

PSYCHOLOGY AND PHYSIOLOGY.¹

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It is not the purpose of this paper, as to many its title may suggest, to draw sharpening lines of demarkation between psychology and physiology. The unity of all knowledge is to-day so obvious that no man of true instinct is likely to waste time in drawing scholastic limitations between any two sciences. Rather is it my purpose to plead that as near together and even overlapping as physiology and psychology now are in some ways, yet in others they are too widely apart. They overlap in subject-matter; they are too widely apart in points of view, in practical touch and in working support. The wish underlying all that I shall say has everywhere for its burden that the borderland between the two sciences be made clearer for both, and be occupied in more intimate and helpful relations. In this spirit I beg that I may be permitted to range over this common ground, now touching upon general subjects, and again upon specific problems.

For a beginning, it will prove wise to give attention to certain historical considerations. There are some reasons why we may study the historical relations between physiology and psychology with special care. I need not, in this age, remind any one of what the world owes to science. And if, instead, I emphasize a little the contributions which science has received from early studies of the human mind, I shall do so in order to bring to view certain evil inheritances which have crept in and come down to modern science therefrom—this, rather than to magnify the good that has come along with them.

By way of appreciating both the good and the bad, one may begin by realizing the bulk of the subject-matter now belonging

¹ This paper was one of a course of six lectures, on "Modern Psychology and its Bearings," delivered by the author, at John Hopkins University, in March, 1896.

in common to physiology and to psychology. Taking down Foster's latest edition, we find one-half of the entire four volumes, 772 pages out of 1556, devoted to the muscles, nerves and sense organs; and every word of this must now be considered to be the indispensable property alike of both sciences.

Having measured this bulk, we may observe of this great text-book how continually its pages involve psychological assumptions, data and explanations. Scarcely can we read a dozen lines without running upon some "sensation," "perception" or "feeling" "worked in the mind" by some physiological organ, or upon some physiological organ "reacting to" some sort of "mental occurrence." If in a thoughtful mood, one cannot read far without being struck with how impossible it would be to construct a science of physiology without psychological terms and conceptions.

Bearing in mind, therefore, how the bulk of physiology is thus permeated through and through with psychology, got from somewhere, let us now glance at certain events which have influenced the development and dissemination of psychologic science everywhere. Previous to the dawn of modern science the study of the human mind had been a favorite occupation of some of the profoundest men the world has produced. We may to-day reject their conclusions and their methods, but we do ill to neglect their influence upon their times and upon the conceptions inherited from those times. A pretty complete outline of psychologic theory was accomplished by those men. That it was not an entirely sound and successful system is well known. Yet what happened when the epoch of modern science came was something as follows: When the significance of the brain as the basis of mental phenomena became comprehended and the old doctrine of soul faculties was consequently thrown over, the old psychology was not so much thrown over with it as taken up bodily and transferred, good and bad together, to its new physiological basis. It is remarkable, upon examination, how little new psychology was really created in this early transitional epoch, and how few fundamental changes were made in the old. The whole energy of psychologists and of physiologists alike was exhausted in mere readjustment; and we can well imagine that much of this work was clumsily and carelessly done.

At that stage of history, physiology and psychology stood on the same basis of psychologic theory. Soon, however, great events happened that affected our two sciences in markedly different ways. First came the burst of metaphysical speculation which spread through Berkeley, Hume, Kant, Fichte, Schelling, Hegel, Herbert, Schopenhauer, Lotze, etc. Then followed the Darwinian epoch of science, culminating in our present evolutionary theories. The metaphysical epoch affected physiology and general science little; and we find them to-day throughout the enormous volumes of their production, using, for the most part, the same terminology and metaphysical conceptions that prevailed in the middle ages. Both epochs, on the contrary, influenced psychology profoundly. The new flood of metaphysical analysis demonstrated that the ordinary assumptions regarding body and mind are fundamentally inadequate; and post-Darwinian science forced a revolution equally far-reaching regarding their biologic relations. In consequence of all this, much conflict and misunderstanding have arisen between psychology and general science, including physiology. Psychology, finding itself without any adequate working hypothesis, has been forced to consider its fundamental problems in such a manner as gives to its current work precisely that speculative aspect which followers of the more settled sciences above all else abhor. From this so-called "speculation" the other disciplines draw back, declaring that it is wrong in spirit and is not true science.

