives another variation. Again, the caricaturist has a pretty definite idea of what woman ought to be and a sharp eye for the mishaps and comicalities of woman's revolt from her class type. Most of these comicalities are summed up in the word *topsy-turvyism*. His idea seems to be that to give the feminists what they want means a topsy-turvy world. Not that he looks upon such a world with stern moral disapproval—far from it; it offers too many delightful possibilities to the imagination.

The simplest form of topsy-turvyism is reversal of dress and bearing. In the French and German cartoons of the forties, in Daumier and Grandville, for instance, the mannish woman is made fun of: she is shown in the full bloom of eccentricity, craving man's cut in dress, man's swagger, and, worst and best of all, man's pipe or cigar. The same sort of fun, rather rough, not very subtle, not always amusing, is still popular.

A second variant of topsy-turvyism is a reversal of parts, assigning to man the domestic rôle and giving woman a free hand in business and in the world of science and art. To the caricaturist such a reversal means another and more exotic blossoming of eccentricities and trivial affectations. Gavarni and Daumier played brilliantly with it; seldom has caricature been more successful at a not very ambitious task than it is in Daumier's *Bluestocking* Series of some forty drawings. He shows a woman reading in bed while her husband awkwardly mops up the floor; going to see her publishers while he is to feed the baby; looking for a review of her latest novel. As a rule the face is homely, the form distorted, the manner of dressing queer, the soul consumed with such vanity as is ordinarily man's peculiar property. In one of the drawings the author is contemplating her likeness and remarks: "The artist has depicted me in the act of writing my sad volume, *Vapors of My Soul* . . . the eye is not bad, but the nose is not sufficiently downcast." But the nose *is* downcast in a most ludicrous way.

In the moral side of the problem of feminism caricature shows little interest, and on the whole neither sympathy nor antipathy. In the eighties, when women were beginning to compete with men in business, and, objecting to the property idea in marriage, were seeking to round out their lives with intellectual and aesthetic interests, the stress of these changes was felt in the plays of Ibsen, with their sympathetic portraits of the new woman, as well as in the protests against these plays in Norway, Germany and England. But nothing of this stress is to be felt in the caricatures of the time; they limit themselves to poking fun at George Sand or to giving a glossary of oddities of dress and manner.

Occasionally cartoons for or against feminism are morally charged. That step is taken when the topsy-turvyism is felt to be destructive. Picture the bad mother, the unsexed woman, the slovenly housekeeper, or on the other side the household drudge, the "world's worst failure", and strong moral feeling will mark the drawing. By way of a moral

sting there may be a sentimental method of attack or defense, a passionate protest against special forms of tyranny, a plea for "equal chances," or an intellectual appeal, marshalling facts or binding within the compass of a moral epigram such things as the vote, economic waste, political corruption.

War has always been a favorite theme of the caricaturist's: war in general as well as war of the sexes. As an artist he likes sharp contrasts and as a moralist he thinks in black and white. War contains within itself all manner of things: the horrible, the glorious, the pathetic, the grotesque, the laughable; appeals to many motives; provokes many comments. It is an enchanter and a disillusioner, a fine opportunity for intelligence and in itself a proof of man's utter stupidity. It destroys individual differences, melting down characters, interests, and lives to one intoxicating and nauseating brew; and also develops new, sharp differences in the way of enmity, strength, loyalty, or brutality.

Many war cartoons are not morally charged. They exploit in a light manner the topsy-turvyisms and anomalies of war. A portly banker is shown drilling conscientiously if not effectively; a one-legged man is hurrying to join the last reserves of his sovereign; an old drunkard, to obey the order "All lights out!" is powdering his phosphorescent nose. Nothing escapes, from national oddities of dress, cooking and language down to the class foibles of officers or the haphazards of recruiting stations, prison camps and trenches.

But there are, and always have been war caricatures with some sort of moral criticism. Often it is partisan, as in Dyson's *Kultur Cartoons* or in the German cartoons against the English; but back of many partisan charges of brutality, treachery, or hypocrisy there is an indictment of war itself.

One of the most striking indictments of this kind is to be found in Goya's series of etchings called *Los Desastres de la Guerra, The Horrors of War*. The drawings were not published until after Goya's death, and may safely be regarded as expressing, artistically and morally, his personal reactions. The

Napoleonic régime in Spain and the guerrilla warfare of the Spaniards against the French furnish the occasion; the street fighting in Madrid, the wholesale slaughter of the populace, unnameable cruelties practiced by French soldiers and cruelties quite as unnameable perpetrated in revenge by Spanish peasants, and the heroic defence of Saragossa furnish the material; the execution of non-combatants, pillage, rape, devastation, human wastage furnish the separate counts of an indictment which looks beyond the special occasion to the brutal senselessness of war.

It is hard to describe these drawings. Fine use is made of black and white, the grouping is simple and vigorous, the sense of movement astonishing. There is just a hint of distortion, except in a few cases where Goya indulges his liking for the grotesque quite as boldly as he does in the *Caprichos*. There is no sentimentality, and war is stripped of its glamor. Some patriotism there is, of course, in such drawings as *The Bird of Prey* and *What Courage!* The second of these pictures the Maid of Saragossa firing a cannon. What a chance for the glorification of war under the stress of patriotic emotion! Aeschylus, a fighter as well as a poet, did something of the sort in his splendid description of the battle of Salamis. He felt the splendor of war as well as its hardness, and never allows the pathos of captive Cassandra or of the chorus of women in *The Seven Against Thebes* to outweigh that splendor. In describing a naval battle he speaks of the sea as strewn with wreckage and "blossoming with the dead." But there is no such poetry of war in Goya; and little patriotic glorification. I cannot help but feel that the real meaning of the drawing is the mass of shapeless corpses on which the Maid is standing. Goya was not first and foremost a patriot. His standards were comfortable, and he was not the man to make or exact extreme sacrifices, or to sing a Song of Hate in an outburst of patriotic anger. War throughout the series is a senseless butchery, brutalizing the soldier and laying a heavy hand on the non-combatant. Its sinister side could hardly be exposed

more mercilessly than it is in *The Beds of Death, Always the Same, She is Mine, Bury the Dead and Be Silent.* One sketch, *Barbarians,* shows a man tied to a tree, and soldiers preparing to shoot him in the back. There is a grim humor in the man's bald head and in his position—were it not for the cords and guns we might think he were climbing the tree; and this grim humor takes us, not to the pathos, but straight to the senselessness of war. Another sketch, which Goya calls *Because He was Found with a Knife,* alludes to a proclamation forbidding the carrying of weapons of any sort. A priest in a cassock is tied in an erect posture to a post. His hands grasp a crucifix; around his neck they have hung the knife, which is not much larger than a penknife. The face of the man shows neither fear, nor strain, nor softness. Again the comment of senselessness!

What sort of moral criticism is to be found in caricature? The problem is in no sense a simple one. Of course, a general theory can be had at slight expense—inattention to facts and comfortable standards of intellectual honesty. But I must frankly admit that the more caricatures I examine the more sceptical I am of finding any theory that will fit all the facts. When I am inclined to call the caricaturist a scoffer he turns into a preacher; when I attend to the preacher he changes to a clown; the clown becomes a free spirit, a moral rebel; and the rebel turns out to be very conventional in his moral criticism, after all. This is the merry dance of caricature within whose circle I am caught. The only way out of this difficulty is to be content with something short of an extreme theory, and to study the *drift* of moral criticism in caricature, as one might study the prevailing winds of a season or the drift of ocean currents.

The task then is to answer the question: "*Which way does caricature, morally speaking, lean?*"

A tempting theory at once suggests itself. Why not regard

the caricaturist, in his more serious mood, as a moral iconoclast, a smasher of idols, a man chafing under social restraints, with a hearty, often gross appetite for freedom? Victor Hugo in some such fashion explained the work of the *imagiers*, the lay sculptors who put into the Cathedral at Chartres and other French churches as ornaments countless grotesque and obscene faces and figures. To him they were rebels with a keen longing for freedom, men who helped swing open the portals of medievalism. Unfortunately for his theory, the same sort of work, the same liking for the grotesque and the obscene, is to be found in much of the old satire, in which the very spirit of medievalism speaks.

By way of preparing for some other theory, turn to social morality as a set of acts, judgments, ideals, all bearing on welfare and happiness. Set aside the problem whether morality is of the essence of eternity, unchangeable at heart; take it simply as a living thing with a sort of surface-wash of change. In morality thus considered there seem to be two levels, the level of conduct and the level of ideals; and, making all allowance for special codes and divergent ideals within society, a certain standardizing is constantly going on. Codes and ideals are being shaped along average lines. Nowhere does the ordinary individual feel himself quite so comfortably settled as in his conscience, in the home circle of his moral beliefs. But his tenancy is insecure, for life, after inviting him to possess his soul at ease, urges upon him all manner of new problems which he cannot solve in the old way, and punishes his failure by turning him out. For life demands not only stability, but alertness and enterprise.

Morality then responds in varying ways to two demands: the comfort and strength of the old and the subtle appeal of the new. Moral criticism may follow either lead. It may set itself the task of backing the moral code and of keeping morality at a commonly accepted notch. Or it may in a spirit of double dissatisfaction, with what men do and with what they prize, push on to new values and stake new claims.

The first is *defensive* criticism, the second might be called *claim-staking* criticism. Both have their good and bad variants. It is no easier to keep morality at a standardized level than it is to keep a rope taut: some slackening there will always be. For that reason, many of our moral approvals and disapprovals show a defensive irritability, a distrust of anything that might possibly be a danger. There is some such feeling as this: Give the Devil an inch and he will take a yard. It is easy to understand the desire to have old things well guarded—and most of them are worth it, but it is hard to sympathize with a distrust that is largely cowardice; and it cannot be right to bury one's moral *talent.* At its best defensive criticism makes for strength; at the worst, for bigotry. Claim-staking criticism, too, has its good and bad variants. At its worst it is like the destructiveness or restlessness of a child; at its best it is resourceful and enterprising, and finds its reward in new discoveries.

Turning back to caricature. I find in it much defensive and little claim-staking criticism, much that is strong and little that is subtle.

It chastises simple vices such as drunkenness, gluttony, sottishness, vanity, inconstancy, or presents simple standardized ideals such as honesty, liberty, decency, fairness, temperance, patriotism, truthfulness. It strikes hard at the moral laggard or delinquent, for the sake of maintaining a certain average level of conduct; it sees to it that no wide breach is opened between average conduct and average ideals. That is why it attacks so savagely the vice of hypocrisy, which means a divorce of habits and ideals.

The moral criticism of the ordinary political cartoon meant for home consumption is of this defensive type. There the rallying points for attack are unfitness, inefficiency, corruption. This applies to the campaign cartoon which warns against spoliation-systems, corrupting alliances, boss-rule, demagogue-rule, or anything else that is felt to be a menace to the public good. Such criticism has appeared at all times

and in many forms: Aristophanes' attack on Cleon in *The Knights;* Gillray's attacks on Fox and on the Georges; Daumier's exposure of a corrupt government; Caran d'Ache's *Checque Book* Series, in which the French Panama Canal scandal is aired. Fun, malice, and righteous anger are mixed in different proportions; it is hard to say which is the best formula, but on the whole the straightforward method of Nash is more effective than the grotesque thumping of Aristophanes. Whether effective or not, all this criticism is a social gesture in defense of ideals which are commonly accepted as ideals. All of us, so far as we look at such things morally, disapprove as a matter of course of bribery, dishonesty, unfitness and corruption, and are inclined to challenge anything opposed to political decency. The great importance of such defensive gestures lies in the frequency of lapses and the resulting divorce of practices and ideals. One of Daumier's cartoons chastises in an amusing way such a divorce. He pictures, grouped in twos, certain Pillars of Society—judges, officials, and the like—with a very mountain of respectability flung into the foreground. They are all saying: "Let us embrace; we are all of us honest men!" meanwhile each takes purse or watch from his neighbor's pocket.

Or consider moral criticism turning against certain social vices. We disapprove as a moral matter of fact of drunkenness, and, what is more, we don't get drunk: it is a vice which stands outside our ideals and practices and has therefore no place on either level. This matter of drunkenness suggests the mention of a great artist's commonplace moralizing production. Cruikshank's series *The Bottle* belongs to the type of what I should call the *Moral Penny Dreadful.* It gives with all the tawdry and stagy devices of melodrama the career of a drunkard—the first temptation, the constant pull at the bottle, the debtor's prison, a family in rags, suicide. All these things may or may not happen, to imply that they always do is to falsify and to interpret in a very shallow way the saying: The wages of sin is death. Not every *Idle Apprentice* dies by the

hangman's noose on Tyburn, nor does every *Industrious Apprentice* become Lord Mayor of London—Hogarth to the contrary. Hogarth's Rake's Progress and Gin Lane are other instances of the Moral Penny Dreadful.

I do not mean to condemn such caricatures as dispatch with one swift stroke of symbolism things that ought to be dispatched, but I do protest against moral bogies, moral claptrap, and moral criticism which soaks the feelings in horror and leaves the intelligence untouched. Such criticism there undoubtedly is in much of morally charged caricature. Our political campaign cartoons may be vastly amusing, but as moral criticisms they lack balance and the spirit of fair play. Must we bespatter a political opponent with mud, and then with smug self-righteousness call him a sink of iniquity? Or what could be narrower and more out of keeping with the artistic bigness of the man than Gillray's campaign against Napoleon? One of our amusement journals now and then takes it upon itself to play the moral critic in its caricatures. I know little that is quite so immoral in spirit as these caricatures, for what can be worse than the bigotry of moral romancing? The sentimental appeal of melodrama rules throughout; the whole machinery is there: the poor dog and the inhuman doctor; the bloated capitalist and the ragged boy; the cruelty of law; the secret plotter. There is here nothing like a spirit of fair play. If it be answered that any stick is good enough to beat a dog with—what becomes of the poor dog of the cartoonist's own favorite moral allegory? There are, of course, a great many things to be fought against—society easily becomes callous and neglectful; but to obstruct science, to sow class hatred or race hatred, and to be melodramatic cannot be the right method of fighting.

Defensive criticism then *at its worst* shows a combination of sentimentalism, bigotry, and injustice. It is disconcerting to find that in the Dreyfus affair the leading caricaturists of France, men like Forain and Caran d'Ache cast their vote against justice. They pictured the pro-Dreyfus papers as a

pig wallowing in mire, with the motto: "Nothing can touch me"—a slap at Zola; they appealed to patriotic motives, and their patriotism when looked into resolves itself into a coarse and blind backing of the army at all costs, and the vicious fallacy that a man cannot be a Jew and a patriot. Bigotry shows itself quite as strongly as injustice. Useful as it is to keep ideals at a certain notch and to hold ideals and habits within fairly close touch, the unpleasant truth remains that such standardizing easily lends itself to a bigoted defensive war against the exceptional.

