SCIENCE

FRIDAY, JULY 22, 1898.

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

PROBLEMS OF BIOLOGY.

A BOOK entitled 'Problems of Biology' has recently been issued from the press of Swan, Sonnenschein & Co., which is in many repects remarkable. Its author, Mr. George Sandeman, is evidently a metaphysician whose knowledge of biology is limited largely to theoretical writings. His style is peculiarly obscure and incoherent; *e. g.*, the following is the preface: "This volume contains the criticism of the contemporary biological systems. That enquiry is necessary as an introduction to the study of the problems of organic life, but it is not in itself a doctrine of biology. The argument ought to proceed to the discussion of the philosophy of nature." There is a flavor of dogmatism, pedantry and extravagance about the book, and often one does not know whether the author is in earnest or is perpetrating a huge satirical joke. But, in spite of all these imperfections and uncertainties, there are many keen and just criticisms of certain popular biological doctrines and methods.

The contents are divided into five chapters, the first of which is a far-going criticism of the Methods of Biology. There is, we are told, a remarkable anarchy within the science as well as a certain indefiniteness in its scope. "The inner confusion of biology depends upon the form of the science. The *necessary* form is a theory of individuality. The *professed* form is the

induction of general laws from known facts. The *actual* form is a certain product of these two factors. Each biological system has to answer two questions: How are the qualities of the individual related to one another? And, How do the qualities exist by reason of their significance?" The various systems are complete and final in themselves and are mutually exclusive. "There is complete independence of one another and almost complete independence of research. If it were not so they would combine and research would discriminate between them. There are twenty good theories of the development of the individual, but I cannot say that any one seems to be better or worse than all of the rest. A certain controversy with regard to natural selection and use inheritance lived long and was discussed in every public place and with the aid of hosts of detailed observations. Yet it was never cleared up and neither side had the advantage; but because men become weary of it, it has now been allowed to rest. It is not otherwise with the history of biology. New systems supersede old ones and the latter are not disproved but forgotten. * * * These are some of the features of the inner confusion. They have made the very name of biology a by-word. And though the anarchy may not be obvious to a people delighting in formulæ which may be applied with equal facility and barrenness to everything which is organic, it is so present to men of research that they leave the whole matter on one side as simply not pertinent to their occupation, and are not patient to bear even the mention of what they repudiate with more justice than they are always aware, as metaphysics."

Such a criticism is plausible and misleading. In biology, as in other sciences, there is a field of well ascertained facts and of well grounded theories, and outside of this there is a region of hypothesis which, as in chemistry and physics, extends out beyond observation and experiment and thus enters the sphere of metaphysics. Because popular interest is so largely drawn to the borderland problems, our author seems to assume that the whole science is merely an aggregation of crude, pioneer hypotheses. It will astonish many persons to learn that the theories of biology are completely independent of each other and of research, that they cannot combine and that research cannot discriminate between them. There was once held a doctrine of preformation which taught that the homunculus existed *as such* in the egg or sperm. Does any one hold that view to-day? There was once an opposing doctrine of epigenesis which taught that the egg or sperm is *unorganized* matter. Does any one still hold this view, and has research had nothing to do in settling this famous controversy? This single instance, and many others could be cited, proves that what appear to be contradictory views may be harmonized when research has made our knowledge of the subject more complete; and in this biology does not differ from any other science. Other problems, though not absolutely settled by research, are out-grown and forgotten; we do not care to seriously discuss the *circuitus gallinaceus* to-day; the narrow limits of the old problem have been outgrown, and it is not otherwise with any science: "The old order changeth, yielding place to new." The ideas of many people are hazy as to the significance of the word *biology*; by some it has been regarded with suspicion; by others it has been used to conjure with, but who will not be surprised to learn that the name *biology* is a by-word? To be sure, it does have the same sound, but the spelling ought to save it.

Another subject of the author's criticism is the vagueness, ambiguity and self-contradiction of the most important terms and conceptions of biology; *e. g.*, *function*, *acquired character*, *inherited character*, etc.

This criticism is especially applicable to the most general and inclusive terms of biology and of many other sciences. It is unfortunately true that many biological definitions are not as clear cut and consistent as they should be, but where a definition includes a great mass of little known phenomena nothing better can be expected; it would be ungracious on the part of the biologists not to be thankful to the philosophical critics for pointing out these inconsistencies, but the real remedy here, as in the matter of unsatisfactory hypotheses, lies not in criticism, but in exploring more thoroughly the facts and phenomena in question.