With these things in mind, we may now approach the crux up to which they have been leading from the first. No class of men have been more zealous in expurgating from their science the false notions which scholasticism and mysticism held of it, than physiologists. But if the physiologists, through a desire to be "soundly conservative," now feel bound to draw back coldly from present psychological work because of its "speculations," we are forced to consider what sort of psychologic conceptions they are to which this conservatism chains their science the more closely. Plainly, they will be those which physiology prevalingly now holds, and which have come down to it traditionally from the middle ages; the same "speculative and pseudo-philosophic obfuscations" from which psychologic science has been seeking to free itself for two centuries. It may be that this

Herculean effort of psychology has not yet culminated in entire success; yet the physiologist should well consider whether he is wise in wholly ignoring the residuary influence of two hundred years of profoundest struggle for basal truths which the world has known. Also, he should consider whether his shrinking back into the metaphysical assumptions of mediaeval times is likely to prove essentially the sort of shrinking from "foolish" metaphysical speculation which he, at heart, intends.

We must not be content to view abstractly this danger of tying down modern physiology to these crude and primitive notions of psychology; and we must therefore now press on to witness concrete instances of the harm which such a course already has brought us.

To this end I propose to examine a group of subjects for which the words "visceral sensations," "emotions," "instincts," "sub-conscious processes" and "personality" may, in a measure, prepare the reader, and which, though they may seem, as thus strung together, to have no mutual relationship, yet I shall hope to show they are, in common, beset with a round of false traditions, tangled one with another, in a way fairly exemplifying our subject in hand.

I have spoken of the attitude taken by many scientists against current psychology. Nothing is more common than a certain sort of rank censure of the attempts of modern psychology to grapple with its elementary problems in a way necessitating closer speculation as to the relations of mind to body than physiological text-books have yet been driven to consider. In Dr. Charles Mercier's recent book (1895) on "Sanity and Insanity," we have an example of this, which, from the eminence of the author, and from the unique relationship of his profession, as an alienist, both to psychology and to medicine, serves admirably for our present purpose. In laying down the foundations upon which he is to build his views of insanity, we find this distinguished author declaring as follows (p. 47): "In the first place we must discard altogether the notion that mind can work upon, or influence, or produce changes in the nervous system, or in matter of any kind, however arranged." And, similarly, he "discards" the influence of neural activities on mental activities, going on to object, facetiously, to the idea of "putting beefsteak into a sausage machine and pulling out a sonata"; and to striving to imagine a thing that is "partly an iron bar and partly a smell of paint."

Now, as a matter of fact, precisely what does happen, miraculous and impossible as it may seem to Dr. Mercier, *is* that we are continually putting beefsteak into our sausage machine and pulling out sonatas and effects of that kind. Nothing but the superstitious traditions of primitive ignorance should blind any sober scientist to this fact. Modern psychology is bravely endeavoring to find how the trick is done, and has, I think, fair chances of success; possibly through giving Dr. Mercier a more correct notion of what a beefsteak really is. Be that as it may, this tirade is an example of my point in hand. For confessing that we do not yet know the ultimate nature of mind or body, I must remind Dr. Mercier that the assumption which he positively and unhesitatingly makes is nothing more or less than a specimen of the crudest metaphysical speculation that has come down to us from scholastic and pre-scholastic times.

I have not space here fully to point out the results of Dr. Mercier's rashness in his own book and in his department of science, interesting as this would be. I shall have occasion later to note a single item. But we can, here and now, compare his method with the magnificent judiciousness of Dr. Foster toward the same subject. Already we have had occasion to speak of the bulk of psychology to be found in Dr. Foster's pages. Yet throughout all his four good-sized volumes I do not find a solitary passage wherein he does not take for granted, and as fundamentally assumed, that mind and body *do* causally interact and "influence" and "produce changes" mutually in each other, all quite as Dr. Mercier declares we must not do. Constantly he speaks of stimulations that "determine" sensations, or "give rise to," or "affect," or "cause changes in" them. Always a causal relation between body and mind is directly involved in the language used. Moreover, it would have been absolutely impossible for him to have written his work on physiology without having taken this for granted. It is all very well for one to carry on an abstract metaphysical argument about the "absolute disjunction" of mind and matter and the "impassable abyss" between the two. But let that same person undertake to carry out his hobby concretely by rewriting Dr. Foster's text-book and he will give up the job very soon. Simply, he could not write a page intelligently *without* making the very assumptions blindly that Dr. Mercier arraigns

the psychologist for striving to make with clear knowledge. The harm which such men as Dr. Mercier—and they are many—do in their science by their own inconsistency, and still more by their denunciations of others for attempting to do what plain common sense demands all science should always do, is, I assert, a concrete example of the evil of which this paper treats.