The exceptional may contain within itself the menace of new vices or the promise of new virtues. To strike at it indiscriminately as society often does is to lose a larger hope by a large distrust. Caricature often reflects this spirit: it attacks without judgment what rises above as well as what falls below the common social level; it shows little insight into, and less sympathy with, reform movements. The reformer's foibles are magnified; his beliefs are distorted; his motives questioned. He is called quixotic, dangerous. One need but think of Aristophanes' treatment of Socrates in *The Clouds*. Could caricature be more entertaining and more unjust? more blindly loyal to the old and more blindly distrustful of the new? As a matter of history caricature has rarely seized the real meaning of a new movement. Abolitionism, prohibition, the peace movement, socialism, feminism have received from it unintelligent abuse or unintelligent excuse. Do the Civil War cartoons express at all the seriousness of the issue or the greatness of Lincoln? What, one might ask Tenniel, had the man's lankiness to do with the measure of his greatness? Must a man who does not believe in war be called a fool? Must we describe a suffragist as a woman without a fine sense of moral restraint, and an anti-suffragist as a woman without any sense at all? There is not much to choose between a cartoon which sets a cultured woman over against a lot of drunkards and wastrels and asks: "If these vote, why not we?" and a cartoon which by way of pointing the moral that a woman's place is in her

home draws a woman voting, children hungry, and a household ruined. Both are unjust distortions; both are melodrama, sentimental and conventional in their appeal, and alike intolerant.

It may sound like a paradox to say that the caricaturist is more often than not conventional and unoriginal in his moral criticism, and that he is in a way a bit of the defensive mechanism of society. What of the licence which marks so much of his work, touching and sometimes soiling so respectable a thing as matrimony, so fine a thing as honorableness, so sacred a thing as religious conviction? Why is it that French caricaturists make marriage a thing of ridicule, American cartoonists do their best to discredit the Presidency, and papers of the type of the *Simplicissimus* and the *Pasquino* carry irreverence to great lengths? It would be idle to deny that moral radicalism has had and always will have a place in caricature, or that there are abundant evidences of a moral individualism which would rather praise the Devil in solitude than God en masse. Such moral Devil-worship there is in much of the work of Rabelais, Swift, Rops, and Kubin. But it would be rash to interpret even the greater part of the licence of caricature as moral radicalism, and to deny, on that score, that the general drift of caricature is conservative, defensive, socially protective in spirit. The licence is that of the artist, not the moralist. What seems a foul, satiric underthrust at morality or religion is often merely a bold imaginative stroke aimed at strong artistic contrasts—and where could the contrasts be stronger than they are on the border-line of morality and immorality, religion and irreligion? Not that this artistic pungency is always in the best of taste—but then, ought delicacy to be looked for in caricature?

There is another angle to this matter of imaginative licence. It need not express itself in terms of grossness or indecency; it may show itself as a playful ingenuity which gives ever new imaginative turns to the common incident, the common form, the common idea. The caricaturist is a shrewd observer

who collects matter of fact bric-a-brac—a political incident, an ordinary domestic or social complication, a face or figure, a bit of street life, a sham, a well-grooved character—; but he is more than that; he sees laughable possibilities and other artistic chances in this bric-a-brac, and so he melts it down and gets from it new shapes and outré surprises. It is in this fashion that he becomes creatively self-expressive.

Creatively self-expressive yes, *as an artist;* not to the same degree, as a moralist. Caricature has developed in very close relation to a public and to current matters in which that public happened to be interested. It appeals to the man of the street, who gathers in front of shop windows with large colored drawings or about bulletin boards—curious, often shrewdly intelligent, with a definite idea of what he wants and with his opinions firmly set. It addresses itself to the newspaper reader, and seeks not so much to change him as to keep him amused or well satisfied with the policies of his favorite paper. By these policies the caricaturist is bound. He is transmissive of what is "in the air"; registering as part of the defensive mechanism of society the convictions, prejudices, and practices of a political party, a social set, a moral clique. Whether he is part and parcel of a stiff-jointed, moribund conservatism or of a hasty and jaunty progressivism matters little; the bias will be equally strong and the guidance equally unreliable. A fact like the following ought to caution us against accepting, without very close inspection, the caricaturist as an ardent moral partisan or a reliable moral guide. In 1884 during the Cleveland-Blaine campaign Gillam submitted to the editor of Puck the *Tattooed Man* cartoon. Davis was to be the tattooed man, and one of the tattooed signs was Bribery. The editor suggested the substitution of Blaine for Davis; and from that time on Gillam in Puck attacked Blaine along these lines, meanwhile publishing in Judge equally unjust cartoons of Cleveland. The caricaturist may be as many-sided a mouthpiece as an actor in a stock

company. In both cases any claim to originality and self-expression lies in the manner and not the part.

It would hardly be fair to leave matters at this point. It is not intolerant enough to explain why it is that caricature is often defensive and sound transmissive in its moral criticism. Nor is it just to pass by unnoticed the good variants of this defensive criticism. When certain standard social goods such as liberty, and honesty are imperilled, or individual shams and vices become rampant, caricaturists like Daumier and Nast have shown courage and great moral strength.

But quite apart from defensive criticism, quite apart also from the claim-staking criticism which makes an occasional appearance in caricature, is another type which merits some notice. I hardly know what to call it, and cannot give it the space it requires. It might be called *oblique* criticism, for instead of thrusting into a subject with a straight downward stab it cuts into it on a slant. It often develops incidentally: the artist may become a moralist simply by his candour and sharpness as an observer and the range of imaginative vision which he develops.

Of such oblique criticism there is much in caricature. Its chief variants are *Symbolism* and *Cynicism*. Symbolism of the type to be found in caricature starts with some particular object or fact, sees in it chances of arousing imagination, intellect, or conscience, pushes on to some general idea, and then seeks to embody this general idea in some grotesque or horrible or amusing symbol. The skeleton in the *Totentanz* and *danse macabre* series is used to symbolize death. Two of the greatest masters of symbolism in caricature are Goya and Rops. Goya's etchings *The Giant, The Slothful,* and *They Shall Not Escape* are examples of an imagination bold enough to aim at the universal and of moral criticism which is not merely didactic. Rops' symbolism is cynical.

Cynicism plays a large part in caricature. Many French cartoons interpret war cynically. A soldier has lost a leg in battle. He is offered a crown of laurel, looks at it and suggests

that a stout cane of it would be more serviceable. Of the other two, one shows the lawlessness of war, the other the horrors of the battlefield. Quite conventional! it seems. But one of these drawings bears the words "The path to glory" and the other the phrase "The day of glory has arrived." Here is the cynical touch, in the pricking of a conventional motto *Gloire!* There are many irridescent bubbles in which a thoughtless society delights. We are not inclined to thank the cynic for putting an end to the play and color of our enthusiasms, or to forgive him his wantonly destructive way of disillusioning us. There ought to be room in life for ideals; and man as an idealist and enthusiast is not a bit less true—only infinitely less ugly—than what Swift, Rops, Forain, and Toulouse Lautrec give in their biting mood—man as a coarse, misshapen, vicious, two-legged animal. So far our distrust of the cynic is justified. But he is capable of helpful work in counteracting thoughtlessness, bombastic shams, self-deceptions and the like. Only let him beware of making his cynicism as flippant and uncritical as is the idealism which he attacks!

Permit me one more glance at my subject as a whole. Caricature may not be the highest form of amusement or the most subtle form of moral criticism; like most things, it gives mediocrity its chance. It is as unsafe a guide to truth as a newspaper. But to one who selects carefully and inspects critically, to one who combines sympathy with a watchful independence, it yields much. It shows the imagination at play; it discloses some of the defensive secrets by which society maintains itself at a fixed moral level; reveals class antagonisms, social hardening; and gives glimpses of symbolism, of bubble-pricking, and, occasionally, of a moral criticism which matches earnestness with insight and enterprise.

RECENT PROGRESS IN ROENTGEN RAYS

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In December, 1895, Professor Roentgen, of Würzburg, whose picture is now on the screen, discovered a "New Kind of Rays." He named them X-rays, for their nature was as yet unknown to him. The scientific world has adopted this name and uses it interchangeably with Roentgen rays, in honor of the discoverer. In this paper I shall review what has been done during the past five years toward finding the properties of these rays and toward determining their place in nature. In addition I shall exhibit some of the most recent apparatus which has been designed for producing them.

Let us first recall how X-rays are produced.

This induction coil is causing a spark to jump between the terminals of its secondary windings. I have connected the terminals to electrodes sealed into the ends of a long glass tube. A Gaede air-pump is at work exhausting the tube. At first no discharge passes through the tube, but as the exhaustion progresses the discharge begins in a writhing line of light. As the exhaustion continues the discharge spreads out to fill the tube. Dark spaces appear at the negative terminal, or cathode. Striations appear in the luminous part of the discharge. Presently one of the dark spaces spreads out to fill the entire tube, and on the walls of the tube is to be seen a green fluorescent light. Of the original air only the one hundred thousandth part remains in the tube. At this low pressure there stream off from the cathode countless little particles of negative electricity called variously electrons, corpuscles or cathode rays. They have the smallest masses known: fifteen hundred of them together have the mass of one hydrogen atom, and

one trillion quadrillion of them have a mass of one gram. They leave the cathode at right angles to its surface and travel with speeds of about twenty thousand miles per second.

In another highly exhausted tube which will now be exhibited, the cathode stream is made to pass through a small orifice and to strike a sheet of paper covered with willemite, zinc orthosilicate, a mineral which shows fluorescence when bombarded by these particles. The spot of light shows where the stream hits the paper. The stream can be moved by a magnet. If the north pole of a bar magnet is held near the tube the spot shifts in one direction. If the magnet be turned end for end the spot moves in the opposite direction. If this motion be tested by a simple rule of electrodynamics it appears at once that the stream must consist of negative electricity moving away from the cathode.

Professor Roentgen discovered the X-rays while he was experimenting with electrical discharges through a highly exhausted tube. He soon traced the rays to the region of the glass wall which was suffering bombardment by the cathode stream. The X-rays were found to originate when an electron, moving twenty thousand miles per second, hits an obstacle. In the type of tube which was developed for the efficient production of X-rays the cathode stream is caused to converge to a point. At this point is set a target of heavy metal such as platinum, tungsten or rhodium. At the spot where the stream strikes the target the X-rays originate and from it they radiate.

There is now on the screen a diagram of an X-ray tube. It is a globe of glass highly exhausted. These are the terminals for the electric discharge. The concave terminal is the negative one or cathode. From it stream off the electrons at right angles to its surface. Evidently the stream must converge to a point. At that point stands the target of heavy metal. From it the X-rays radiate through the glass into the surrounding air.

We shall now send a discharge through an X-ray tube and observe some effects of the rays. In the tube which is being used the cathode is at the top, the stream of electrons is directed

downwards, and the target faces the audience. When the discharge passes through it, the bulb shines with a fluorescent light. This is a secondary effect. The X-rays cannot be seen. To show their effects we shall enclose the tube in a light-tight wooden box. Between the audience and the box is placed a screen of a fluorescent salt, platino-cyanide of barium. When a discharge is sent through the tube the screen shines with a pale green light. This light is excited by the X-rays which penetrate through the wood of the box. If objects are placed between the box and the screen shadows of the denser parts appear upon the screen. One sees, for example, the bones of the hand and wrist, coins in a purse, a knife enclosed in a box.

By this time we have recalled how X-rays are produced and have prepared ourselves to consider some of the recent advances which have been made. We shall consider first some improvements in the X-ray tube. It was observed soon after they were discovered that X-rays are not all alike. Some penetrate matter readily, other kinds are easily absorbed. Penetrating rays are called "hard," those easily absorbed "soft." Now the "hardness" of X-rays is determined in the tube where they originate. It is all important that the user of an X-ray tube, in particular the physician, shall be able to control the quality of rays which it produces. Many devices have been invented to enable him to do this. The most recent and most successful will now be exhibited.

The most important factor in determining the quality of X-rays given out by a tube is the pressure of the gas which remains in it. If the pressure is low the rays are "hard," if it is high they are "soft." To control the hardness of the rays the operator must be able to change the pressure inside of the tube at will. The most recent and most satisfactory device for regulating the pressure is the invention of a resident of Philadelphia, Mr. H. C. Snook.

On the screen is a diagram of the Snook Hydrogen Tube. The residual gas in the tube is hydrogen. The operator can let hydrogen into the tube and make it "soft," or out of it

and make it "hard" just as he wishes. A reservoir connected to the tube contains considerable hydrogen. From this reservoir a little hollow tube of platinum sealed at one end leads into the X-ray tube. Hydrogen is allowed to pass from the reservoir into the X-ray bulb by heating the platinum tube red hot by means of an electric current. It passes through the pores of the red-hot metal from the higher pressure to the lower one. To make the tube hard hydrogen must be let out of it. This is accomplished through a tube of palladium which leads from the interior of the X-ray tube to the air. Air contains such a small amount of hydrogen that it acts like a vacuum toward the interior of the tube. The palladium tube is heated to a red heat and hydrogen then passes from the interior to the air and the X-ray tube becomes harder.

Another important advance in X-ray tubes is the invention of Dr. Coolidge, of the General Electric Company. A diagram of the Coolidge Tube appears upon the screen. This tube is exhausted as highly as possible. The residual gas plays no part in its operation. The electrons are liberated from a spiral of tungsten wire, which is heated red-hot by an electric current. The electric pressure of the induction coil drives the electrons against the target. A cylinder of molybdenum which surrounds the spiral of tungsten causes the electrons to form a narrow stream. The intensity of the rays from this tube depends upon the temperature of the tungsten spiral. It in turn depends upon the current through the spiral, a factor entirely under the control of the operator. The "hardness" of the rays is determined by the electric pressure applied to the tube.

[At the end of the lecture the Hydrogen and Coolidge tubes were exhibited by Mr. E. C. Drew.]

We shall now turn to another field in which great progress has been made recently. Roentgen called his "New Kind of Rays" X-rays because they were an unknown quantity in the plan of nature. During the twenty years which have passed since the original discovery many efforts have been made to identify these rays with other phenomena. It was not until

four years ago, 1912, that the solution to the problem was found. The rest of the hour will be devoted to the consideration of what this solution is, how it was attained, and to what results it has led.

As an introduction to this discovery let us recall the principles of wave motion. A wave consists in the continued transmission of a relative state of particles through a medium. The motion of each particle separately considered is a reciprocating one. The model now exhibited illustrates this exactly. You observe a wave-form move through a row of particles. The distance from one particle to the next one in the same phase of motion is called a wave length. If the particles move across the path of the wave, as they do in the model, the wave is called transverse. When the particles move parallel to the path of the wave the wave is said to be longitudinal. My voice travels to you as longitudinal waves in the air. All known evidence indicates that light consists of transverse waves in an all-pervading medium called the ether.

Now wave motion, in whatever form it appears, presents certain characteristic phenomena. Waves travel through homogeneous media, which are alike in all directions, in straight lines. Waves are reflected by obstacles in their paths, and the angle of incidence equals the angle of reflection. Waves change their direction of motion when they pass obliquely from one medium to another. Waves bend around the edges of obstacles. The longest waves bend the most. This phenomenon is called diffraction. Waves superpose themselves upon each other. Two interfering waves may produce areas of rest.