But leaving the general introduction and passing to the more specific criticism of the methods of biology, we are told that the actual form of theoretical biology is dependent upon three postulates: 1. "The qualities of the individual are discrete, numerable constituent elements of which the organism is the total sum, and have, therefore, each the value of an ultimate unit for biology. They are thus independent of one another as regards their significance, maintenance, development in the individual, existence when latent, inheritance and variation and acquirement by the race." 2. "The qualities of the organism and all its stages are the manifestation of, and are related to one another only through, an agent or system of agents within the known body. The agent which answers to the unity of the organism is purely self-determining; it is in the attitude of pure activity to the body, which in consequence is in the attitude of pure passivity to the agent. * * * It carries the qualities when they are latent and carries alternative qualities, and it manifests these when and where they ought to be manifested." 3. "The adaptedness of organisms is due to the external addition of new qualities to the rest, which henceforward are included among, but not conditioned by, the qualities which have up to that time existed. The environment is something separate from the organism; and the latter is, by the addition of new qualities to the trust of the agent, thus educated up to circumstances which can exist without it. The inertia of the agent is such that it may persist in presenting qualities which are unrelated to other qualities and which have ceased to have any special external and independent use. The various qualities of the organism are thus due to the slow addition of modifications through many years of changing circumstances."

At first thought it will be doubted whether any biological system makes any such radical demands as are contained in these three postulates; certainly few biologists are conscious of making such demands, and yet the author shows, with much ability and a wealth of illustration, that this is the logical outcome of many biological doctrines.

The book is almost entirely devoted to a philosophical criticism of these three postulates. This criticism is, in the main, clear sighted and well founded. After declaring that these postulates are not working hypotheses and in themselves are of no value to research, the author points out their weaknesses from the standpoint of philosophy. "The first and second postulates arise from the relativist theory of knowledge and the agent is the thing-in-itself * * * The whole method depends upon a fiction; * * * it is a mere logical fallacy. If biology is to treat of *individuality* we need a better form of doctrine than that of the agent." As to the third postulate, it presupposes the transformation of species, in favor of which doctrine the author sees but little direct evidence, though he feels compelled to accept it because of analogy with other systems.

I. In the second, third and fourth chapters the author deals at length with the

three postulates named. As to the first, he says that it is actually affirmed, or at least assumed, in many theories of general biology, of which the following are illustrations:

1. Nägeli, De Vries and many other biologists think it necessary to believe in separate, discrete and numerable hereditary units which exist in a kind of symbiosis in the organism. The qualities which are represented by these units may be morphological, physiological, latent, alternative, stages in development, etc.; in fact, every difference in the organism is to be distinguished as a separate constituent element.

2. This postulate is also closely associated with the cell theory, which has become unduly important under its influence. "It is possible to so insist on the multitude, on the similarity and on the independence of cells as to deny the supreme individuality of the body. The whole organism, it is said, is but a colony of these, the true individuals, and the secret of its form is to be found in their habits of growth, reproduction and differentiation. And so the question of the whole and the parts is removed from the sphere of the body, in which we have some opportunity of studying it, only to be repeated in the microscopic sphere of the individual cells. * * * If the individuality of the body is to be slurred over we have a right to expect that some architectural principle should be found in the cell itself. * * But I find no such attempt to fill up the conception of cells as anthropomorphic agents. * * We are not likely to find within an individual abstracted from a system in which it is only an element, the principle of the architecture of the whole system. * * Myriads of miserable Egyptians carried stones to the Pyramids; but no microscopic watching of any of these, stone and all, would ever explain the Pyramid itself."

3. Another illustration of this first postulate is found in the doctrine of the independence of parts, particularly put forward by Roux in his 'Struggle of the Parts.' "There must be some curious fascination about this conception of *struggle* that it should be introduced into the explanation of the parts of that which is the most perfect and unique unity we know."

4. The ordinary conception of independent variability of parts implies independence of qualities. If variations are really independent then we may at once give up the unity of the organism. The author argues that there is no such thing as independent variability, that all variations are correlated. Darwin's cases of correlated variations, viz., hairless dogs having imperfect teeth, white cats being deaf, etc., are only whimsical instances of a general law of correlation of parts. Natural selection, by insisting on independent variability, is unable to explain the numerous coordinated variations necessary to make the variation of a single part effective. The same difficulty is met, though to a less extent, by the advocates of use inheritance, for here also qualities are considered as primarily independent. "Confusion inevitably awaits any theory which moves by the disintegration of the individual into self-sufficient and primarily unrelated parts."