It is my declaration that physiological text-books are full of scholastic traditions which not alone mislead science from its larger needs, but also mislead her in details and in her practical problems. Let us now examine some of these latter at even closer range. Few things have struck me more forcibly of late than the extraordinarily good psychological work being done among alienists. Yet I continually note in it certain peculiarities. A part of this work is so fresh and suggestive that I know at once it has come from new and direct observations in one of the richest of fields. Another part of it, however, makes me groan with humiliation to think that it must have come, at some time, from some psychological text-book, and that psychology ever could have been so bad. Now in these reports I have been much impressed with the prominent rôle given by these alienists, in their treatises on insanity, to so-called “coenaesthetic” affections, and regarding them you will permit me again to quote from Dr. Mercier, p. 92:

“Roughly speaking, there are four groups of viscera which are sources and receptacles of the nerve currents which correspond with the coenaesthesia. These are the heart, the lungs, the digestive organs, and the genito-urinary organs; and a morbid change occurring in either of these groups imparts a special character to the nervous currents proceeding from it, and is attended by a special modification in the coenaesthesia. Thus the special alterations of consciousness that attend disease of the heart is a tendency to anxiety—to active terror. When the lungs are diseased it is said that there is a tendency for the cast of mind to become joyous, and it is certain that the apprehension of danger and sense of ill-being are often insignificant in comparison with the gravity of the disease. Affections of the bowels are invariably attended by mental depression, by melancholy and wretchedness, more or less acute and profound, and this is the case whether or not the patient recognizes that he suffers from such a disorder. In affections of the genito-urinary apparatus, in addition to the feeling of illness common to all maladies, there is an irritability of temper, and often an hypochondriacal attention to the disease, which is peculiar to disorders of this class.”

Our attention is the more attracted to this from the dominant interest just now being given to visceral feelings, by psychologists, as the basis of our emotions generally. It may be recalled that psychology almost universally has separated mind into three ultimate divisions—Will, Intellect, and Feeling. Until three or four years ago all emotions, and all feelings agreeable and disagreeable, were conceived to be reduced, in accord with this orthodox plan, to pleasure and pain (Sully, 1892). In the last three years no subject of psychology has been more radically overhauled. And the old notion has been so sharply criticized that I think Prof. James voices the best opinion of his day when he declares of the traditional "pain and pleasure" doctrine that "it is one of the most artificial and scholastic untruths that remain to disfigure our science."

While this old doctrine has been thus shaken, no constructive explanations have been offered in its place that have been given anything like common acceptance. One theory, however, has been offered which undoubtedly is full of pertinent suggestion, if not satisfactory throughout. This is the James-Lange theory, which bases emotions on the "reverberatory feelings" which rise from our muscles and viscera during emotional excitement; that is, upon the sensations that come from our muscular activities exercised in *expressing* emotion, and the visceral sensations accompanying these acts. As Prof. James states it, "we do not laugh because we are happy, but are happy because we laugh"; the emotion rises from the visceral and muscular activities, rather than gives rise to them.

Such doctrine, coming from such high authorities, and coincidently with what the alienists tell us about these same visceral occurrences, must of necessity rouse our interest. Wishing to know what our standard physiology has to say regarding visceral sensations, let us turn again to Dr. Foster, IV., p. 282:

"In respect to all structures other than the skin and nerves, to such structures, namely, as muscles, tendons, ligaments, bones, and the viscera generally, there is a large amount of experimental and clinical evidence showing that, so long as they are in normal condition, experimental stimulation of them does not give rise to any distinct change of consciousness; a muscle or a tendon, the intestines, the liver or the heart, may be handled, pinched, cut or cauterized without any pain, or indeed any sensation at all being felt, or any sign given of consciousness being

affected. Nevertheless when the parts are in an abnormal condition even slight stimulation may produce a very marked effect in consciousness. If, for instance, a tendon becomes inflamed, any movement causing a change in the tendon, especially one putting the tendon on a stretch, will affect consciousness and give rise to a sensation. *But the sensation is one of pain, and not of any other kind.*"

The impulses which Dr. Foster speaks of as "continually passing upward from the viscera" (p. 283), end, therefore, in pain and in pain only. At once we begin to suspect that, at the very least, there is something quite irreconcilable between this "common sensibility" of Dr. Foster and that of the alienists of the James-Lange school of psychology, and of history. Certainly joy and similar emotions cannot be explained on the basis of visceral sensations if physiology finds the viscera capable alone of pain.