Diffraction and interference are the crucial tests of wave motion. So important are they that I shall illustrate them. On the screen is a remarkable shadow picture of a sound wave taken by Professor Foley, of the University of Indiana. A sound wave has been photographed just after it has passed through a row of slits. Your attention is called to the little wavelets which have bent around the edges of the slits. This is diffraction.

To show interference of sound waves I sound a tuning fork and with it stimulate a column of air tuned to unison with the fork to vibrate. The fork is held so that the waves from the two prongs enter the air column "in step." I rotate the fork until the waves from the two prongs enter the air column in opposite phases, "out of step." Silence results. You observe the destructive interference of two trains of sound waves.

The diffraction of light is best shown by the diffraction grating. On the screen is the image of a narrow slit. In the path of the light is placed a piece of glass on which are ruled eight thousand equidistant, parallel, vertical grooves. The light passes between the grooves and bends out on either side to form spectra. Theory shows that the longest wave length of light is bent most from its path by a grating. You observe that red is bent the most, violet the least. This phenomenon demonstrates then that red light has a longer wave length than any other color. Violet light has the shortest wave length of any color. Two measurements, the distance from the grating to the wall, and the distance from the image of the slit to any color in the spectrum, are all that one needs to make in order to compute the wave length of that color. In addition the width of the lines on the grating must be known.

With this information about wave-motion in mind let us return to X-rays. Roentgen was strongly impressed with their resemblance to light. Like light they travel in straight lines, and cast sharp shadows. They cause some substances to fluoresce, as does light. They cause some chemical changes to take place, notably in the salts of silver, and in this respect they are like light. Accordingly Roentgen attempted to identify them with light completely. He attempted to reflect them, but only scattering and no regular reflection resulted. He tried to refract them with prisms and lenses, but without results. He looked for diffraction and interference and obtained at best only doubtful phenomena. The identification was far from satisfactory.

Accordingly the X-rays remained an unknown quantity. During seventeen years after their discovery many different attempts were made to fit the X-rays into the generally accepted scheme of nature. Two theories only gained a wide hearing. One regarded them as irregular independent pulses in the ether set up when the electrons in the tube hit the target. The other looked upon them as neutralized electrons shot off from the tube. Both are now obsolete, for they have been supplanted by a theory at once simple and beautiful and supported by the best of evidence.

In 1912 Dr. Max Laue, of Munich, Germany, predicted that X-rays would show diffraction phenomena if they were passed through crystals. Two considerations led Dr. Laue to make this prediction. He suspected X-rays to be light of very short wave length. His knowledge of crystals led him to think of them as atoms packed together in an orderly way with spacings of just the right dimensions to diffract very short waves.

You will understand Dr. Laue's idea better when we project a beam of light through a small hole and set in its path two gratings with their lines perpendicular to each other. You observe on the screen a number of spectra set in a square pattern—a diffraction pattern. Laue thought of a crystal as a diffraction grating with three dimensions. He predicted that if a beam of X-rays were sent through a crystal the beam would break up into a number of beams arranged in a pattern determined by the crystal.

This theory was confirmed by experiment in every respect. On the screen is the photograph of a diffraction pattern formed when a beam of X-rays is sent through a well-known crystal of the cubic system, zinc sulphide, parallel to a cubic axis. From measurements upon this photograph and others like it, Dr. Laue computed the wave length of X-rays. He found the wave length to be about one hundred millionth of a centimeter. The longest red waves are seventy-seven millionths of a centimeter long, the shortest violet thirty-six millionths; one thou-

sand "X-waves" placed end to end have the length of one wave of visible light.

The work of Dr. Laue and his associates attracted attention everywhere. Throughout the civilized world physicists began to experiment with the action of crystals of various kinds upon X-rays. In a few months Mr. W. L. Bragg, of Cambridge, England, showed that X-rays can be reflected from cleavage planes of crystals. He at once turned this discovery to use in the X-ray spectrometer. The slide shows its construction. The X-rays to be studied pass through a slit and fall upon a crystal. They are reflected by the cleavage planes and fall upon a photographic plate, and record themselves. Crystal reflection is different from mirror reflection in that a given wave length can be reflected only at certain angles. For this reason the crystal separates the various wave lengths present in a beam of X-rays from each other.

It was stated in this city a few days ago by a well-known physicist that progress in science follows the growth of ideas and the improvement of instruments. This is well illustrated in the work we are now reviewing. Dr. Laue gave the world a new idea, that crystals diffract X-rays. Mr. Bragg added to this a new instrument, the X-ray spectrometer. A new field of investigation was opened by these two contributions. The results which have been attained will now be presented.

The place of the X-rays in nature has been found. They are ether waves and belong in the electro-magnetic spectrum. On the screen is a slide of the part of the spectrum visible to the human eye. The waves in this region range from seventy-seven millionths to thirty-six millionths of a centimeter in length. The next slide shows the spectrum at its full extent. The wave lengths range from ten miles to one billionth of a centimeter. Observe what a narrow region visible light occupies. Beyond the red are the heat waves or infra-red. Then comes a narrow gap and then begin the Hertzian waves, the kind used in wireless signaling. Beyond the violet is the region of ultra-violet. The extreme ultra-violet is known as Schumann

waves. A wide gap follows and then come the shortest waves in the spectrum, the X-rays, and after them follow the Gamma rays of radium.

I presume that the term characteristic spectrum of an element is one familiar to my hearers. When the vapor of an element is heated to incandescence, or is stimulated by an electric discharge, it emits a light of characteristic color. If this light be analyzed into a spectrum it is found to consist of sharp bright lines separated from each other by dark spaces. Each line has a definite wave length. I am showing you as an example the characteristic spectrum of the element radium. By its spectrum an element can be identified even in the sun and distant stars. Quite recently it has been learned that elements have characteristic X-ray spectra.

A second result of the scientific activity inspired by Dr. Laue's discovery has been the study of the characteristic X-ray spectra of the chemical elements. It has been known for some years that if an element such as iron, gold, sodium, or platinum be used as the target in an X-ray tube, the X-rays produced show a "hardness" or penetrating ability dependent upon the element. This hardness was known to depend upon the atomic weight of the element. The greater the atomic weight, the more penetrating are the X-rays sent off.

The X-ray spectrometer has made it possible to study the characteristic radiations of the various elements by measuring their wave lengths. The most important part of this work was done by Mr. Moseley, a young Englishman, who has since lost his life at the Dardanelles. The slide shows some of Moseley's results. The dark lines are the characteristic X-ray wave lengths. You will observe that the elements are not at random, but follow the order of their occurrence in the Periodic System. A close examination has shown that the wave length of the characteristic X-ray radiation given out by an element can be computed at once when the position of the element in the Periodic Table is given.

Up to this point I have confined myself to the information

which crystals have given us about X-rays. Now I shall tell in brief what X-rays have shown us about the structure of crystals. A crystal consists of atoms built upon a pattern. Systems of parallel equi distant planes can be drawn through the atoms of a crystal. This diagram illustrates such a system. If a beam of X-rays of one wave length only falls upon such a system of planes it is reflected at certain angles. These angles are determined by two factors, the wave length of the X-rays, and the distance from plane to plane. If two of the three quantities, angle of reflection, wave length and distance from plane to plane are known, the third may be computed by a simple mathematical formula.

If then the angles at which X-rays of known wave length are reflected by a crystal are measured, we know at once the spacing of the planes in the crystal. The intensity of the reflected X-rays gives a clue as to whether the planes are made up of light atoms or heavy ones, for the heavier the atom the more effectively it reflects the rays.

The most notable work in the study of crystals by X-rays has been done by Prof. W. H. Bragg and his son, Mr. W. L. Bragg. I shall not enter into all the details of their methods, for it is a long story. It is all told in their recent book, "X-Rays and Crystal Structure," as well as in many recent articles. I shall content myself with showing some of their results. Here are models of two of the crystals which they have analyzed.

These models are, I believe, the first of their kind to be exhibited in this city. They were made by Mr. Fred Kalmbach, of this laboratory. The first one we shall examine shows how the atoms of sodium and chlorine are arranged in a crystal of common salt. The pattern, or space-lattice as it is called, is a cube. Let us call the yellow spheres sodium atoms, the green ones chlorine. The Braggs reflected beams of X-rays radiated from a palladium target from the principal atom-planes of a rock-salt crystal. They studied the direction and intensity of the reflected beams. They concluded that planes parallel to two cubic axes contain equal numbers of sodium

and of chlorine atoms. Planes parallel to one cubic axis which cut equal intercepts on the other two also contain sodium and chlorine atoms in equal numbers. But planes which cut equal intercepts on all three axes are composed alternately of sodium and of chlorine. This model shows the only possible arrangement of atoms which fulfil these conditions.

The other model shows how the atoms of zinc and sulphur are arranged in a crystal of zinc blende. The space-lattice is cubic, but the arrangement is a different one from that in the rock-salt crystal. A zinc blende crystal was studied by means of X-rays. The direction and intensity of the beams reflected from its principal planes were measured. The model shows the conclusions reached. I am assured by crystallographers that the recent developments in X-rays have given them their first real insight into crystal structures.

In a hasty and superficial way I have reviewed the recent discovery that X-rays are part of the electro-magnetic spectrum and have told of the new knowledge which this discovery has given about the X-rays themselves, the chemical elements, and the structure of crystals. I have mentioned the great names, Laue, the Braggs, father and son, and Moseley. Our own country is participating in the work. Let me mention Professor James Barnes, of Bryn Mawr, and Professor William Duane, of this city and Harvard, as prominent workers in the new field. That the new developments are of more than scientific interest may be judged from the fact that the General Electric Company is taking an interest in them.

The ambition of the physicist is to grasp all phenomena in their relations to each other. He is convinced of a unity in nature. Deep in his soul is rooted the faith that matter, electricity and the ether are intimately related, perhaps one thing. The addition of the X-rays to the spectrum was an advance toward unity. It brought a thrill of joy to all who grasped its full meaning. But after all the mystery remains unsolved. The "X" of the X-rays has only been expressed in terms of another unknown. "A wave in the ether." How

easily said! How little understood! Into the great problem of the "ether waves" the problem of the X-rays has merged itself.

In concluding this lecture it is a pleasure to acknowledge the enthusiastic assistance I have received from Mr. Edwin Barker and Mr. Harry Walp. Without their assistance the lecture could not have been illustrated as it has been.

THE ROMAN EMPEROR WORSHIP

By George Depue Hadzsits
Assistant Professor of Latin

It is to the Roman Emperor worship that I beg to call your attention this afternoon, but I shall not so much undertake to give a history of that amazing institution as to analyze the meaning of the worship of Caesar and of Augustus, with whose apotheoses the institution began and upon the foundations of which the whole vast superstructure was reared. It were instructive and a fascinating diversion to compare the Emperor worship with analogous manifestations elsewhere in the world before and after, but my Clio bids me to limit this investigation to narrower limits, with a view to discovering the true significance of the Man-God idea in Rome at that critical juncture when the Republic was passing into an Empire, when life was entering upon a broader and more cosmopolitan career, and when religion consequently was subject to profound changes.

Let us follow the steps in the gradual evolution of the worship of Julius Caesar. The steps are quite clear and indicate the certainty of the eventual cult of Caesar, although we may not be certain of the motives of an Antony, the sympathy or scorn of the Senate, the attitude or deeper undercurrent of feeling of Caesar himself toward the phenomenon of deification; these are all subtler problems in comparison with which the phenomenology is easy to follow. On the battlefield of Pharsalia upon which the fate of an Empire rested, in the contest between Caesar and Pompey, Julius Caesar invoked the aid of Venus *Victrix*, to whom he vowed a temple: a fine battle cry, her name,—for troops who responded to the appeal with an ardor natural to men when fighting a real or quasi-chivalrous combat. The glamor of Venus-Aphrodite could not but have a hold upon

the emotions and imaginations of men howsoever varied their experiences of life. In Rome, in the municipalities, in the provinces there were temples to this goddess to which the minds of the troops reverted. Aphrodite and her paramour Ares, Venus and her lover Anchises, Venus the goddess of gardens, Aphrodite born of the foam were all playful associations from the world of mythology, hovering about the name of that goddess whose authority was exercised in the sky, in the rivers, in all lands and even in the realms of Pluto below. Romanticists, rationalists, skeptics, artisans, poets, one and all could derive solace and inspiration from prayers to this goddess, the delight of gods and of men. Some two years after the battle, Caesar dedicated in Rome the handsome temple of solid marble that was, however, consecrated to Venus *Genetrix*, the mother of the Roman brood, and in particular the reputed ancestress of the Julian gens. Caesar himself, as quaestor, had in all seriousness laid claim to this divine descent. "Our stock, therefore," he had said, "has at once the sanctity of kings, whose power is supreme among mortal men, and the claim to reverence which attaches to the gods who hold sway over kings themselves." It was Varro who had said, "It is useful in a state that brave men should believe themselves descended from the gods, for it stimulates the human mind to strenuous endeavor and vigorous action." The idea of divine descent, the concept of a Man-God was received by Rome from Greece where it was a common belief. It had no place in Rome's native religious traditions, but the obvious lesson involved in building the great temple of Venus Genetrix was hardly lost upon the population in Rome. The year before the dedication of this temple, Caesar had been deified in true Hellenistic fashion at Ephesus. Rome was quite familiar with temporal, local apotheoses offered her provincial governors by Greek people, so that Caesar's apotheosis at Ephesus might have passed as a breath of wind over the face of Rome except that religious conditions were such that the Ephesian apotheosis became an important step in an irresistible movement. Divine honors had been offered Flamininus, Metellus

Pius, Sulla, Marius Gratidianus, Lucullus and many others without any perceptible reaction upon Rome. These were brief expressions of ephemeral enthusiasms, kindred in character, to be sure, to religious awe and supported by the external forms of worship such as incense, candles, hymns and statues, but Rome's attitude was that of the Cynic, dissatisfied to be sure with her own faiths but skeptical as yet of the validity of this new religious prescription. Cicero's refusal to accept worship of himself from his provincials reflects the sobriety of Roman common sense, but the time was coming and was not far distant when the deification of a Caesar, resting upon the foundations of these earlier apotheoses, was to command a respect not guaranteed to them. As yet there was no worship of Caesar in Rome, but the temple of Venus Genetrix eloquently proclaimed as effectively as epic verse or prose annals, the divine descent of her great war-lord who was rapidly passing from victory to victory, to an estate of the unconquerable and the invincible. Senatorial decrees following the battles of Thapsus and Munda in the minds of the common people at least, certainly brought Caesar within the range of divinity. His chariot was placed "opposite to that of Jupiter on the Capitol, with a statue standing, or intended to stand, on a model of the world, and with an inscription calling him demigod;" an ivory statue of Caesar was to be carried "in procession, with a chariot to itself, in the *ludi circenses*, along with those of the gods," and another statue was to be "placed in the temple of Quirinus on the Quirinal Hill." Thus, imperceptibly as a bay-tree the belief might grow gradually and insensibly that there was about this Caesar something more than human. The Greeks in the population of Rome would readily yield to this suggestion; the Ciceros and the Varros might withhold personal assent, but the great masses, whatever their inherited religious convictions, scarce had the moral or intellectual courage to resist the encroachment of the Man-God idea, presented throughout a series of years in this seductive variety of forms. A second founder of Rome had arisen, another