5. "This first postulate is further shown in the ordinary biological treatment of *functionless* parts, which are supposed to exist in their own right and in virtue of a separate inheritance. A functionless part of an organism is not useless; it is merely useless in a certain manner. * * * Nothing organic is functionless, except for a certain special abstract point of view." Every part is in some way related to every other part, and the very fact that a structure exists at all is evidence that in the process of its origin, development and maintenance it is functionally related to other parts. "One is apt to hastily assume that the significance of the part to the individual has nothing to

do with its rise and maintenance in the individual, and this assumption, when it is generalized, becomes the law that structure precedes function in the individual development. The whole movement of thought is due to the attribution of a merely abstract and external significance to the part."

6. "The postulate of the independence of parts is further found in the biological treatment of *latent* and of *alternative* parts and qualities. * * * The manifold features of the organism are latent in the germ; * * * regeneration of lost parts is due to the existence of the necessary parts in a latent condition; * * * all organic differences are inherited in latency and may vary when latent; * * * each generation in alteration of generations contains the other in latent condition; each sex holds as latent the alternative characters to its own; every change which the species undergoes in new conditions was latent in it before. * * * Latency is the chief category of biology. * * * Now, whatever is latent is simply not there; it has no existence. * * * Latency is possibility, and a thing is possible because of something else. And the problem of biology is to find a form for that *something else*. * * * The biological treatment of latent qualities shows that they are looked upon as independent of the rest." Against this position the author urges the great number of possibilities open to an organism under varying stimuli. "There is much more latent in an organism than is ever actual at any one time, and if all the possibilities are separate things we must invent a form for them in which they can be present in infinite numbers within a microscopic cell." In his treatment of alternative qualities the author admits that latency is not the same as possibility, for here we have one of two perfect forms developed, which may be wonderfully adapted to each other, as, for example, in the two sexes. He concludes, as have all who have reflected upon this subject, that it is necessary to assume some mechanism which will react in one of two definite ways. In treating of this subject his use of the word *Anlage* is unusual. "The *Anlage*," says he, "is not a thing which has ever been seen, but is that hypothetical object which represents the latent existence of one future particular." A glance at any text-book of embryology would show that a nascent, *visible* structure which has not yet the form and function of the developed part is frequently called the *Anlage* of that part.

7. Finally, this postulate dominates the doctrines of organic evolution; since each part exists in its own right, it is easy to imagine the putting together of this or that adaptation, the subtraction or addition of this or that part to any extent and in any combination that is able to survive.

In conclusion, the author affirms: "Organic differences of every kind are not separate elements; they are not numerable units, and the organism is not a mere sum of such units. To find that this is the case one has only to attempt to find one character in an organism which is not at once a part of a larger whole and itself capable of analysis into a hundred subordinate relations. * * * However much we may appear to gain for biology by separating the organism into things which play upon one another externally, * * * we really do no more than to do away with the individuality of a natural system in order to invest its parts with the more unique character of moral agents."

II. The second postulate, viz., that there is a self-determining agent within the known body, in which the unity of the organism inheres, is a necessary consequence of the first postulate, for as the latter breaks the organism up into separate and independent qualities so the former finds the unifying principle in the anthropomorphic agent. This agent is concieved under two different

guises: (1) as a material bearer or vehicle of the qualities; (2) as a quasi-psychical principle. The majority of biologists are advocates of the former view, among them Darwin, Spencer, Haeckel, Nägeli, DeVries, Wiesner, Weismann; the latter view has had numerous adherents from Bruno to Bunge, among them Stahl, Jaeger, Bunge and Hartmann.

With remarkable insight, the author criticises the theories of DeVries, Spencer, Weismann and Nägeli. The gist of this criticism can be given here in only a few fragmentary extracts. As to DeVries' theory of Pangenesis he says, after giving DeVries' point of view by various quotations from his work: "It seems fairly evident that we have to do with a metaphysical question alone, in all these quotations, just the question of identity in difference, of substance and quality. The pangenes are anthropomorphic agents, each one of which is a material vehicle of a special quality. They are anthromorphic because they are purely self-determining and not passive, and because they know the right and do it. They become functional *when it is time for them to do so*; they slip out of the nucleus *when they are needed* outside; they go through the cytoplasm to that part of the cell *which requires* their quality."