We must examine, therefore, what evidence Dr. Foster offers for his semi-heretical views. All the more shall we be interested in doing this from the fact that, since the writing of Dr. Foster's latest edition, the theory of pain which he deduced, as above, from the old doctrine of "general sensibility," has been laid under wide suspicion and the doctrine of specific pain nerves exalted to strong probability in its place.³

If the coenaesthesia of history is turned into pain by Dr. Foster, and proven to rest on pain nerves by weightily accumulating evidence, not only will the running-aground of this hoary doctrine be interesting evidence of how mediaeval psychology has played mischief with the most learned and cautious physiologists of our day, but also our curiosity will be enlivened to see what may be the influence of the tradition in the psychic theories of Prof. James and of Dr. Mercier.

Of course, Dr. Foster had heard of the doctrine of pain nerves when he wrote his book. But so little heed did he give it that he dismissed it in a single sentence, remarking "that such a special mechanism [as pain nerves] has been preserved, but unused, through whole generations in order that it may once in a while come into use [when we have pain] is in the highest

³ See article in *Brain*, p. 1, 1893, and p. 339, 1894, by Dr. Henry Head, of University College Hospital, London. Also articles by Prof. von Frey in *Berichte d. math.-phys. Classe d. Königl. Sach. Gesellschaft der Wissenschaft zu Leipzig*, 1894, pp. 185 and 283; 1895, p. 166.

degree improbable." The incomparable looseness of this remark in the mouth of Dr. Foster becomes apparent when we consider that if constant use be necessary to the preservation of nerves, then he could just as well conceive the pain nerves to be employed with the obscure impulses which he declares are "continually passing upward from the viscera," as should his own basis of these impulses, whatever he conceives that basis to be, and which he has neglected to name. But neglecting this, we will pass on to examine the direct proof which Dr. Foster offers for his peculiar opinions (p. 283):

"We are in a certain obscure way aware of what we may call the general condition of our body. To put an extreme case, if the whole of our abdominal viscera were removed we should be aware of their loss. We should be aware of this through more ways than one. The tactile sensations from the abdominal skin would be in such a case different from the normal, and moreover the muscle sense of the abdominal walls and of all the muscles whose actions bear on the abdomen would make us aware of the void. But beyond all these indirect ways, it is probable that we should in a more or less obscure manner be directly conscious of the loss. It is probable that sensory impulses, not of the character of pain, are continually or from time to time passing upward from the abdominal viscera to the central nervous system. These do not affect our consciousness in such a direct manner as to enable us to examine them psychologically in the same way that we are able to examine special sensations, such as those of sight, or even sensations of pain; nevertheless they do enter, though obscurely, into our consciousness, so that we become aware of any great change in them, and they have been spoken of under the title of 'common' or 'general sensibility.' . . . When they do assume such a magnitude or intensity as to break in upon consciousness, the change of consciousness which they produce is of the kind we call pain," etc., etc.

Now note the confusion! Dr. Foster tells us explicitly that pain is not an exaggeration of pressure nor of temperature sensation (p. 282); that "general sensibility," pressure and temperature sensations are three separate kinds of sensations (p. 283); that "general sensibility," before it becomes "excessive," is "not of the character of pain" (p. 283); and that when it becomes so "excessive" that it breaks in upon consciousness sufficiently for us to become aware of it, then it is pain (p. 284). Surely it is anomalous for an impulse to be of one class of sense quality before it rises above the threshold of consciousness, and of another kind

as soon as it does this. It is anomalous, also, to speak of an impulse becoming "excessive" before it rises above the lower threshold (p. 284). What obfuscation, then, it is to declare that a sensation is not pain while "in consciousness" so obscurely that it has not yet reached "intensity" enough to break in upon consciousness sufficiently for us to be aware of it; and that then it is pain!