Romulus, like the one of old, who, Elijah-like, was believed to have been translated miraculously to the skies. Caesar's statue in the temple of Quirinus inevitably provoked comparisons between the mortal Romulus, son of Mars, become a God Quirinus, and the mortal Caesar, descended of Venus, but already deified in Ephesus, and in Rome assuming a stature worthy of the gods. There was but need of a great crisis, a period of grief or depression for this feeling about Caesar to become articulate, for the drama of deification to be enacted. Caesar and Romulus! aye, and the latter, deified, had given to Proculus Julius a message worthy of Caesar. "Go," he had said, "announce to the Romans that the Heaven-dwellers wish my Rome to be the capital of the world; let them learn the art of war and thus understand and teach posterity that no power on earth can resist Roman arms." Any of the common people with a leaning toward the belief in transmigration of souls might now have seen in Caesar a reincarnation of the mythical founder whose grave in the Forum was a sacred reminder of Romulus' earlier mortality. But that Man-God had laid aside his mortal nature and had entered into the kingdom of the gods. It required no great imagination to prophesy that the object in placing Caesar's statue in Quirinus' temple would, in due time, be fulfilled. Had Caesar had the co-operation of poets to lead a willing people into the mysticism of this Graeco-Oriental speculation in accord with which the human seemed to merge into the divine, the lesson might have been conveyed more swiftly. Rome, however, was not accustomed to such a methodology and waited on the action of her Senate, so that the idea of the Man-God was imposed through political influences in a cruder way; after the beginning of the year 44 B. C., the Senate decreed that a fifth day of the *ludi Romani* should be added in honor of Caesar; this step would seem like a serious attempt at deification, analogous at least to the manner in which other cults had previously been introduced into Rome. For hundreds of years Greek gods had been accepted, becoming identified with native divinities; similarly this action of the Senate brought

Caesar, at least a demi-God by now, into closest relation with Jupiter to whom the Roman games were sacred. There was a banquet which in its origin was "a form of thanksgiving to Jupiter for the preservation of the state from the perils of the war season." It was an imperial Jupiter with whom Caesar was now an associate, and in this process of deification the might of the warrior was an element not to be neglected. Through proximity to Jupiter, Caesar was to gain in august character, comparable to the god of the sky, the god of lightning, the god of good faith, that manifold deity supreme in the state religion and vitally touching the lives of Romans in their private concerns. Jupiter's temple on the Capitoline was the symbol of Rome's majesty; it was to this temple that Ovid instinctively turned in the hour of his agony. Horace proclaimed his literary immortality in terms of the unending ceremony that forever was to have as its goal, the Capitoline. This senatorial decree carried Caesar a step beyond the Man-God estate, it involved the inauguration of a new guild, the *Luperci Juliani*, and Mark Antony was to be a priest of the new Caesar cult; for this there was no precedent in the Roman religion, but Mark Antony cared little for that, while Cicero's voice was not raised in emphatic protest and sarcasm melted into mild surprise. What the effect upon the people might have been had Caesar been spared, to what extent this official deification of the living Caesar might have been accepted is but a matter of idle guess-work. Events were destined to move rapidly in this fateful year of 44 B. C., and the overwhelming importance of the impending tragedy and the subsequent apotheosis quite outweigh all other considerations.

"The Ides of March are come!" "Yes, but they are not gone," and Calpurnia's dreadful dream came true. Caesar's biographers of a later date coolly recorded the unmistakable signs that had foretold his murder but these had not been heeded and Caesar lay dead at the foot of Pompey's statue. His conquest of the Nervii, his victory at Alesia, where he overcame dangers that make the imagination giddy to recall, his impulsive

plunging into an uncertain future at the Rubicon, that series of momentous triumphs at Pharsalia, Thapsus and Munda, all seemed to have come to naught. Caesar lay dead and slaves carried his mortal clay away from the base of the statue of his arch enemy who had presided over this work of vengeance. Cicero was in a brief ecstasy of joy; the people at first observed an ominous silence that boded ill for the welfare of the conspirators who had counted on popular resentment at Caesar's regal ambitions. Death had brought an end to these and by all laws of logic there should have been popular rejoicing at the irrevocableness of that judgment. The hand of death had stayed the threatening onward progress of the dictator, the imperator, the Caesar who had brought upon himself the odium of having aspired to the title of monarch. The memory of the ominous episode of the preceding Lupercalia, when the refusal of a regal crown was no assurance of sincerity, lingered in the popular mind and Caesar's death, despite the shock of assassination, should have reconciled the people to this seeming guarantee of the return of Republicanism. The following day the Senate decreed a general amnesty and voted to Caesar divine honors,—an innocent proceeding fraught, however, with a significance that the panic stricken senators little dreamed of, for when on the seventeenth the people learned of Caesar's will and of his benefactions and, besides, had heard from a herald that the Senate had voted Caesar all human and divine honors, the pent-up passion of the populace manifested itself in impulsive fury, in grief, and in adoration. There were veterans of the legions who threw into the flames of the funeral pyre arms with which they had adorned themselves, women offered up the jewels which they wore, and the amulets and robes of their children, foreigners engaged in lamentation and above all the Jews who for several successive nights haunted the place where the funeral pyre had been. This expression of devotion ignored recent bitternesses and harked back to the days when Caesar's popularity with the masses had been great. Never did a fickle crowd more quickly forget its animosity and more completely yield

to deeper emotions than at this crisis when feeling surged upward in an irresistible flood.

Caesar was no longer the monarch to whom this sentiment had been attributed as a favorite one: "If wrong may e'er be right, for a throne's sake were wrong most right," but, rather, gratitude for lavish gifts of lands and of treasures, remembrance of splendid games and entertainments for the people, recollection of past stupendous achievements and of greater future projects for the city, all of these factors entered into an intense emotional state that but required this spark to flame into religious frenzy. Rome's motley population, with its conflicting religious sentiments, was peculiarly susceptible to the imminent irrational suggestion of Caesar's divinity,—a suggestion that was fostered by earlier acquaintance with the Man-God idea. No wonder that the myriad forms of admiration were crystallized in a popular proclamation of the dead Caesar as God. In a moment, the general and the statesman loomed up larger than ever before, in a moment death glorified the past, in a moment love broke down the barrier between man and God, so that sacrifices were offered and vows made and oaths solemnly taken in the name of Caesar where just now the funeral pyre had been and where at once an altar was erected and a column of Numidian marble set up, affectionately inscribed "Parenti Patriae." Thus, with utmost dispatch, with dramatic swiftness, Caesar was numbered among the gods, not only by formal decree but also by common consent. The essential elements contributing to earlier Hellenistic apotheoses were present in the case of Caesar's deification:—the savior of men, who had given promise of relieving the economic distresses of many decades, and the great benefactor under whose magic power order was emerging out of a seemingly hopeless political chaos. This impetuous and instant heroification of Caesar, exalting the greatest Roman of them all to a plane above that of mortal man, was born in an hour of passion that was filled with a recollection of the super-man's gigantic accomplishments of mind, of judgment and of will. This deification was a confirmation

of earlier steps pointing toward the same goal and was a retribution for the supreme injustice of a heartless murder. If no further significance had attached to it, this apotheosis might have died in the hour of its birth but it survived a variety of vicissitudes until Caesar with all due formality was officially proclaimed a god among gods and was worshipped with all the regular religious machinery of the state that provided an infinite abundance of pomp and glory. "Mischief, thou art afoot, take thou what course thou wilt," might better have been spoken not of an impending riot as Shakespeare's Antony intended, but rather of the inauguration of a new cult in Rome that howsoever justified in its beginnings carried with it an ultimate degradation of spiritual aspiration. Though the deification was now virtually an accomplished fact in Roman life, except for the important official confirmation of it, which did not come for two years, meantime the appearance of a great comet in the skies which shone very bright for seven successive nights and then disappeared, constituted an omen for a superstitious folk, only too ready to receive confirmation of their belief that the soul of their Caesar had made its way to the skies. The progress of the sciences has dispelled from our lives innumerable superstitions that once crowded in over the Roman's horizon, filling his life and his religion with innumerable dreads. Strange omens were recorded, associated with the battle of Pharsalia and foretelling that issue. At Tralles in the temple of Victory, where there was a statue of Caesar, a palm tree, at the very time of the battle, sprang up at the pedestal of the statue, although the ground was naturally hard and paved with hard stones besides. Suetonius gives us the following delightful narrative: As Caesar at the Rubicon stood in doubt, "this sign was given him. On a sudden there appeared hard by, a being of wondrous stature and beauty, who sat and played upon a reed; and when not only the shepherds flocked to hear him, but many of the soldiers left their posts, and among them some of the trumpeters, the apparition snatched a trumpet from one of them, rushed to the river, and sounding the war note with mighty blast, strode to the opposite

bank. Then Caesar cried: 'Take we the course which the signs of the gods and the false dealing of our foes point out. The die is cast.' " Of Caesar it is said that on the fateful Ides he offered sacrifices and as the diviners found no auspicious tokens in any of them, he actually sent Antony to dismiss the Senate. Plutarch is responsible for this statement although Suetonius says that no regard for religious scruple ever turned Caesar from any undertaking. I think, though, Caesar had his illusions about *Fortuna*,—but in any case to the common folk this phenomenon in the skies at this momentous time could convey but one conclusion which Ovid has immortalized as follows: " 'Oh, Venus,' says Jupiter, 'change thou this soul snatched from the murdered body into light, that eternally the deified Julius may look down from his lofty shrine in the sky upon our Capitol and Forum.' Hardly had he uttered these words when the blessed Venus, perceived by none, stood in the very midst of the Senate House and snatched the soul from the body, away from the limbs of her own Caesar, and not suffering it to dissolve in air, she bore it amid the stars of heaven. And as she bore it, she perceived it assuming a train of light and becoming inflamed, and she dropped it from her bosom. Above the moon it takes its flight and as a star it glitters, dragging in a long train a flaming comet's tail."

Although the deification of 44 B. C. was ostensibly only short lived, since the consul Dolabella a few weeks later took away the column and the altar, laying a new pavement, the momentum of the movement was all too great to be checked thus arbitrarily, and on January the first, 42 B. C., there appeared the first Roman official ordinance that made a man into a god: Genio Deivi Iuli parentis patriae, quem senatus populusque Romanus in deorum numerum rettulit. Finally, on the 18th of August, 29 B. C., the temple was dedicated, placed on the same footing with other temples, provided with a priest and consecrated with the usual formalities and ordination of special religious festival days. This temple, the first of its kind in Rome, arose at the East end of the Republican Forum, hard by the temple of Vesta,

and near the Regia of the Pontifex Maximus. For eight hundred years at least human life has surged through the little valley of the Forum, for eight hundred years the religion of the Romans had been centered here, subject to manifold changes brought about through contact with the religious experience of Etruscans, Greeks, Egyptians, Asiatics, but now for the first time a shrine appeared in honor of the deification of a human life, raised to the same level with other gods who had been worshipped here from time immemorial. On the same spot where the earlier Numidian marble column and sacrificial altar had been, a spot hallowed by all the associations of death, cremation and popular impulsive deification, there now arose that visible symbol of the *Aedes Divi Juli* which survived even the fall of Paganism. A great rectangular platform of concrete, 3.5 meters in height, upon which there rested another platform or stylobate, nearly 2.5 meters in height, lifted the temple far above the level of the Forum. Thus about twenty feet above the level of the Sacred Way, passing in front of it, there soared this shrine, housing a colossal statue of Caesar with a star set upon the crown of his head. Duly established by recognized processes of law, the Caesar cult was secure among pagan cults in Rome. In time, temples of Augustus, Vespasian, Antoninus and Faustina, and of Romulus, son of Maxentius, were added to the temple of the *Divus Julius*. But in 29 B. C. it stood among the shrines of Saturn, Concord, Janus, Castor and Vesta, and over the popular mind not deeply concerned with the question of the origin of gods, the deified Julius exercised, no doubt, a sway quite as great as that of any other divinity of the Roman state pantheon. Rome had long been accustomed to the official adoption of gods and the legal inauguration of their cults, so that this epoch-making phenomenon of Caesar-worship need not have seemed passing strange to Rome's religious experience. Any sense of surprise was readily lulled to rest by observation of the concrete evidence of this deification, and any skepticism was beguiled by the convincing fact of an uninterrupted ceremony, insidiously establishing the conviction

that Caesar was in truth a God. Habit begets belief and the power of ritual over the uncritical was well known to the Roman government. A process of deification, begun systematically, had gained root in popular affection and imagination, being forged in the fire of a passionate moment. Caesar was not ranged with the old Roman *numina* of this earth, but had rather entered the celestial *attrium*, henceforth to be worshipped by men according to their individual susceptibilities or credulities or degree of their acquiescence in the paradox of human bestowal of immortality and divinity. The man was ostensibly glorified for his great and good works, and, on the whole, such a cult far from being degrading, in Rome, could carry with it much of moral inspiration. While entirely justified from existing premises, yet, after all, this cult was primarily a state cult, carried on by the imperial party as an element in its own exaltation. Caesar's influence was in this way rescued by Augustus in the most effective manner possible and the imperial policy received a sanction greater than any other that could have been bestowed upon it. Heaven and earth were united in a common plan of imperial destiny, and as a reproach to a provincial republicanism that had struck mortal blows at the man Caesar, the god Caesar was raised far above the envious dagger and the shaft of calumny. While the assassination gave an immediate depth and intensity of meaning to the deification of Caesar, that apotheosis was in reality a bit of statecraft. It did not rest upon a deep popular yearning nor was it the result of a mystic longing that ignores all natural law, believing what it wills. It was not an expression of Roman ancestor worship nor was it a recrudescence of an ancient Roman divine-king concept, emerging at this time after a long period of slumbering.

Though the Man-God idea was not native, being of Greek origin, yet it had elements of universal human interest in it, sufficient to guarantee its value in Rome, at least for a time. The instinctive human wonder with reference to the mystery of death, coupled with fear, love and reverence for Caesar, became translatable under official enactment into worship of the great

heroic dead. Yet the surprise of Caesar, the realist and Epicurean, who had no faith in the soul's immortality, must have been exceedingly great when his uncanny dream came true and he found himself flying above the clouds and clasping the hand of Jupiter.