An account of Spencer's theory of Physiological Units is then given and their contradictory qualities are pointed out. "The agents (units) are now similar to one another, and again dissimilar; they are now merely constitutive and again directing. The units are different when considered in relation to the differences of the body, but they are identical when considered in relation to the ideal identity of these differences. When a distinction is thus substituted for a vague self-contradiction the units themselves present that problem of the organism for the satisfaction of which they were invented. They have the two aspects of identity and difference, and can no longer be the identity for the given differences of the body, so that they become useless."

Weismann's theory of the Germplasm is then briefly sketched, and in conclusion the author says: "Let us compare the determinant to an organism. Like the organism, the determinant can retain its proper form and functions and is the same determinant through all changes. It is fed; it reproduces itself. It is not homogeneous, but contains many ordered differences, and in virtue of its qualities it does its work. Now all its qualities are surely not the mere result of one another, for if they were it would not retain its identity through all the differences of its life any more than the organism would do if cells were conditioned by cells and stages by stages. You, therefore, need another system of determinants to control the determinants of Weismann as soon as anything is known about these, and to be the vehicles of their qualities; and you must then examine that new system in order to see whether or no you need yet another."

Nägeli's theory of Idioplasm is next considered, and it is shown that Nägeli regards the idioplasm as mere difference at one time and as mere identity at another, and finally that he considers it a quasi-psychical principle which brings forth *suitable* qualities at the *appropriate* time. Nägeli himself draws an analogy between the idioplasm and a pianist, and in this analogy the author finds a satisfactory summary of Nägeli's theory and a sufficient condemnation of it. "The *sounds* answer to the manifold differences of appearance; the *keys* to the idioplasm as mere differences; the *pianist* to the idioplasm as abstract identity; and, lastly, the *score* to the ideal unity in multiplicity. Now the analogy differs from the known body in one respect, that it inserts between the phenomenal differences and the

ideal unity, two steps; I mean the abstract difference of the keys and the abstract identity of the pianist. And Nägeli's theory, like all other theories of ontogeny, exists only in order to insert those two steps."

The author then proceeds to a consideration of the agent as a quasi-psychical principle, and as illustrating all doctrines of the class he chooses the theory of Bunge as set forth in his essay on Vitalism and Mechanism, in which there is laid down the familiar distinction between physical and chemical processes, on the one hand, and vital processes, on the other. "The former as *mechanical* are set over against the latter as *in some way not mechanical*, but as free from reciprocity and as conditioned only by ends. * * * But we have no reason for excepting psychical *processes* from that form under which we include the rest of the organism. Thinking is not miracle any more than 'cerebration' is miracle, and as a process it is as much in bondage to necessity as anything else is. * * * The *purposefulness* of the organic differences is that which has to be explained, but the two kinds of processes which are here distinguished do not differ in respect of that matter. Both are, if both exist, equally purposive in fact and equally mechanical in derivation. And all that the theory seems to do is to add to one set of processes another set which does not at all help us in the explanation of the former. * * * An intelligence is, indeed, an identity in difference, and it is perhaps natural that we should seek to insert such an intelligence into the organism as the agent of its identity. But an intelligence is the unity of its own differences—its own states; there is no conceivable sense in which it should be unity for the parts of the body."

In conclusion, the author examines the various theories of the agent in their relation to fact and as to their characteristics as a method. As to their relation to fact he attempts to apply these theories to the structure and functions of the Protozoa. What is the inner secret of the remarkable outer differences which are found in this group? "The agent here is of no avail, for you cannot divide up these creatures into separate cooperating cells nor regard their qualities as carried by vehicles. You cannot, in short, in their case delude yourself with the belief that individuality in organisms is a vain show due to the external action of an agent or system of agents upon the passive material which is known to us in research. * * * I believe I am right in saying that *no explanation of the immediate existence of any morphological element has ever been made.* And this fact, veiled in the case of the Metazoa, because in their case an external significance for the structure can so easily be found or feigned, lies open to us chiefly in the case of the unicellular animals, in which we are at once forced to see that form must have its *rationale* and to confess that this *rationale* is hidden from us."