Dr. Foster should have unusually strong proof for sensations that are so obscure and that so violate all known analogies. But what becomes of the proof offered by him, when examined closely?—and here rises the point that particularly concerns the subject of our present paper. He offers, first, that this general sensibility has "*been spoken of*" in *traditional psychology*, and secondly, he offers the purely psychological conjecture that, "to put an extreme case," we should *probably* be directly conscious of the loss of our abdominal viscera if they were wholly removed. If we scrutinize this last point we may note of it, first, that a man is not directly aware of the loss of an amputated limb, but often feels it, after it is gone, precisely as if it were there; thus while Dr. Foster credits "general sensibility" to the limb as much as to the viscera, we are here absolutely certain that the loss of "general sensibility," if such exist, does not make us directly aware of the loss of the limb. Again, it is well known that after the removal by surgery of a kidney, or of other considerable portions of the viscera, one is not directly aware of the loss, not more than we are of their presence commonly and during health. And this, taken with "the large amount of experimental and clinical evidence" cited by Dr. Foster to the effect that experimental stimulation of the normal viscera does not give any sensation save of pain only, and with the well-known fact that pain generally is of itself incapable of giving us knowledge of the parts whence it rises, all this makes extremely doubtful if we should be aware of the loss of the whole viscera *except* through the indirect ways mentioned by the learned author. And finally, the combined facts that pain has now been proven to rise from specific nerves and *not* from "general sensibility," and that there is no reason whatever to believe that these obscure threshold beginnings of pain are anything but obscure and feeble pain, all these facts taken together and in the light of common analogy

Where an instinct is prompted by sight it is said to be aroused through association fibres. Undoubtedly the psychic state in question becomes *associated* with quite different thought-pictures under different conditions, and according to the sources from which it is aroused. Sometimes it is associated with certain conditions of the body, and sometimes with the scenes and events common to conduct for satisfying those conditions. But every tyro of psychology should know that, stripped of these associations, the inner core of these psychic occurrences would be absolutely indistinguishable from each other, and in the one case would no more give us any idea of our viscera (or of their loss, as Dr. Foster suggests would happen from general sensibility) than in the other they would give a wolf an idea of a fine fat sheep, or would give a dog a *sight* of his mistress' kitchen.

Of course the mere turning to this wider view would not, of itself, solve all the mysteries of hunger, nor illumine beyond a shadow all the realms of physiology, of insanity and of emotion. But it would bring light into all these regions. It would enable Dr. Foster to clear up many of the perplexities regarding hunger and thirst which he sets down confusedly in his book. It would enable us certainly to understand how "herbivora and other animals, whose stomachs are commonly more or less full," should yet feel hungry at the sight of food. It would enable us at least to imagine how hunger from an empty stomach may be explained in different ways and yet in conformity with the conclusion that the viscera give no direct sensory currents save of pain from pain nerves, and of muscle-sense from muscular contractions. It *may* be that the mere emptiness of the stomach, or, again, the undue presence of its juices, incite muscular and peristaltic disturbances of such persistency or strength that they force their way, let us guess, to some part of the Rolandic region of the cortex, and thence arouse by association the proper instinctive feeling of hunger, together with their own more immediate muscular feelings. Or in place of muscle-sense, it may be that obscure and feeble pains are commonly the only direct visceral sensations, and these, rising by pain nerves to some yet undiscovered pain centre of the cortex, spread thence by instinctive associations, as we conceived in our foregoing conjecture. Or a continued lack of food may, at times, complicate the

feeling of hunger through the blood; that is, in effects upon the nervous system generally, and similar to those experienced in fainting. Again, all these things may be brought into line with the fact that long-continued hunger may be lessened and apparently satisfied by injection of food into the bowels. Not being a physiologist, I am incapable of saying how these things shall eventually be explained. But of this I am sure, that when physiology shall rise above the traditional psychology of mediaeval times, then will it, and psychiatry and psychology, alike receive enriching inspiration in many fields as a consequence. It is a small matter how hunger be explained—whether as visceral sensation or as instinctive motive—but the collateral issues are momentous. They are momentous in psychology,⁸ and within the sphere of the alienist it must be more profoundly fruitful to his understanding of the maladies which Dr. Mercier treats, to study them as functions of the brain parts which

⁸ Lest it be thought that I have too much emphasized a trifling matter, I may here note that psychologists to-day are being driven into two schools. One, the Kinaesthetic School, inclines to look upon all motor ideas and upon all emotional feelings as *results* of muscular and visceral activities, and to disregard the sensory side of the instincts altogether. The other, the Instinctive, or as it has been more often called the Innervative School, turns all this squarely about and looks upon the cortex as lying in the *primary* road to muscular activity. A dispute can be hardly too much emphasized which thus sets Will, Feeling and Instinct upon such opposite constructions.