In order to realize the true significance of the cult of the deified Julius, we must visualize it in its entire setting as a factor in the religious organization of Rome in the time of Augustus. In the coolest and most calculating manner possible, Augustus set out to accomplish a revival of faith through the re-establishment of all the outward forms of worship. The immediate and the ultimate purpose of this endeavor was to establish the old synthesis of state and religion which, from the beginning, had been the recognized source of all strength. Augustus did not herein appear as an inspired Moses, receiving a divine revelation from a lofty mountain top, but rather as a statesman of the Numa type, who recognized the practical value of religion as a hand-maid of politics. Under Augustus there was a revival of religion, one of the most amazing phenomena in the entire history of Roman religion. That revival was carried on in such a spirit of tolerance, was conducted on such an imposing scale that it constituted the most convincing background for the worship of the dead Caesar. The new cult, the worship of a Man-God, was neither explained nor further justified, but autocratically reckoned with the other, older cults, thus securing to the worship of Caesar the maximum of validity and adding to the older institutions a most powerful bulwark. A genuinely new type of religious emotion was fused with other religious institutions, time-honored and venerable. The time was ripe for a religious revival; a long period of great depression was passing into one of great ecstasy and joy that peace had at length come to a stricken world, and at the psychological moment Augustus merged the worship of Julius into the larger worship of the gods of the state whom the Romans were fain to accept at this moment. To be sure, these older religious institutions for two hundred years past had been the victims of

parasites and enemies, such as rationalizing philosophies and unscrupulous politicians, but the Prometheus of the closing years of the ante-Christian era breathed a new life into the vast hulk of the old institution and brought it to a renewed vitality. The Roman world revived its hopes in rising wells that had no less of efficacy because of their antiquity. Now, Pontiffs, Augurs, Quindecemviri, the Fetial priests, the Arval brotherhood, the Vestal sisterhood, the priesthood of the Salii, the Flamen Dialis, the Luperci came into a new life, not engaged in perfunctory performances and merely muttering unintelligible phrases, but demonstrating the superiority of the Roman State and the triumph of Roman religion. It was into this *milieu* that the Caesar cult came, deriving from it all the vitality that was associated with new enthusiasms, not appearing as an alien and exotic thing, but emerging as part of a genuine worship of the state itself. The Roman world renewed its confidence in the state through the miraculous transformation of religious institutions that by their resuscitation gave the lie to the slander that they had been but the vehicle of unbelief and superstition.

The Caesar worship was not allied to the cults of the Cappadocian Mâ, the mystical Egyptian Isis, the Syrian Atargatis, or the Persian Mithras, but the temple and the temple cult of Caesar were of that Graeco-Roman type that passed for Roman in the first century B. C. The restoration of cults, the revival of festivals and other ceremonies, the imposing celebration of the saecular games, the rebuilding of old and the erection of new temples became the outward expression of a renewed faith in gods who for a space had seemed to be deserting the city to an evil fate, but whose continued protection now was vouchsafed by the obvious survival of the Roman state over crises that had threatened her with ruin. The re-establishment of all the elaborate machinery of worship brought to a new life a religious flame that may have been smouldering, and proved to an optimistic generation that the old *pax deorum* was again established.

"The smoke upon your Altar dies,
The flowers decay,
The Goddess of your sacrifice
Has flown away.
What profit then to sing or slay
The sacrifice from day to day?

"We know the Shrine is void," they said.
"The Goddess flown—
Yet wreaths are on the Altar laid—
The Altar-stone
Is black with fumes of sacrifice,
Albeit She has fled our eyes.

For, it may be, if still we sing
And tend the Shrine,
Some Deity on wandering wing
May there incline;
And, finding all in order meet,
Stay while we worship at Her feet."

The Horatian warning that it was the gods who had punished Rome for neglect of them and that Rome could command only as she walked humbly with her gods was heeded in this brilliant revival that proved the tenacity of the Roman religious conservatism and that rested upon the genuinely Roman conception of religion, for that *religio* consisted so largely of ritual and ceremony, depended so heavily upon the exact Pharisaical performance of rites and rested its case upon the dutiful observance of obligations; now there was turning toward statues with veiled heads, approaching altars and falling prostrate upon the ground, spreading out of palms before the statues of the gods, sprinkling altars with much blood of beasts, and linking vow on to vow—to win the favor of those gods and to inspire belief in them. It was to all of these traditions of religion that the Caesar cult was now linked by the astute Augustus who sought this further divine sanction for his political and military policy.

The maintenance of the worship of Caesar, in its last analysis, rested upon the foundation of political expediency, but the populace (not having the same insight into the nature of things

that a Polybius possessed) naïvely imagined that the worship of Apollo, of Vesta and of Caesar was a return to the golden days of long ago, never dreaming that in worshipping a Caesar, deified, they were worshipping the principle of Empire; to such an extent did Augustus keep men blinded to the changing meaning of life in that transition period from republic to empire; but even to a greater degree than the worship of any other of the state gods, the cult of Julius Caesar was tantamount to an apotheosis of the new state. In the reorganization of the ancient Arval brothers the same motive appears. It was part of the imperial plan that the massive shadow of Mars, the Avenger, should fall across the city, a menace to foes of the new régime. It was in the worship of Caesar that patriotic devotion to the new state, the Empire, was gradually to find its fullest and deepest expression, as intoxication and infatuation with the new dispensation rolled in a great tide of gratitude to the God who had created and given all.

It was inevitable that in time apotheosis of Augustus would follow upon that of Caesar, but in the city of Rome Augustus stubbornly fought a movement that might have dimmed the luster of that earlier deification of Julius. False flattery or servile adulation or even honest enthusiasm did not delude the common sense of Augustus and lead him into the great error of allowing official or open worship of himself, living, in Rome. Such a false step would have constituted a betrayal of his great trust of rebuilding the foundations of earlier Roman beliefs. Therefore it need occasion no surprise that the great reorganizer permitted only the worship of his *Genius*. The *Genius* idea was as old as Roman religion itself, and by being brought so conspicuously to the front, it served as another rallying point in the revival of old religious beliefs. The many to whom ritualistic phrases and ancient ceremony were not mere cant but the expression of orthodox beliefs, with all their innumerable, subtle bonds, found in the new application of the *Genius* idea to the Emperor a lofty extension and expansion which made them dwellers in a larger air. In no other act did Augustus

show greater or deeper knowledge of human nature than in this by which—in addition to being already King and Priest,—he became Father. By tactful evasion of apotheosis and by this master stroke of diplomacy, one of the most vital elements in the domestic cults of the Romans was not only preserved, but placed upon a new and lofty plane,—whereby Augustus appeared as *Pater Familias* of the whole state which thus was ideally conceived in terms of intimate and affectionate family life; for the *Genius* was that god who in particular watched over the life of the father of the family and in whose worship, at the time of birthday anniversaries, the whole household, including slaves, participated. At that time a religious ceremony, including the use of incense, wine, cakes and flowers, became the occasion for common celebration because of the beneficence of the deity in whose care rested the life of the head of the family and the very perpetuity of that family's existence. The *Genius* was that guardian angel to whom all owed devotion, bound by ties of sentiment to those other deep and abiding beliefs in the Lares, the Penates and Vesta. The worship of the *Genius Augusti*, therefore, fostered a sense of fealty to the state of which Augustus was the incarnation. At shrines appearing throughout the city, at the cross-roads, images of Augustus' Genius were placed between images of the Lares Compitales and the worship of the *Genius Augusti* also became part of the domestic cults maintained at the sacred hearth. In the most subtle manner possible, therefore, the interest of the home was made to appear identical with that of the state. The highly complex character of political and economic Rome was resolved into the most simple and comprehensible of terms, through the means of this worship which evoked only the kindliest of feelings for the gracious Emperor who thus came so close to the lives of all. In public and in private life the oath by the *Genius Augusti* was a solemn adjuration, while perjury involved a violation of the most sacred principle of self-preservation. The worship of the *Genius Augusti* was given every opportunity to ripen with the years and this approximation to a worship of the state

through the worship of the Genius of Augustus, who represented the state, served Augustus' purpose well. It became a far flung mode of worship, far to the East and far to the West, a wholesome antithesis to the abnormal craving for the deification of Augustus that was besetting Rome from without. It was a genuine force, until the Titan of whom Horace wrote

> Quo nihil maius meliusve terris
> Fata donavere bonique divi,
> Nec dabunt, quamvis redeant in aurum
> Tempora priscum,—

by reason of his own greatness acquired the unreality of Titans and was enveloped in the more mysterious atmosphere of divinity.

Nowhere do we observe this more clearly than outside of Rome where—that is in the provinces and the municipalities—by imperial decree the worship of Augustus had been permitted though only in conjunction with the worship of *Dea Roma*. Augustus was obviously opposed to the idea of worship of himself, but the tide of Emperor worship was too strong to be arbitrarily stayed. The worship of Augustus in conjunction with that of *Dea Roma* furnished a compromise that to the mind of Augustus, may have seemed a clever means of averting worship of himself and realizing an ideal, a religious devotion to the state. The religious revival in Rome, the Caesar cult, the worship of the Genius of Augustus were all media to accomplish the same end,—a devotion to the Empire in terms of religion. This was not a fantastic dream for since 195 B. C. cities in the East as Smyrna, Alabanda, Rhodes, Athens, Ephesus, Sardes, Pergamum, Miletus had all made a goddess of Rome, that ever growing power in the West whose faith and protection they required and whose enmity they had reason to fear. *Roma* readily appeared to their minds a goddess whose unheralded advent and whose unknown origin did not make for unreality. Augustus planned to divert the insistent demand for worship of himself into this nobler channel. In the hearts of good Roman

citizens, shrines to the goddess *Roma* may have existed long before. There existed in this notion an appeal to patriotism that Augustus could not neglect and the worship of Augustus plus that of *Dea Roma* flourished in the East and appeared in the West as well. The *Dea Roma* was a goddess resplendent, clothed in the glory of past memories, the divine incarnation of might and majesty. One might have expected the cult of *Dea Roma* to emerge triumphant from this dual monarchy of Goddess and Emperor, for she gave promise of immortality, while even an Augustus, with all the frailties of human nature, was but the creature of a day. Yet the deification of the Emperor had gained such a hold on men's minds that even in Italy, and even during the Emperor's life time, it was the concept of *Dea Roma* that vanished and it was the Emperor Augustus whose worship was emancipated and who stood forth supreme. Once more the Man-God idea knocked at the gates of Rome.

While the cult of Augustus at Rome was most severely restrained, the idea of the Man-God grew apace and gained constant ground. From Greece, Rome had learned the theory of divine descent of families; from the same source she had gained the concept of a demi-God, intermediary between man and God, and Ennius had translated for Rome's edification that romance of travel in which Euhemerus argued for the human origin of all gods, so that the ground was well prepared for the sowing of the new seed of the Man-God idea. Philosophers differed, as Cicero said, with most exceeding earnestness regarding the true nature of the gods. In Rome, the rivalry of a great variety of cults from Asia, Greece and Egypt also tended to prepare the way for any new cult that had elements of humanity. Stoicism eloquently proclaimed the affinity existing between the human soul and the divine, and Seneca maintained that the *bonus homo* differed only in point of his mortality from divinity. Cicero, under the impelling grief of a great loss, was prepared to build a shrine to his beloved Julia and worship her. In extolling Pompey, Cicero had said that the people of the Eastern Medi-

terranean would look upon Pompey not as an envoy from the great city but as one descended from the sky. Even Lucretius had passionately exclaimed of Epicurus, "A God he was, a God!" who had lifted life out of darkness into light. In lyric ecstasy Vergil had written of the promised Redeemer that that man would gain the life of gods and be with gods and heroes, who would rule a peaceful world with the finer virtues. The air, therefore, was tingling with this thought and in his Dream of Scipio, Cicero had declared that the great rulers of mankind are heaven born and return to heaven. Augustus had ushered the world into a new era and a new life. The very term of *Augustus* connoted sanctity, and he was the venerated ruler whose era received in the marble altar of peace a fitting and permanent symbolic expression. A century of anarchy was like an evil dream, now dispelled by great and good works for the city and the Empire. The beloved ruler could not escape popular adoration which, in the heart, if not in the mind, was the equivalent of worship. The exuberant language of poets gave the Man-God idea wing and Augustus appeared (1) as man and God, a strange *mélange* of the human and divine, (2) as man who after death would be God, but on this earth was the vice-regent of Jove, and (3) frankly as a God in this life. Augustus was identified in literature and mayhap even in art with the gods Mercury, Apollo and Jupiter. Tales were told of the wonderful omens occurring before Augustus' birth, on the very day of his birth and afterwards: Cicero had had a dream of a boy of noble countenance who had been let down from heaven on a golden chain, and then had seen in Augustus the child of his dreams; a portent was generally observed at Rome which gave warning that nature was pregnant with a king; a story was recorded that told of the miraculous birth of Augustus, as son of Apollo; as an infant it was told of him that Augustus, leaving his cradle, was found on a lofty tower with his face toward the rising sun; and in Thrace a pillar of flame sprang forth from the wine that was poured over the altar, rose above the temple roof and mounted to the very sky,—such an omen as had befallen no one

save Alexander the Great. These *ex-post-facto* tales reflect the strength of the movement toward divinity. "As he sailed by the gulf of Puteoli, it happened that from an Alexandrian ship, which had just arrived there, the passengers and crew—clad in white—crowned with garlands and burning incense, lavished upon him good wishes and highest praise, saying it was through him they lived, through him that they sailed the seas, and through him that they enjoyed their liberty and their fortunes." It was a whimsical fancy, but none the less natural product of the *Zeitgeist*, nurturing the Man-God idea, that led to the Augustan dinner-party at which his guests appeared in the guise of gods and goddesses, while he himself figured as Apollo. Finally, Augustus was compared to other heroes, those demi-Gods Castor and Pollux, Hercules and Bacchus, who by their great and good works had achieved apotheosis. And when the waters of Lethe finally flowed over him, "there was even an ex-praetor who took oath that he had seen the form of the Emperor, after he had been reduced to ashes, on its way to heaven." Signs had not been lacking, premonitory warnings of his approaching end and impending deification. Formal senatorial action, nominally following the Caesar precedent, proclaimed Augustus a God. The cult of the *Divus Augustus* was piously furthered by Tiberius. "The deification of the dead Augustus was not a merely official or political act, but a genuine confession of devotion towards one who had wrought great things for the world and proclaimed a gospel of peace and good tidings."

What men believed or what their faith was it were hard to tell; of course there were skeptics who might have repeated after Demosthenes what he had ironically said of Alexander. "By all means let Alexander, if he wish it, be the son of Zeus and Poseidon both together." But the power of the state religion with which the worship of Caesar and of Augustus was so closely affiliated, was far from spent. The corrupt aristocracy and the educated, to be sure, were contemptuous in their attitude toward the popular religion while the uneducated foreigners and freed-

men were callous about the old city cults, but for the great masses of the Romans the revival of Augustus had proclaimed the inherent power and vitality of that inherited faith. In Horace there are many traces of the old beliefs, that survived even his philosophical and worldly experience; the idealist Vergil pointed the way to happiness in a belief in ancient rustic and domestic cults, and the native animistic spirit of the Italian forbade the surrender of his ancient, treasured pantheism. This undercurrent of belief in the old gods flowed strong for centuries and it was upon this that belief in the divinity of Caesar and of Augustus ultimately rested, for the new phenomena were affiliated with the old, *i. e.*, the Graeco-Roman religion of the time. The apotheosis of these heroes had far less of inherent incredibility than the great tangle of legends associated with the older gods, which the popular mind did not reject. Ovid gives us the fantastic background which the Roman people, steeped in superstitions, great and small, had accepted from the Greek hand as tales of the gods' prowess and adventure. The apotheosis of Caesar and Augustus was no incredible addition to the Graeco-Roman concept of religion. The common people's faith might rather have been stifled by the splendor of ritualistic development but hardly balked at the acceptance of the Man-God idea. There was a minimum of mystery in the new Emperor cult; the new Gods were not supernatural, they were only superhuman. The Man-God idea as such, did not trouble men's souls, for the senate solved that metaphysical problem by its official decree. The Emperor's deification was a natural transition from his human estate to one not so much different in kind as in degree. The Graeco-Roman gods were exalted human personalities. Italian and Hellenic worship were completely fused by external adoptions and internal readjustments of their respective concepts of the gods. Vergil's Aeneid, Ovid's Fasti, and the Saecular Hymn of Horace all show that infusion of the Greek spirit, whence, too, come the Man-God idea. "I, the chorus taught to sing the praises of Phoebus and Diana, carry home the good and certain

hope that Jove and all the gods do hear my prayer,"—is an orthodox expression of belief including faith in Caesar deified no less than in all the other gods.