As to the general characteristics of the hypothetical agents the author observes: (1) that they are not known and have not been observed; (2) they are a scaffolding for the synthesis of abstract sciences; (3) they are alogical, and (4) they are unknowable. "In all these characteristics of the agent there is but one endeavor on the part of the theorists; it is to find an expression for the unity of the organism. But the method seems to me to be so riddled with contradictions as soon as it is taken seriously, and to be in any case so formal and inefficient, that we had better leave the whole problem alone than solve it by the empty doctrine of the independence of organic qualities and by the empty hypothesis of the anthropomorphic agent."

III. The third postulate is the basis for all theories of adaptation, whether they be those of evolution or of design. It proceeds from the assumption that "everything organic exists only by reason of, and is to

be explained only in relation to, some special use which it now has or which a similar structure has had in former times." As well might one say that grass was made for cows to feed on, or that day and night alternate that we may have light for work and darkness for sleep. If a special function cannot be assigned to a structure as its *raison d'etre* it is commonly regarded in one of three ways: (1) the function has not yet been discovered; (2) the structure is necessarily involved in the structure of other parts which have a special function; (3) the structure is 'vestigial' and its special function has been lost, though the part itself is continued by force of inheritance. There are serious objections to assigning a special function to every part for the fulfilling of which the structure exists: in the first place, the special use is only one of many, and frequently not the most important one, which the part performs; secondly, the special use is merely conjectural, and which of the many uses it has is most important cannot be determined. It is impossible for conscious, reflecting beings to give a complete account of the causes of all their actions; much more must this be true of the uses of parts of organisms viewed objectively.

Three 'factors of evolution' are then considered, viz: Lamarckism, Use-inheritance, Natural Selection. Lamarck derives the adaptations of organisms from their needs. A certain confusion exists in his theory due to ambiguity in the use of the word '*besoin*,' which in some connections means *need*, in others *desire*. After quoting several important passages from the *Philosophie Zoologique*, the author says: "Now, all this doubtless appears very ridiculous, and, though it is as good as any theory of transformation, so it is. But it reveals one thing, a haunting sense on the part of Lamarck that he must bring in the conception of need at every point. These are no facts which he is relating to us; they are a set of the most varied and confused fancies as to how *need* can bring about the adaptations of organic life. Of the fact that need effects all this he is well assured, but his knowledge goes no further. And he finds it extraordinarily difficult to imagine how the indispensable principle of his theory does its work. Sometimes that which is needed is represented as actually thought of by the animal, sometimes as merely present to its 'inner feeling,' and sometimes as belonging to the animal only in one respect —in that it would be well for the animal to have it, though it has it not. Sometimes the creature needs the particular structure because of other habits or structures which it has already, and which could not exist in fact without that which is represented here as derived from their need of it. In a word, the main principle of a biological system could not well be more formal and all-inclusive, or in its working-out more indefinite."

As to Use-inheritance the author at once denies the distinction between innate and acquired characters. He takes, as a basis of discussion, the definitions of these terms given by Delage in his work on Heredity, viz: "Innate characters are those which have been contained in the fertilized ovum in some form or other; whether that form is known or not matters little. Acquired characters, on the other hand, are those which have been developed only through the action of the surrounding conditions." But the innate characters cannot be present *as such* in the ovum; they must be there only as separate and unknowable agents, for if present only in the sense that they are *possible* we cannot distinguish them from acquired characters which are also possible. On the other hand, acquired characters must be represented in some form in the germ. If they are only modifications of innate qualities they are innate qualities which are usually latent. "And not only

are acquired characters innate in that they are possible to the germ (and that is the only innateness of which we know anything or can at all credit), but the innate qualities are also acquired. They are, to use Delage's own definition of acquired characters, developed through the action of surrounding conditions." Only through the action of surrounding conditions are characters of any sort developed.

"Everyone admits that the experiences of the parents will in some way or other affect the germ and, therefore, the offspring. Are these changes identical in kind with those changes of the parent which gave rise to them? * * * The only method of exploring the question would be through the whole physiological history of the germ and of its development. * * * It is absolutely necessary that we should know this intermediate germ form and how it relates to the soma whence it comes, as well as how it relates to the soma which springs from it, before we can say what degrees and kinds of effect the particulars of the parent have on the far other pattern of the particulars of the germ, and what degrees and kinds of effect the particulars of the germ have upon the particulars of the embryo."