As a final word regarding "general sensibility," I remark that, as any one who has examined the physiological text-books of the last three hundred years may have noted, it appears always to have been the custom of these authors to tell all that was definitely known about our "five senses," and then to drop all that was surmised but not definitely known concerning the multitude of our other bodily sensations into the fathomless doctrine of general sensibility. As pressure, touch, heat, cold, muscle and joint sensations have each, in turn, been fished out of the common receptacle, the remainder has as often been left, as of old, disposed of by continuing a name. At the time of Dr. Foster's last writing all had been rescued but pain. And with pain now set on common footing with other sensory processes, it would seem well hereafter for physiology in disposing of hunger, thirst, nausea and such complex processes as are not yet understood, to tell only what is known regarding them, and then to drop the subject without hiding it under a mere word which is sure to deaden research and to mislead in many wide and depending fields of science.

most deeply underlie the foundations of our mental superstructure, than to regard them as the superficial effects of visceral disorders.

When in the beginning of this paper I strung together the phrases "visceral sensations," "emotions," "instincts," "unconscious and sub-conscious processes" and "personality," there was little apparent relationship between them. In the light of our general subject I hope I have now said enough to suggest the cogent relationship of them all, and to enable the reader swiftly to connect the little I have left to say, regarding the last three, with what has gone before. The current notion, common even in science, that instinctive conduct is unconscious conduct, is one of the grossest and most characteristic superstitions that has come down from the past. It reached its climax, in Descartes, with the doctrine that all animals, save man, are absolutely unconscious automata. Gradually this declined into the belief that only the instinctive acts of animals were unconscious, it yet being held that animals lower than man are mainly instinctive, and that man is little, if at all, so. To-day we have got so far as to recognize "that man has more instincts than any other creature." Yet the superstition that instincts are unconscious is still of such subtle influence, that while leading psychologists may assert the contrary in the few perfunctory remarks which they commonly devote to instincts in their text-books, yet they do this in a manner so "rootless and branchless," and so detached from their systematic expositions of will, feeling and intelligence, that it remains true that there is no treatise of psychology extant in which instincts play any fundamental rôle, or one proportional to their biologic and psychologic importance.⁴

The relation of instincts to attention, to "the motor problem," and, indeed, to the entire functions of mind, is so obviously fundamental to every one who but soberly considers the matter, that I need not dwell upon it here. Also, I have said enough regarding instincts as the fundamental source of explanation of hunger and like phenomena, to make plain that they are of

⁴This, too, in face of the obvious suggestion that the cortex, the accredited organ of consciousness, is likely to be the seat of congenital traits, and to play a dominant rôle in instinctive processes, proportionally to its size and importance over other ganglia.

practical interest to the physiologist. Yet I cannot better reinforce my accusation of the practical harm done by the ancient superstition that instincts are unattended with consciousness, than by showing its misleading influences in neurology. It is even more important to discover the detailed functions of our cerebral nervous mechanism than to untangle its anatomy. This work must largely depend upon our psychological interpretation of these functions. If we start out with false preconceptions of their psychology we are sure to be misled. The notion that the neural basis of all conscious activities must be "located" in the cortex, that all subcortical activities must be identified with unconscious conduct or processes, and that all unconscious processes must be subcortical, are among the main preconceptions ruling neurology to-day. If these preconceptions are wrong, then research in this field is sure to be greatly delayed; and I believe that these conceptions for the most part are wrong. When one considers the origin, the growth and the functions of the nervous system *as a whole*, then these notions stand out as contradictory of all unprejudiced induction or analysis. If the bulk of scientific opinion is quoted in their favor, yet this is not surprising if we observe that they who give them acceptance suffer from the same traditions as do they by whom the investigations are made. Few scientists have attempted to read the facts they have observed with any wider views. Where they have been forced to do so, the results have been profoundly satisfactory. As example of this, we may note the confusion and darkness that covered the problem of "visual localization" so long as all consciousness was denied to the subcortical parts, and while no distinction was made between the "higher" and "lower" functions of vision; and then contrast this with the present status of this problem, *i. e.* that which takes cognizance of the specifically graded function of the upper and lower areas of the left occipital lobes, of the unilateral and the bilateral activities of the hemispheres, of the thalami, and of the corpora quadrigemina. Throughout the slow genesis of these views, which forms one of the most interesting and instructive developments in the whole great problem of localization, we see the newly observed facts of aphasia and of experimental investigation, slowly and with great difficulty, correcting and fighting against the assumptions which had become

accepted law through no other excuse save those which are the subject of this paper.