The state had long recognized the social and political value of its religious authority and this aspect rather than the theological side was of supreme moment in the Emperor worship. The Imperial idea was inevitably accompanied by the Man-God idea and the Man-God idea, in Rome, was inseparably bound to the idea of Empire. The Roman orthodox conception of piety constrained the Emperor worship and cramped it, so that it never gained a true cosmopolitan character. As the worship of the emperors expanded, the cult of *Dea Roma* came into its own, and Hadrian's temple was the brilliant center of a vivid emotion and admiration for the mother city of the world. The Emperor worship became a political institution with amazing ramifications and extraordinary organization of priesthoods throughout the vast extent of the Empire, but the very strength of the organization was its weakness, for collapse of the Empire spelled complete dissolution of this form of the Man-God idea. The term *divus*, long before Constantine and Christianity, had become a worn-out metaphor; it served the flatterer and served the humble as a term of loyalty merely to the imposing government. Conventional conformity to religious formalities satisfied all the official requirements of both men and gods.

Christians, to be sure, suffered death rather than experience the degradation of worshipping with incense and wine before the statues of unsaintly pagan rulers, but even upon the Romans themselves the Emperor worship, as a religious expression, began to pall when they viewed with dismay the vast increase in the number of gods and goddesses, the deified emperors and empresses, with innumerable other members of the imperial household. The institution represented polytheism gone mad and as it became religiously empty and had no spiritual value it was no more than an accursed superstition and a contagion swept on by its own momentum. The extreme polytheism of the Emperor worship excluded the development of monotheism

which the world craved in that time of religious chaos. The Emperor worship offered no hope of individual salvation, no communion with God. The Emperor worship was all too much attached to the old paganism and to the state to become a beacon of light for religious or social progress in new paths. The career of a Caligula, a Claudius or a Nero should have put a check to an institution that brought the Man-God idea into such disrepute.

But with the founders of the dynasty, Caesar and Augustus, the Man-God idea had started upon an auspicious career. Faith in Empire was sufficient to create faith in the divinity of these commanding personalities, and worship of Caesar and of Augustus was equivalent to *consecration* to the state. The worship of Caesar and Augustus had the elements of a real religion for the Roman, defining his vital relations to this mysterious universe and his duty and destiny there. In the dim vista of passing years, Caesar and Augustus might have gained more and more of mystery, and as to the inspired vision of Vergil Aeneas had been the guarantor of divine favor unto Rome, so Caesar and Augustus might have appeared as the Castor and Pollux, the heralds of the divinely appointed Empire. At its genesis, the movement carried with it the possibility of a genuine contribution to the pagan idea of divinity. A Caesar and an Augustus, deified for their good works, might have seemed even to the mind of a Lucretius a nobler type of God than those gods upon whom the Epicurean school poured all the bitter indignation of holy frenzy. The Man-God idea, in Rome, attached only to Caesar and to Augustus, might have become the nucleus of a profound religious inspiration and aspiration, of consecration to noble memories, of devotion to highest personal and civic ideals. There was the opportunity for development of legends of death and resurrection, battle-flags for the armies of men who hoped for life beyond the grave. Stoicism that gave a new vitality to the *genius* idea by making the Genius a God within the soul, might have leant a transforming inspiration of duty and of immortality to the new cult.

But in this guise the Man-God idea was destined to rise to no such heights in Rome giving birth to no illusions or delusions. On the contrary, all the pomp and power, all the splendid externals of Roman Emperor worship faded before a star that rose in the East and made the humble pilgrimage of Three Wise Men a turning point in world history.

HOW THE TWENTIETH CENTURY IS INDEBTED TO PURE MATHEMATICS

By George Egbert Fisher
Professor of Mathematics

In his discussion of "Darwinism," Dr. Wallace states[1] that he is unable to find "any origin for the existence of pure scientists, and especially mathematicians, on the hypothesis of natural selection." The same biological difficulty has doubtless been experienced, consciously or unconsciously, by others, who have questioned the usefulness of mathematics, except as an admirable instrument for disciplining youthful minds and as a more or less mysterious assistant of applied science. "Some people," said Sylvester, "have been found to regard all mathematics, after the forty-seventh proposition of Euclid, as a sort of morbid secretion, to be compared only with the pearl said to be generated in the diseased oyster, or, as I have heard it described, *une excroissance maladive de l'esprit humain*. Others have found its justification, its raison d'être, in its being either the torch bearer leading the way, or the handmaiden holding up the train of Physical Science; and a very clever writer, in a recent magazine article, expresses his doubts whether it is, in itself, a more serious pursuit, or more worthy of interesting an intellectual human being than the study of chess problems or Chinese puzzles. . . . But this is like judging of architecture from being shown some bricks and mortar, . . . or of painting from the colors mixed on the

[1] In connection with this opinion of Wallace, the following statement of Sylvester (Mathematical Papers, Vol. II, note, p. 652) is interesting: "I once heard the great Richard Owen say, when we were neighbors in Lincoln's-Inn-Fields (doves nestling among hawks) that he would like to see *Homo Mathematicus* constituted into a distinct subclass, thereby suggesting to my mind sensation, perception, reflection, abstraction, as the successive stages or phases of protoplasm on its way to being made perfect in Mathematized Man."

palette, or of music by listening to the thin and screech sounds produced by a bow passed haphazard over the strings of a violin." Such conceptions ignore the greater debt owed to the labors of mathematicians of today and of the centuries that are gone.

To emphasize a few of their contributions to the intellectual and spiritual life of mankind, as well as to the material conveniences and advantages, is my task for this afternoon. My remarks will be addressed, not to the professed mathematician or scientist, who is not in need of information concerning these contributions, but to the educated laymen who have, perhaps, placed their mathematical knowledge upon the back shelves of their mental closets, but who may not be unwilling to brush away some of the accumulated dust for part of an hour.

In limiting my subject to pure mathematics, I shall not pass over results obtained by its help in the natural sciences. Indeed, one might claim that the greatest achievement of mathematics has been its assistance to astronomy and physics in their rejection of beliefs founded upon superstitition and mysticism and in their rise to the basis of unprejudiced, logical thought. Herschel's opinion was that "admission to astronomy's sanctuary and to the privileges and feelings of a votary is only to be gained by one means—sound and sufficient knowledge of mathematics, the great instrument of all exact inquiry, without which no man can ever make such advances in this or any other of the higher departments of science as entitle him to form an independent opinion on any subject of discussion within their range." Kant was even more emphatic. "Every branch of natural knowledge," said he, "contains only as much science as there is mathematics in it." But the so-called applied mathematics, on its theoretical side, is pure in so far as it employs only methods and reasoning peculiar to mathematics. It ceases to be pure when aided by physical considerations, as, for example, when the possibility of expanding arbitrary functions in series of other functions of specified type are inferred from such considerations; when the form of

the solution of a differential equation, or theorems concerning them, are similarly derived; when the existence on a given Riemann's surface of a function having stated singularities is derived from properties of electric currents. Therefore, my tribute is to those disciples of pure mathematics who have appreciated its higher values, whatever may have been the sources of their inspiration.

The vastness of the subject forbids great detail, or even consideration of very many phases. In making selections, one must be guided by his conception of values. Spencer assumed, in discussing the question, what knowledge is of most worth, that the ultimate test of value is contained in the answers to the questions, "Of what use is it? How does it contribute to satisfactory living? How influence action, conduce to happiness?" To this test mathematics may assent, if it be admitted that happiness, in the words of Professor Mahaffey, does not lie wholly "in motors, or in turbines, or in wireless messages across the globe, or in daily newspapers full of inextricable fact and falsehood," that satisfactory living implies the possession of ideal standards and not what Huxley, fifty years ago, termed "the English conception of Paradise, 'getting on' "; that the idealistic rather than the materialistic should influence action. In addressing the British Association for the Advancement of Science, at the 1915 meeting, President Schuster said: "It is necessary to insist at the present time that the utilitarian drum can be beaten too loudly. There is more than one point of contact between different activities of the human mind, such as find expression in scientific pursuits or commercial enterprises, and it is wrong to base the advantages to be derived from their mutual influence solely, or even mainly, on the ground of material benefits."

If then I do not recite to you numerous examples of the uses of mathematics in developing the material side of our civilization, my omission is not due to lack of appreciation of these results or of the part of mathematics in producing them. It has helped to provide the twentieth century with a myriad of

physical conveniences, comforts and luxuries; with benefits which make more complete the lives of the poor and of the rich. Our buildings and bridges rest upon foundations of mathematical principles as well as of stones and mortar. With its assistance the oceans have become highways almost as well defined as those of asphalt and steel on land. On its practical side, mathematics has never forgotten its origin in humble service to mankind. But it does not claim for itself too large a share in conferring these advantages; sister sciences and the ingenuity of men's brains have contributed much.

The engineer is indebted to mathematics for his ability to compute the strength of his materials and to determine their safe use in various structures; but the designing of these structures, in respect of their harmony and beauty and their adaptability to specific uses, demands often originality and ingenuity of a high order.

For these reasons I make only this passing reference to the ultilitarian part of the debt owed by the twentieth century to mathematics. Its higher values, the "worlds of truths" in man and nature, the better knowledge of the powers and limitations of the human mind revealed by it, its appeals to the emotions and the imagination, to the ethical and aesthetic judgments of men—these constitute the more important part of that debt. If I can a little help, or perhaps better confirm, the layman's appreciation of these values, I shall have accomplished my purpose.

When one reads today the theoretical treatment of many branches of applied science, one is profoundly impressed by the evidence of the necessity of mathematics to progress in them. Such works as Thomson and Tait's "Natural Philosophy," Rayleigh's "Theory of Sound," Maxwell's "Electricity and Magnetism," Richardson's "Electron Theory of Matter," are treatises on mathematics quite as much as on physical subjects. Wherever one turns one finds that calculus, differential equations, series, etc., are the ordinary tools of the astronomer and the physicist. A few only of many notable

instances in which mathematics has helped to reveal nature to man may be given.

When the genius of Newton conceived the most perfect of all known physical laws, his law of gravitation, he placed in the hands of mathematical astronomers and physicists a principle, concise but marvelously far-reaching in interpreting the phenomena of the visible universe. It explained the falling of an apple to the earth, the movements of the planets in their orbits. From it were deduced all the effects of perturbations, all of celestial mechanics. A first approximation to a world-equation, the ideal aim of scientists, was made.

In astronomy the most generally known example of the power and accuracy of mathematics is the discovery of the planet Neptune. Observations had shown that Uranus did not appear precisely in the positions in the sky computed from its orbit, even when allowance was made for the disturbing pull of all other known planets. Though the computed and observed positions disagreed by an amount only one-half as great as the smallest distance on the Celestial Sphere perceivable by the naked eye, these orbital irregularities, if not accounted for, would have pointed towards inexactness in Newton's law. They were attributed by Leverrier, in France, and Adams, in England, to the pull of an exterior body. In 1846 Leverrier computed the orbit and visibility of this planet, as yet undiscovered, and confidently announced to the astronomer Galle, at Berlin: "Direct your telescope to a point in Aquarius, on the elliptic in longitude 326°, and you will find a new planet looking like a star of the ninth magnitude and having a perceptible disc." The planet was found by Galle within one degree of the exact position indicated by Leverrier, and within one-half hour after the search for it was begun. A little later the Royal Astronomer in England discovered it from Adam's estimates.

A somewhat similar and quite recent investigation[2] was made by Seelinger concerning outstanding deviations in the

[2] For this example, I am indebted to my colleague, Prof. Eric Doolittle.

motions of Mercury, Venus and Mars. Since they apparently cannot be accounted for by the disturbing pull of any known member of the solar system, various other hypotheses have been suggested to account for them, including an alteration of the law of gravity. But Seelinger has shown that if an almost inconceivable tenuity be attributed to the faint, lens-shaped mass of matter which surrounds the sun and is known as the Zodiacal Light, its pull under gravity will exactly account for all the discrepancies observed.

In physics one instinctively mentions first Maxwell's Theories, which, according to Hertz, are Maxwell's equations. His two famous electromagnetic equations are marvelously concise and yet have embraced the whole of physics, except dynamics. Speaking of his investigations, Maxwell himself said, "The only use we have made of experimental knowledge is to recognize, in the abstract quantities deduced from the theory, the concrete quantities discovered by experiment and to denote them by the names which indicate their physical relations rather than their mathematical origin." It is worth noting, as an additional tribute to Maxwell's genius, that no new experiences made necessary a modification of the existing electro-dynamical laws, which were adequate to explain all facts at that time known, and that his theories were twenty years ahead of experimental verification. But by adding a term to existing equations, thereby making them more symmetrical, he revolutionized modern physics. Let a physicist speak of the value of his theory. "It marks," says Professor Barus, "one of the most important epochs in the history of physical science; an epoch comparable to that of Newton . . . more than the widest sweep of the generalizing fancy could have anticipated was here completed, for at a single stroke of the wand the whole of light and heat was annexed to electricity. . . . The theory endowed the world medium, the ether, with new potencies."

Of the many other equations in pure mathematics, important also because of their uses in applied science, I mention only

two which have special features of interest. These are Fourier's Series and Laplace's equation.

Trigonometric series had been used by Daniel Bernoulli in problems of vibrating cords, and Euler had indicated the method of determining the coefficients. Fourier, however, first announced the theorem that any given arbitrary function, represented graphically by several arcs of curves ordinarily regarded as distinct, can be expressed analytically by a trigonometric series, or as stated more precisely later, a function which satisfies Dirichlet's conditions can be so expressed. Fourier assumed the validity of the theorem, which was later rigorously proved by Dirichlet, and used it in solving problems in the conduction of heat. It thus had its origin in the needs of applied science and has proved to be of the greatest importance in many mathematico-physical theories. The special significance of the series for pure mathematics is that it furnished a precise instrument, used continually in analysis, by which to express a discontinuous function, and thereby greatly enlarged the mathematician's concept of function.