The consideration of Natural Selection falls under two heads: (1) a discussion of the struggle for existence; (2) a criticism of Delage's objections to the doctrine. As to the struggle for existence the author maintains that in the Darwinian sense every relation of an organism, whether external or internal, may be regarded as a struggle. Species struggle with each other and with their environment, parts and organs struggle with each other, and unknowable agents with unknowable agents. "The mother struggles with her child for nourishment. All individuals of one sex struggle with one another for those of the opposite sex. Parents struggle for representation in their offspring, and even forgotten ancestors, we are told, are separately within us, conflicting among themselves for another sight of the sun. In none of these cases do we see any struggle; we see merely results, and the struggle is a method of explaining them. * * It comes to be a question why we should speak of two things as *interfering with* one another, rather than as being *related to* or as conditioning one another in such and such a way. * * * The struggle between species or between the members of a species being, as we understand, a conflict by means of all qualities which have external uses, it is no more a special phenomenon of natural history than the struggle between the members of my body is a fact of physiology. In either case we have to do with nothing more than with a merely general anthropomorphic expression for relation."

The author then discusses seven objections which Delage sets down against the adequacy of natural selection in species formation. He agrees neither with Darwin nor with Delage. The objections to the doctrine of natural selection are not as to details; they lie at the basis of the whole method. The question is not whether natural selection is an all-sufficient factor of evolution, as Darwinians maintain, nor yet whether it is a subordinate factor, as Delage maintains, but whether it is a factor at all.

The book concludes with a brief chapter on the 'Unity of the Organism.' It is argued in a very positive fashion that the unity of the organism cannot be found in the protoplasm; that it cannot be found in any agents supposed to reside within the protoplasm; that it cannot be found in unity of feeling or the immanent soul, and that it can be found only in the *character* as distinguished from the characteristics. "We can regard all particulars as manifestations and components of one character. That character may develop itself in the ontogeny, but it does not

change. It is the same in the simplicity of the germ as in the complexity of the image. It is identical under the differences of male and female. It is the common nature, though no common quality, of germ and somatic cell, and of the elements of the different tissues. Individuals which differ from one another differ by one difference which, however, cannot be described except as an infinite number of differences, and all the features of one individual are one character. This is not the character of the protoplasm, nor of the idioplasm, nor of the immanent soul, but of the whole creature. And this character is no cause or condition amongst others. It is an aspect of all and is that aspect by which all comes into unity."

As thus defined the character, and hence the unity, of the organism is a purely metaphysical conception, wholly removed from the possibilities of research, and for my part I cannot conceive how such a conception can in any way advance our knowledge of organisms or assist us in the study of vital processes.

The basis of the whole criticism is the first postulate, which, in one respect at least, is wide of the truth. This postulate asserts that the qualities of an organism are *absolutely* separate and distinct elements. This, no one I suppose, has ever explicitly assumed or believed. If it were granted that the qualities of the organism are not absolutely independent, that the elements of the germ are related to each other as are the parts of the adult, the foundations of much of the criticism would be removed. But even as it is, the book will serve a good purpose as pointing out certain dangerous tendencies in recent biological speculations, and it should be read by all those who are interested in such speculations or who are in danger of rushing into biological metaphysics. It is a pity that the book is divided into chapters only and that there are no subordinate headings or numerical indices to indicate the subdivisions of the argument, and also that in many places the style is obscure, dogmatic and metaphysical, since with all these evident defects it will hardly obtain the reading which it otherwise deserves.

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*LANGUAGE STUDY.**

From a general consideration of the child's training it becomes evident that the great subjects which are most useful for discipline in the period of secondary education are the mathematical studies on the one hand, which exercise the faculty of abstraction, and the positive sciences, which train the power of observation and require truth to detail. If we should pursue the subject into the collegiate period we should find mental and moral science, literature and history coming to their rights. If this be in the main psychological we see that language study, as such, should have no great place in secondary education. The study of grammar, as has been already said, is very useful in the early periods of development if taught vocally; it brings the child out in self-expression, and carries its own correctives, from the fact that its results are always open to social control. These are, in my mind, the main functions of the study of language.

What, then, is the justification for devoting ten or twelve years of the youth's time to study of a dead language, as is commonly done in the case of Latin? The utility of expression does not enter into it, and the discipline of truth to elegant literary copy can be even so well attained from the study of our own tongue, which is lamentably neglected. In all this dreary language study the youth's interest is dried up

* Extract from *The Story of the Mind* in the press of D. Appleton & Co. (Useful Story Series.)