From the first, the problem of localization has been aborted by false traditions. At the very outset false notions of the will gave a wrong significance and interpretation to the pioneer localizations made in the Rolandic region. Our emphasis of these as "motor" in turn blinded investigators to the true nature of all the so-called "sensory lobes." Also, as the latest reports show, preconceived notions delayed our understanding of the cerebellum. Similar things happened regarding the histology of the cortex. So long as the motor and sensory functions were supposed to be anatomically separate, it was easy to give the big cells of the rind wholly to the "necessarily powerful muscle innervations." The tradition that the ideational side of mind does not demand equal "power" with the connective, lent itself to this view. But according to the very latest reports there is reason to suspect that the branches of the broadest and most capacious of these cells lead finally upward rather than downward, and that their "greater power" has equal, if not more, reference to associational processes within the cortex, than to direct muscular innervations issuing out of it. All of these latest histological determinations quite keep pace with the newly determined psychologic law that all ideas are motor ideas, and that all associations, both within the cortex and without the cortex, stand on the same plane. And this parallel advancement in the two spheres admirably examples the good that would come were equal regard paid by physiologists to the new psychology, though admittedly not yet wholly satisfactory, as to the old metaphysics which, though hoary with conservative and unsuspected acceptance, yet proves upon examination to be still less satisfactory.

One of the most serviceable tasks that could be performed for our two sciences to-day (and one, I believe, that can only be accomplished by them jointly), would be to clear the air of obfuscating notions regarding "sub-conscious consciousness." Both sciences are becoming filled with obscurities under this head. It is well known how much is made of such processes in many current theories regarding hypnotism, multiple personalities and psychical research. Already we have encountered them

in the realm of physiology, influencing Dr. Foster's theory of pain. A still wider use is made of them in the fields of biology by those men who are penetrating enough to see that a broader hypothesis regarding the relation of mind to body is indispensable for the advancement of *all* science in the near future: for example, by Prof. Lloyd Morgan in his "Comparative Psychology." Into whatever field of "the living sciences" one turns, he finds an uncontrollable tendency, at present, to cover up whatever is not understood regarding obscure neural processes, with blind and wordy assumptions of subconscious sensory activities. Our problems of binocular vision, of hearing, of the knee-jerk, and our motor problems generally, are full of this sort of mystery. No one who has not specially examined the subject can suspect how widely and how pretentiously this looseness prevails. A short while ago I listened to a famous professor who, beginning with Prof. Wundt's description of his visual fields of perception and apperception, proceeded as follows:

"We are fully conscious of what we see through the fovea. The outer edges of the retina perceive, but do not apperceive. What they perceive is *in* consciousness, but is not noted. But if things may be *in* consciousness and not noted, then anything, and therefore everything, may be thus in our consciousness though not noted. And therefore the mind of the Absolute and all other minds may be in our mind; and our mind in every other mind; and all minds be one. In which case personality will mean solely the specific process of 'noting' or 'apperceiving'; and 'various personalities' will signify but so many separate 'loci of apperception' within the one Absolute."

This is a beautiful conception and perhaps a true one; yet before it is established much of its vagueness must be dispelled. Before we go further, it is necessary to know definitely, both on the neurological and the psychological side, what "noting" and "perceiving" and "apperceiving" involve. And while seeking this information, it is disastrous in both fields to talk blindly of "unconscious consciousness," and to cover up processes that are not understood with mysterious doctrines that are still less understood.

In view of this pernicious and increasing tendency, it is important that two things be done. First, endeavors should be made experimentally to clear up these obscure processes, and

since this must chiefly be done by anatomical and functional investigations, the work is likely to fall peculiarly to physiologists. And secondly, in this work physiologists must avoid being misled by the use of false psychological language. Let us all remember that it is not necessary to assume that the sensory counterpart of every possible external stimulus (external to the cortex) is directly represented "in consciousness" until it be proven that an unbroken communication from the periphery to the cortex has actually taken place. For example, when it is asserted, as has commonly been done since the day of Berkeley, that "muscle-sense" constitutes the important element in our perceptions of visual depth, let us remember while this may be true or not, that it is not necessarily true just because movements of the eyes facilitate these perceptions. The latest researches, indeed, make it extremely doubtful if muscle *sensations* enter at all into the sensory result. While it is necessary and well proven that currents descend from the cortex to move the eyes, it is not proven that retinal currents, running back to represent in consciousness the muscular contractions so occasioned, either actually occur or would be of the slightest use. The harm of assuming unconscious visceral impulses to explain all cases of hunger we have already discussed. In investigating all such processes, then, let us hereafter, and till we know the truth, speak of them as affecting the cortex and consciousness in some unknown manner; this rather than bolster up an unfounded doctrine which leads on to endless mistakes and adds no real comprehension to our stock of knowledge.