Laplace's celebrated partial differential equation is notable not only for its simplicity, but also for its comprehensiveness, and exhibits admirably that power of mathematics to express much in little. It is fundamental in the Theory of Functions and especially in partial differential equations. But it is of the greatest importance in many branches of mathematical physics, including heat, gravitational attraction, hydrodynamics, electrical and magnetic attraction, and radiation. This wide range of physical problems emphasizes the mathematical analogies between physical phenomena which apparently have no connection, as pointed out by Poincaré, and thus leads to analogies in nature.

In chemistry mathematics had done very much less than in astronomy and physics. But this science is beginning to make extensive use of mathematical theories and results. Dr. Frederick von Müller, Professor of Medicine at the University of Munich, states: "Physical Chemistry, which has found

numerous applications in medicine, and which has become indispensable in our laboratories, assumes a knowledge of higher mathematics. The text-book on "Physical Chemistry," by Nernst, is for this reason unintelligible to me, and, indeed, to most of my pupils." A notable instance of the application of mathematics to chemistry is a celebrated memoir by Gibbs on the equilibrium of chemical systems. Of this memoir, Professor Picard says: "It is so analytic in character that it required some effort on the part of chemists to recognize laws of great importance under their analytic mantle. It seems that chemistry has today gotten out of the pre-mathematical period with which every science begins, and that a day must come when great theories, analogous to those of our present mathematical physics, but far more vast, will be systematized, and that these will comprise the ensemble of physico-chemical phenomena."

Another science into which mathematics has thrust itself with notable results, is medicine. About the time when Harvey was laying the foundations of modern physiology, students of mathematical physics and chemistry proposed to explain the physical phenomena of the human body by the principles of these sciences. Prominent figures in this work were René Descartes, philosopher and mathematician, and Giovanni Borelli, mathematician and physician. Descartes' book on Man (l'Homme) was not experimental, but mathematico-physical, and came to be regarded more as philosophical than as physiological. Yet to it Foster, in his "History of Physiology," pays this tribute: "He (Descartes) had to show that the new views which were making it clear in so surprising a way that the universe was a machine working in accordance with physical laws, might be applied also to man; that man, that is to say, the body of man, might also be regarded as a machine working in accordance with physical laws. . . . His main idea made itself felt and produced effects in after times." Borelli spoke of physiology as a "part of physics" and proposed to "ornament and enrich it by mathematical demonstrations."

Of his work, Foster says: "He treats in succession of the various problems of muscular mechanics, of flexion and extension, of the most complex problems of standing, walking, running and other forms of locomotion . . . in the same rigid, exact manner, calling in the aid of mathematical figures and calculations, as he and others had investigated the problems of falling bodies and of the action of various propulsive and other machines. . . . Working on mechanical, mathematical lines, and almost on these alone, . . . he was able to approach very near a conception which was not to be laid hold of for a century or more." Dr. Foster gives this estimate of Borelli's work on the circulation of the blood: "We may almost say, even not forgetting Hales, that Borelli brought our knowledge of the subject nearly to the point at which, after the lapse of more than a century, indeed of nearly two centuries, Poiseuville and Weber took it up again."

These remarkable results were obtained at a time when physics was just beginning to assume the position of an exact science, and when an era of wonderful development of mathematics, originating in the genius of this same Descartes and others, was opening. In view of this fact the layman in medicine may be pardoned for speculating on what would be the present state of that science had mathematicians turned their attention more in that direction, or, if you please, had physicians remained mathematicians.

On the question of a knowledge of higher mathematics as a necessary part of the preparation for the study of medicine today, Professor von Müller states, "If, therefore, physics is to be taught in our universities in such a way as shall satisfy the needs of physicians later in life, an absolutely different view must be taken, and this is possible only when a higher degree of mathematical knowledge is assumed. Today, for the study not only of physics, but also of chemistry and physiology, a thorough knowledge of mathematics is necessary. For this reason I can follow only in part the text-book of Hamburger, written for physicians, on osmotic pressure and the theory of ions. There

are many students of medicine to whom the important works of Otto Frank on the problems of the circulation of the blood are only in part intelligible, because they assume a knowledge of higher mathematics." The discoveries of Zuppinger in the treatment of fractures of bones is based on mechanico-mathematical principles. Dr. Theodore Christen has embodied Zuppinger's discoveries in a book, from the preface of which I quote the following: "Right here an objection which we meet at every turn, that Zuppinger's ideas may be very interesting, perhaps even theoretically correct, but that they are too 'mathematical,' too 'abstract' and not intelligible to the medical fraternity, must be answered.[3] . . . We have, however, owing to the sentiment at present prevailing among our colleagues of the medical profession, made it our duty to keep the principal part of the text of this book free from every mathematical formula. . . . To give only an approximate idea of the importance of every improvement in this field of science, it may be stated that (according to Hoffa) about two-thirds of the premiums paid in workmen's compensation insurance in Germany are the result of poorly healed fractures of bones."

In the preface to his masterly work, written especially for physicians and zoölogists, Otto Fischer states that he has endeavored to derive and represent the kinematic principles in an elementary way, so that the book may be more generally understood; but in Chapters IV and VI he was obliged to have recourse to the Differential and Integral Calculus, because without it he could not obtain the principles sufficiently general and intact.

In view of its splendid triumphs in astronomy, physics and other sciences, it is not surprising that enthusiastic disciples of mathematics overestimated at times the possibilities of its usefulness, especially when stimulated by strikingly new and original discoveries or a re-awakened interest. In the early

[3] A sufficient answer might be to ask physicians to study mathematics as a necessary part of their professional equipment.

days of analysis much more was expected of it than it had power to give. As stated by Bertrand, "the first successes were such that one might suppose all the difficulties of the science overcome, and believe that mathematicians, without being longer occupied in the elaboration of pure mathematics, could turn their thoughts exclusively to the study of natural laws." But if, according to d'Alembert, mathematics "is generous and gives us more than we ask of it," one must, unfortunately, admit that it sometimes gives less. Astronomers and physicists are waiting today for mathematics to remove unsurmounted obstacles to further progress in numerous important directions. Unsolved problems in hydrodynamics, electricity and magnetism, in the equations of celestial mechanics, still present themselves. Mathematicians have long lost hope of solving differential equations in terms of a finite number of known functions, except a few of special type, and resort to infinite series which formally satisfy the equations; but many questions relating to the properties and applicability, and especially to the summation of these series, yet remain unsettled. The more minute perturbations actually to be reckoned with in the solar system can in most cases be obtained only in the form of infinite multiple series, which are of a form too intricate for the determination of their convergence or divergence. In the classic problem of n bodies, series can be obtained which are universally valid if the bodies repel each other. But celestial bodies attract each other, and when n is greater than 2, the problem transcends the present power of mathematics. The mathematical difficulties of a complete kinetic theory of electronic conduction, which would have to take into account the occurrence of collisions between electrons, in order to account for Maxwell's distribution under normal conditions, according to Richardson, appear to be as yet insuperable.

A striking example of apparent failure of mathematics to render appreciable service in a practical field, as yet nearer to us than the stars, is found in the development of cars or

ships traveling above the surface of the earth. Such notable results as have been obtained, so far as I am informed, are associated with the names of skilled mechanicians, ignorant of mathematics, although Langley, after much study of aerial locomotion, earlier announced that mechanical flight was possible. This failure is in part due to the fact that mathematicians seem as yet not to have given sufficiently sustained attention to this problem.

But if such outstanding, unsolved problems have destroyed the dreams of the earlier mathematicians of an unchecked, triumphal progress, the difficulties have but increased the devotion and confidence of their successors. As Picard says of Celestial Mechanics, "It is not perhaps so much because of the needs of practice as in order not to avow itself vanquished, that analysis will never resign itself to abandon, without a decisive victory, a subject where it has won so many brilliant triumphs."

Mathematicians have been reproached for devoting their energies quite largely to theories which seem to be remote from any applications, while there is so much work in applied science for them to do. Unquestionably, mathematics has in many directions far outstripped applications, and in some it has seemed deliberately to avoid them. But notwithstanding the truth of such statements, the mathematician is justified in all of his work, not only because of the assistance of mathematics to a better knowledge of the mind of man, of which more presently, but, in part, also because by such work the mathematician is giving to his instruments keener edges, which later may be found ready to cut the knot of some new problem in applied science. The history of mathematics furnishes numerous instances of theories made ready for such demands. I cite only one, that of the so-called imaginary. The theories emanating from this notion have greatly advanced modern analysis and geometry, and through them, the real in the physical sciences. It is impossible to overestimate their importance in developing a general theory of functions, and

especially those parts of this theory relating to infinite series and differential equations, the great instruments of the astronomer and physicist. The theories of quaternions, vectors and kindred subjects, very extensively and profitably used in science, owe their origin to this same misnamed "imaginary." Sir William Rowan Hamilton's quaternions were the result of his attempt to enlarge the complex number system, which uses only two dimensions, by extending it to space of three dimensions. Maxwell's great triumphs in electro-dynamics have been attributed to the fact that he "thought in vectors."

Moreover, there are many who, like Gauss, find the chief charm of mathematics in those phases of it which are most remote from the practical. He who can see in the stars only nuggets of gold is ill-fitted to appreciate their orderly movements in the heavens. A boast of the Pythagorean School was that it had raised arithmetic above the needs of merchants; in the words of one of its maxims, "A figure and a step forwards; not a figure and three pennies gained." Darwin's reason for regretting that he had not given sufficient attention to mathematical studies was not because of their usefulness or their importance as a logical discipline, but because, in his opinion, "men gifted with mathematical learning seem to possess a sixth sense." The unusual speculations are the mathematician's intellectual luxuries. In the economy of our complex human life, surely every individual is entitled to a sanctum sanctorum, into which he may sometimes retire. If non-analytic functions, hyper-space and such like, lack something of the appeal to human interest which is in a contract written on clay at the time of Abraham, or a mummy of Rameses II, or the personal idiosyncracies of a great poet, they may, nevertheless, afford aesthetic satisfaction to that strange class of human beings for whose origin biologists are unable to account.

But even if it were possible to affirm that many mathematical speculations never can have any applications outside of pure mathematics, and if the mathematician be not entitled

to his intellectual luxuries, there remains the weightiest of all justifications for such speculations in their influence on pure thought and in their revelations of the resources and workings of the mind itself. Poincaré, the philosopher, as well as prince of mathematicians of our generation, said: "On the one side mathematics must reflect upon itself, and this is useful, because reflecting upon itself is reflecting upon the human mind which has created it; the more so because, of all its creations, mathematics is the one for which it has borrowed least from outside. This is the reason for the utility of certain mathematical speculations, such as those which have in view the study of postulates, of unusual geometries, of functions with strange behavior. The more these speculations depart from the most ordinary conceptions, and, consequently, from nature and applications to nature's problems, the better will they show us what the human mind can do when it is more and more withdrawn from the tyranny of the exterior world; the better, consequently, will they make us know this mind itself."

A brief but slightly fuller statement of some peculiar concepts, such as are referred to by Poincaré, may give to them more definiteness in the non-mathematician's mind.

A non-analytic function, represented geometrically by a continuous curve without a tangent at any point, seems at first thought to contradict our mental images of such curves. But try to imagine a kind of "crinkly" curve which has an infinite number of infinitesimal oscillations or waves in the neighborhood of every one of its points. The space-filling curves of Peano and others are, perhaps, more difficult to imagine. An example is a line which, by making an infinite number of turnings in a unit square, in the limit fills the square and corresponds, point for point, to a straight-line segment of unit length.

The transfinite ordinal numbers of Cantor, which use the increasingly important concept of "correspondence" and the theories of point-sets, may be crudely illustrated by a simple example. The set of numbers,

$$1/2,\ 2/3,\ 3/4,\ 4/5,\ \ldots$$

continued indefinitely, lies between 0 and 1. Each number in this set can be checked off against (put in correspondence with) a definite number in the set of positive integers,

$$1, 2, 3, 4, \ldots$$

continued indefinitely; and, conversely, each number in the second set can be put in correspondence with a definite number in the first set; that is, there exists between the numbers in the two sets a one-to-one correspondence. If now, in connection with the preceding, we wish to extend the correspondence to include the set,

$$1, 1\ 1/2, 1\ 2/3, 1\ 3/4, \ldots$$

on the one side, how, on the other, shall we extend the set of positive integers, not one of which is unused in the preceding correspondence? We postulate a transfinite number, designate it by w, say, and place the two sets,

$$\begin{array}{l} 1/2, 2/3, 3/4, \ldots, 1, 1\ 1/2, 1\ 2/3, 1\ 3/4, \ldots \\ 1, \quad 2, \quad 3, \quad \ldots, w, \ w+1, \ w+2, \ w+3, \ldots \end{array}$$

in one-to-one correspondence.

The non-Euclidean geometrics, considered from the point of view of projective geometry, are classified as hyperbolic, parabolic and elliptic, according to their measures of curvature. One of them (Lobatchevsky's) replaces Euclid's eleventh postulate by the assumption that two straight lines can be drawn through a given point parallel to a given straight line. In this geometry the sum of the angles of a plane triangle is less than two right angles; yet it is as logically complete and perfect as is Euclid's.

A quite different concept is that of hyper-space, or space of more than three dimensions, and wholly beyond our present mental powers to imagine. Interesting speculations have been made by scientists of the first rank in regard to the reality of space of four dimensions. It is related of Gauss by his biographer, Baron von Waltershausen, that "he used to say that he had laid aside several questions which he had treated

analytically, and hoped to apply to them geometrical methods in a future state of existence, when his conceptions of space should have become amplified and extended." Just as, in solid geometry, plane figures are the projections of figures in three-dimensional space, so the latter may be regarded as projections into space of three dimensions of figures in four-dimensional space.

As last examples of such speculations, I cite the researches on Fundamental Systems of Axioms by Hilbert and others, who imagine "three kinds of things," which we call points, straight lines and planes, for which fundamental axioms are to be established without appeal to our ordinary concepts of geometry; and the attempts of the logisticians to reduce mathematics to formal logic and to make it independent of any appeal to purely mathematical reasoning.

It is impossible to predict the ultimate value of such theories, but experience has taught us not to classify them with "Chinese puzzles." Referring to criticisms of Gauss, Riemann and others, by scientists of the highest standing, Professor Mach asks, "Have these men never experienced in their own persons the truth, that inquirers on the outermost boundaries of knowledge frequently discover many things that will not slip smoothly into all heads, but which on that account are not arrant nonsense? True, such inquirers are liable to error, but even the errors of some men are often more fruitful in their consequences than the discoveries of others."

In many of his speculations the mathematician meets the philsopher and the natural scientist on the common boundary regions of their sciences. With them, he concerns himself about the nature and origin of his mental constructs; about the absolute value of his axioms and postulates, and the part played by intuition in formulating them, and in the logic of his reasoning processes. The intellectual tournament over these questions we must not expect to see settled today or tomorrow. It would be impossible to discuss adequately any one of them in the brief time yet at my disposal, but, in

passing, some comment may be made on one or two phases of them.