All I have said from the first regarding "visceral sensations," "emotions," "unconscious and conscious instincts," and "unconscious and sub-conscious neural processes," leads up to the brief final word which I still have to say about "personality." Leaving aside all religious questions, and confining our considerations alone to the neural processes involved, regarding no question of to-day is there greater traditional prejudice, in the midst of most obvious contradictions of such views, than now prevail regarding personality. It is said that the problem is beyond practical research and outside of physical analogy. Upon examination this does not appear to be the case. If two Leyden jars be differently charged and then properly connected, they will imme-

diately join in one electric "personality." If two sensory neural cells discharge mutually and unobstructedly into each other, they likewise join into a strictly analogous "personality." The psychic counterparts of similar happenings to this in the cortex and higher brain centres, constitute *our* psychologic personality. The whole problem, in so far as the nervous system is concerned, is one of simultaneously connected and mutually influencing neural activity. If an impulse gets sent in to the cortex, say from the lumbar region, in a way to modify and to participate in what at that instant is going on there, then that impulse will get represented in *our* consciousness. If the impulse does not reach high enough, but stops in some lower and momentarily disconnected ganglia, then it will not get represented in *us*, *i. e.* not in *our* minds.

The question now rises, of these massive split off groupings of subcortical activities which are strictly analogous with those of the cortex, and which perhaps at times are no contemptible rivals of them: are these attended with consciousness of their own or not? Assuredly it would be unwise for science to commit herself precipitately, and without profound consideration of the full depth and breadth of the problem, to the hypothesis that *all* so-called physical processes are conscious processes. To do this would be as unwise, perhaps, as it has already proven to be for her to shut herself within the opposite doctrine. Science is too vast, too precious, and yet far too unknown, to be staked either through rashness or through traditional superstition upon *any* narrow prejudice.

Undoubtedly, also, due heed must be given to religious beliefs. But it is just for this that I most earnestly plead for more strenuous consideration of our problem of personality. I believe in our personal life after death. With many others, I do so solely and wholly on scientific grounds. With them, I am convinced that a full and fearless investigation of the problem will, in time, substantiate this faith and make its reasons clear. Moreover, the time is rapidly stealing upon us wherein it breeds the greatest possible danger to religion to repress and to vilify these investigations. Just enough is becoming known or suggested, inevitably to lead to the most nauseating mystic and abortive results, unless fostered within the antiseptic atmosphere of pure science.

The modern facts of hypnotism, of multiple personalities and of psychic research can not safely be ignored. The worse the hands they are left in, the worse must be the result. This danger on the one side, and, on the other, the encouragement which is prompted from every analogy or rational conclusion which I am able to deduce from psychology, biology and neurology, and, as well, from chemistry and physics, urge imperatively that all science should now unite in earnest reconsideration of the fundamental conceptions of matter and mind, and that among these the problem of personality be given its rightful place.

"Visceral sensations," "insanity," "emotions," "instinct," "personality," "the unconscious," "the sub-conscious," "the conscious," all these processes, I trust, now stand significantly related within the thesis of this paper. Each one of them represents a practical sphere of physiology which remains shrouded in great darkness and misconception by reason of crudely primitive metaphysical notions which have come down to present science uncriticised, and which present science shrinks from properly examining for fear of becoming metaphysically speculative. Nor are these exceptional examples. Practical physiology, and especially practical psychiatry, is full of them. I could as well have selected, to the same end, any other of several similarly related groups of "traditions." I hope, however, that what I have said of these may kindle in you a thoughtful consideration of the proposition, that there is as much need that physiology shall unite now, heartily and generously, with psychology to purge the realm of the latter from primitive scholasticism, as it was, at an earlier date, for her to drive out from her own realm the false notions of physiology, derived in the same manner from the same sources.

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