The fundamental concepts of the mathematician, in so far at least as these relate to the visible universe, are unquestionably idealizations of experiences of that space and of associations formed by these experiences. It seems to be well established that, in the formation of these concepts, the experiences not only of the individual, but also of the race, handed down to the individual by hereditary descent, play some part. But these sensations are crude in comparison to the refined concepts of our thought and reasoning. No one has ever seen a geometrician's straight line, or has ever drawn one straight line perpendicular to another; nor has any one found by physical measurement that the sum of the angles of a plane triangle, in Euclidean space, is equal to two right angles. Whence comes then the mathematician's infinitely precise concepts? Are our ideas of space and time, according to Kant, "necessary forms of perception, à priori truths, imposed by the perceiving mind?" Or must we, with Gauss, "humbly confess that . . . space presents a reality outside of our minds, of which reality we cannot dictate à priori the laws?" Poincaré asserts that the infinitely precise geometry of the geometricians was developed from the rough, primitive geometry through fertilization of the latter "by the faculty we have of constructing mental concepts." But one may ask, Whence comes this faculty? He replies by asking, "Is it not to the unconscious experience of the individual that we owe the infinitely precise space of the geometricians? This is a question that is not easy of solution." Whatever may be the ultimate answer to this question, the geometrician's space is exact, and it is of his own creation.

It is important to note, in this connection, that conception is often confused with visualization. It is easy to image a finite, unbounded space, as, for example, the surface of a sphere; but not Riemann's finite, unbounded space of constant positive curvature. The old difficulty of forming a concept of space either as infinite, or as finite but unbounded (that is,

space without some more space beyond it), may be traced to this source. One cannot picture mentally a plane of infinite extent or a single point as satisfactorily representing the part of it "at infinity"; yet this concept has been of great value in mathematical theories which have been productive of very useful results. An imaginary point or line in Cartesian geometry cannot be represented in the geometric picture; yet two imaginary points may determine a definite real straight line, and two imaginary lines may intersect in a real point. Such conceptions have benefited mankind today by removing barriers to the progress of mathematics, and thus enabling it to make advances productive of useful results, which otherwise could not have been obtained.

A concept then is simply a mental construct, not necessarily imaged, but defined in such precise terms that it may be subjected to the processes of exact, logical thinking. The scientist will naturally content himself with the simplest concepts necessary to his researches, and will change them only as they are shown to be inadequate to explain the phenomena with which he deals. Yet, when necessary, according to Professor Mach, the physicist "always prefers to sacrifice the less perfect concepts of physics rather than the simpler, more perfect, and more lasting concepts of geometry, which form the solidest foundation of all his theories."

And this leads me to consider briefly the question, Is there absolute rigor in mathematical reasoning, and, if so, where shall we find it? Is it simply a co-ordination between the perceptive and reflective faculties, to which the mind can add nothing, or does intuition enter into it? Unquestionably, geometrical proofs do often make use of the sensuous imagination, of "naïve intuition," as Professor Klein calls it, and must be supported by appeals to experience. Unsupported intuition would lead us to infer that a continuous curve has everywhere on it a tangent, as I have already stated. This assumption was tacitly made by Newton in thinking of a moving point as having everywhere in its path a definite velocity.

Yet Weierstrass's classical example of a continuous curve without a tangent at any point, translated into terms of velocity, would mean that a point moving along such a curve would not have anywhere a definite velocity, a statement which should not be confused with a velocity continuously changing from point to point, but perfectly definite at every point.

And even in arithmetic an inference concerning the universal application of a principle must sometimes be verified. The mathematician, C. G. J. Jacobi, discovered in the theory of numbers a law, of whose generality he had very little doubt, as he states. Nevertheless, in order to test its generality, he substituted a number chosen at random, or perhaps by a kind of divination, with the result that his formula was shown to be at fault. Every other number tried confirmed its generality. Later he found that the number chosen at random belonged to a system of numbers which made the sole exception to the rule. Professor Klein, contrary to the opinions of logisticians that intuition may ultimately be dispensed with, states, "I am of the opinion that, certainly, for the purposes of research, it is always necessary to combine intuition with the axioms. I do not believe, for instance, that it would have been possible to derive the results discussed in my former lectures, the splendid researches of Lie, the continuity of the shape of algebraic curves and surfaces, or the most general forms of triangles, without the constant use of intuition."

In the latter half of the seventeenth century and in the eighteenth century mathematicians were consumed with zeal to produce results from new discoveries and methods, and followed too literally the maxim of d'Alembert, "Go forward and faith will come to you," to examine critically the foundations of all of their results. With apparent lack of critical rigor, they trusted more to intuition, with the result that it has been necessary later to place some of their work upon more secure foundations. But the wonder is, not that they sometimes made mistakes, but that their results have stood so well the later more rigorous tests. The field of mathematics

is, and has been undergoing a very intensive and extensive critical examination, and exhaustive studies of the foundations are occupying the attention of mathematicians. As a result, mathematics is assuming today that quality of exact rigor which was so pre-eminently characteristic of the period of Euclid. The opinions of the two most eminent mathematicians of our generation are interesting and weighty. Poincaré affirmed only approximate rigor in intuitions of sense and imagination and absolute rigor in those of number, and directed us to seek it where it has remained pure—in analysis. Professor Hilbert's opinion, equally weighty, is, "While insisting on rigor in proof, as a requirement for a perfect solution of a problem, I should like, on the other hand, to oppose the opinion that only the concepts of analysis, or even of arithmetic, are susceptible of a fully rigorous treatment. This opinion, occasionally advanced by eminent men, I consider erroneous."

What then can we say of mathematical reasoning? That its processes will more and more satisfy the rational human mind; that its conclusions will be accepted for the "today" of the future; that men will continue to believe, as in the past, that any superstructure may safely be built upon it as a foundation, with implicit faith that the future will perfect but not destroy.

But it is a mistake to assume that by calling mathematics to the aid of science, final and exact statements of natural laws have been, or can be, obtained. What then is meant by the statement that the phenomena of the universe are "ruled by exact and rigid mathematical laws?" This, that the experimental law which describes a phenomenon is only approximate, but that the reasoning based upon it has the rigor of mathematics. It is impossible to incorporate in an experimental law all of the conditions which affect an observed phenomenon, and it is illogical to assume that all of them can be observed. The string of a violin vibrates with many degrees of freedom, but the differential equation which states the law governing its vibration cannot take account of all of them. The physicist

knows that the pendulum of his most refined experiments is far from being the simple pendulum of his mathematical theory. All that the scientist claims is that his experimental equation is a more or less closely approximate description of the phenomenon observed. From this he derives rigid mathematical laws. Further observations may be checked or corrected by reference to these results, on the assumption that they, more accurately than observations, express the laws of nature. Lord Rayleigh compares the results of the dynamical theory of vibrating strings with aural observations, "but rather," as he states, "with the view of discovering and testing the laws of hearing than of correcting the theory itself." But when there is too great divergence between results and observations, the mathematical theory may be corrected by taking into account conditions neglected or previously unobserved, thereby sometimes leading to important discoveries, as in the case of the planet Neptune.

We, therefore, conclude that the mathematico-physical laws are only approximate, but that, as knowledge increases and means of observation become more and more refined, a closer and closer approximation to ideal exactness will be attained.

There are certain other qualities of mathematical laws and processes which well merit a moment's consideration.

In brevity and exactness of expression the language of mathematics is pre-eminent as a vehicle for expressing thought. An equation in analysis is the most refined form of exact statement; indefinite or vague meanings are impossible in analytical language. "There cannot be," said Fourier, "a language more universal and more simple, more devoid of errors and obscurities; that is to say, more suitable for the expression of the invariable relations of natural objects. Considered from this point of view, it is as wide as nature itself; it defines all perceptible relations, measures time and space, forces and temperatures; this difficult science is formed slowly, but it maintains all the principles that it has once acquired. It increases and strengthens without ceasing in the midst of so many errors of the human

mind." When the scientist has expressed in this language an experimental law, he has written a paragraph in a description of the universe and has taken another step towards satisfying a universal craving of mankind.

Compare with this exact definiteness of meaning the inadequateness of ordinary language to express the exact shade of meaning intended. Imperfections in the alleged logical arguments of the lawyer, of the publicist, even of the philosopher, are often attributable to imperfections in the analysis of ordinary language. It has been stated that Plato used the word "Cause" in sixty-eight different meanings, and Aristotle in forty-eight. Moreover, mathematical language eliminates the "personal equation" which enters to such an extent in the use of ordinary language. One is not surprised, therefore, that there are so many "schools," each one, in the opinions of its disciples, entirely logical in the exposition of its principles; that political economists, reasoning from the same data, come to diametrically opposite conclusions; that historians, having the same sources, form different opinions of the characters of important personages in history, of the significance for today of historical periods. But all men are led inevitably to the conclusion that the sum of the angles of a plane triangle is equal to two right angles, if they accept Euclid's eleventh postulate.

A second quality of mathematical results is their permanency. The structures built by the engineer and the architect, the creations of the artist and the scultpor, in time will crumble and fade; human laws and ethical standards of today will not suffice for tomorrow; with the increase of knowledge and of precision in observation and experiment, the foundations of science will undergo revision, the mental constructs of human minds will change; but most closely approximating to the ideal of permanency will stand mathematical reasoning. The Euclidean geometry is the most perfect example of the permanency of intellectual achievement; the creation of other geometries has but emphasized this perfection. If the new theories of dynamics, not yet proved, which question the

immutability of Newton's law, ultimately make necessary a modification of it, one may expect it to be perfected but not destroyed.

The combined simplicity and comprehensiveness of many of the statements of mathematical principles will always excite our wonder and admiration. Newton's law, Laplace's and Maxwell's equations, already cited, are brilliant examples of this quality. Indeed, this power in simplicity has led many to assume that natural laws are simple; that, for example, only analytic functions occur in nature. But they forget that the mind in forming its concepts will naturally choose the simplest approximate relations which are adequate for its purpose. Weierstrass has proved that one can always find an analytic function which will approximate as closely as one pleases to a given non-analytic curve. Moreover, the assumed simplicity of natural laws is due, in part, to the comparatively simple channels through which sensations are recorded.

In conclusion, I wish to emphasize two qualities, or products, of mathematical thought, in my opinion, the most important of all, namely, their influence on our ethical and aesthetic judgments. Culture, the real basis of a worth-while civilization, implies, as Huxley has said from a different point of view, "the possession of an ideal standard, and the habit of critically estimating the value of things by comparison with it." Such a standard, among others, is the truth of mathematical laws, their surety, their justness. In an intellectual world filled with the obscure and insecure subtleties of metaphysical and theological discussions; with opposing "schools," adapted to the special predilections of evey individual; with man-made laws often neither reasonable nor just nor consistent, and too frequently inequitably, or not at all enforced,—is there not a feeling of intellectual satisfaction in the thought that a mathematical result, granted the premises, is forever true and always just? To me it is an oasis in a—I do not say desert—in an intellectual expanse as unsettled as the shifting sands. Should not our teachers of mathematics lay emphasis on its pre-eminent value

in stimulating respect for that form of veracity of which it is the most perfect example?

Because of the close intimacy of mathematics and science, natural phenomena continually assume new aspects. With more knowledge of nature's laws, our aesthetic judgments are better satisfied, our appreciation of the harmony and beauty in nature becomes more keen and sympathetic. Nature is no longer a picture with its face turned to the wall.

One's thought of a great bridge assumes a wholly new aspect when the problems solved in its construction are pointed out by the engineer; it is no longer simply a safe means of passage across a river; it has become idealized, its elements of symmetry and beauty are seen, not only in its physical features as revealed to the eye, but in the harmony and correlation of these with the paralleling mathematical thought. The noblest creations of the architect, when thus viewed, yield not only an aesthetic pleasure, but an intellectual satisfaction, the higher, the more perfectly its designer has made mathematics the hand-maiden of harmony in its design. In like manner, one's appreciation of a picture may be greatly enhanced by listening to the comment and interpretation of a painter. It is not, I believe, a canon of painting to copy nature exactly; but a picture cannot be truly great, however inspiring the thought of its creator, however perfect the harmony of its colors, if it depart sensibly from conformity to nature's laws, in shadows, perspective and other physical features.

But how shall the educated man, a layman in mathematics and science, appreciate such appeals to his emotions, to his imagination, to his intellectual gratification? Is it necessary for him to understand the mathematical laws and their derivation? In watching the flight of a ball through the air, must he know how the path followed by it can be expressed in a mathematical equation, that every infinitesimal change in its velocity and direction admits of mathematical expression and can be predicted in advance, in order to feel emotional quickening and intellectual pleasure? Must the genius of a poet, for his better

understanding, express all this in an ode? Would you deny to the layman in music, who cannot perhaps read a note and whose aural sense is not as finely attuned as is your own, any part of your aesthetic and intellectual pleasure in listening to a symphony? The latter appeals to the mind and heart through the ear, the former, more subtly perhaps, through the stimulus of an antecedent mental quickening. Leave then to the mathematician and the scientist the determination of the mathematical laws, and let faith and your imagination open the doors to their poetry and art. Mr. Robert Frost's comments on these in literature, when recently in Philadelphia, are pertinent to my thesis. "Art," said he, "should follow lines in nature like the grain of an axe handle. . . . But people say to me, 'The facts themselves aren't enough. You've got to do something to them, haven't you? They can't be poetical unless a poet handles them.' To that I have a very simple answer. It's this: 'Anything you do to the facts falsifies them, but anything the facts do to you transforms them into poetry!' " One could wish that Mr. Frost would turn his thought also to the poetry of differential equations and the theory of functions, of groups and the theory of numbers, of the foundations of mathematics. For mathematics not only assists in the creation and appreciation of the beautiful, it is itself beautiful. A mathematical formula is not a collection of dry bones; it is a living spirit, which to the initiated speaks a language as noble as that of a Homer or a Shakespeare. Each symbol is a thought, the whole a poem. One sings of a ball, thrown by the hand of a child, another of the sublime movement of a planet in its orbit. Each gives an added, often subconscious charm to some phenomenon of nature, and acquires thereby new beauty of its own. "The world of ideas which it discloses or illuminates," said Sylvester, "the contemplation of divine beauty and order which it induces, the harmonious connection of its parts, the infinite hierarchy and absolute evidence of the truths with which it is concerned, these, and such like, are the surest grounds of the title of mathematics to human regard,

and would remain unimpeached and unimpaired were the plan of the universe unrolled like a map at our feet, and the mind of man qualified to take in the whole scheme of creation at a glance."

Is there not poetry in "a language which thus reveals mysterious worlds of truths, of which without its help the mind could not have formed the least conception?" Before its revelations, man stands exalted yet humbled; he realizes the immensity of his science, "which no one can flatter himself that he knows. Yet all the world speaks it, and particularly those who most profoundly ignore it."

One does not wonder that Lagrange, inspired by the inherent worth and beauty of mathematics, when confronted with the guillotine and asked how he would make himself useful in the next world, replied, "I will teach arithmetic."

> But, ". . . with taper-light
> To seek the beauteous eye of heaven to garnish
> Is wasteful and ridiculous excess."