obviously, upon the subject taught, upon the standard which is reached, upon the technicality of the subject, and upon the experimental preparation involved. Therefore it would be impossible for the Board to make any just assessment of the magnitude of the subsidiary duties entailed on a bare return of actual teaching hours. If the Board of Education is unable to accept an approved agreement as sufficient evidence of full-time service, then, in justice to the teachers of science and technology, it must have more information than would be given by a mere return of actual teaching hours.

The circular indicates that the specific preparation of lessons (as distinct from general study) would be regarded as a subsidiary duty entailed by actual teaching, and we would point out here that teachers of science and technology must spend a large amount of time in keeping in touch with modern developments in science, and with the even more rapid and more extensive developments of the applications of science to industry. The time absorbed to this end cannot be regarded fairly as general study of an independent kind; it cannot be considered as dissociated from the teaching service; and it cannot be described as non-essential.

The teacher of science and technology has a claim for very special consideration here, for, though we are prepared to admit that every teacher should and must spend time in general study and should keep in touch with modern developments, yet we cannot be expected to believe that the time which must be spent in keeping up with the development of, for example, Roman history, is comparable with that which must be spent in keeping in touch with the development of electrical engineering.

In this connexion we note with amazement that according to this circular (clause 7) research work will not be regarded as teaching service, and the time spent in research work would not be counted as teaching service for the purpose of the Superannuation Act. We can only hope that either our reading of the clause is wrong or that it has been badly phrased, and does not express the real intention of the Board. If the research work referred to is research work which a teacher is undertaking on behalf of some firm, and for which he is receiving remuneration, then it is quite reasonable to regard such work as private work and not as teaching service to the State. But if the clause means that all research work will be regarded as non-teaching service, then we must protest most emphatically in the interests of the State.

Is it not essential for teachers of science and technology to give a certain amount of attention to research work in order to keep in touch with modern developments? Are there not students doing research work

in many of our technical institutions? Will the time spent by the teachers in these institutions in guiding and directing that work be regarded as of no service to the State? Surely that clause in the circular has been badly phrased: it is incredible that all research work in technical institutions should be banned, by order of the Board of Education! For many years the value of research by teachers has been impressed upon the governing bodies of our chief technical institutions, but if the Board holds that time spent upon such investigations, however stimulating the work may be to teacher or pupil, is to be excluded from the superannuation scheme as pensionable service, then the institutions will be thrown back to the state they were in twenty years ago.

We feel that this circular has been drawn up without sufficient consideration of what is involved in the teaching of scientific and technological subjects, and it would seem that there has not been sufficient regard for the special conditions of teachers of science and technology in our technical schools and colleges.

We are glad to note, however, that the circular has been sent out to local authorities, governing bodies, and others for their observations, and that the Board will not arrive at a final decision as to the application of the principles set out until these observations have been considered. We hope, therefore, to see very considerable amendment in the final form of the circular.

Internal Secretion.

Glands in Health and Disease. By Dr. B. Harrow. Pp. xv+218. (New York: E. P. Dutton and Co., 1922.) n.p.

Internal Secretion and the Ductless Glands. By Prof. Swale Vincent. Second edition. Pp. xx+422. (London: E. Arnold and Co., 1922.) 25s. net.

THE two books before us have not the same object or scope, but they appear equally to fulfil the purpose intended. On the whole, they may be said, along with Sir E. Sharpey Schafer's "Endocrine Organs," to be the most useful books on the subject in the English language, apart from the encyclopædic "Endocrinology" edited by Llewellys Barker. While that of Dr. Harrow is of a somewhat popular nature, assuming comparatively little physiological knowledge on the part of the reader, Prof. Swale Vincent's book has the more ambitious aim of a scientific presentation of the facts definitely known on the subject. This latter has therefore rather the character of a work of reference, and will be found very useful in this way. It is naturally not so easy to read as Dr. Harrow's book, which presents an admirable, connected account of the

subject and may be thoroughly recommended to all who wish for a critical statement of the problems which are attracting so much attention at the present time. It is to be hoped that those of us who have been misled by the wild reports of marvellous results published in the Press will adopt Dr. Harrow's cautious attitude and assess such reports at their proper value. Prof. Harvey Cushing, as quoted by Dr. Harrow, remarks :

"Nothing will discredit the subject so effectively as pseudo-scientific reports which find their way into advertising leaflets, where, cleverly intermixed with abstracts from researches of actual value, the administration of pluriglandular compounds is promiscuously advocated for a multitude of symptoms, real and fictitious. The Lewis Carroll of to-day would have Alice nibble from a pituitary mushroom in her left hand and a lutein one in her right hand and presto ! She is any height desired !"

The title of Dr. Harrow's book, and also to a lesser degree that of Prof. Vincent's, invites some criticism. The name "gland" implies to the physiologist many organs and tissues which have functions other than that of producing substances for the purpose of exerting a particular action on other organs or tissues when they pass into the blood current. Those which form saliva and also the lymphatic glands may be mentioned. It is true that we might define a gland in a new way and say that any organ that produces some substance not already contained in the blood is entitled to the name. It would conduce to accuracy, however, if the name "gland" were limited to those organs able to pour out a secretion which can be collected and examined—those of "external secretion" in fact. In this case, the ductless "glands" would have to be called "bodies," or some similar name, as is indeed frequently done in speaking of the "pituitary body" or the "supra-renal bodies." The name "secretion" itself as applied to the activity of the endocrine organs is also not very satisfactory.

It must be confessed that we do not possess a really good name for these substances which act as "chemical messengers," formed by special cells for the special purpose, if the expression may be allowed, of producing an effect on another organ or cell when carried to it by the blood. A short word with the meaning of "chemical messenger" is what is wanted. When Prof. Starling and the present reviewer were engaged in investigating the mechanism of pancreatic secretion, we sought in vain for a word of this kind and were finally obliged to be satisfied with "hormone," although we felt that it was not exactly what we wished. It has, however, come into general use, although its meaning as "setting into activity" has caused the introduction of a number of other names, which might perhaps have been avoided. It is to be remembered that a messenger

is sent for a special purpose, although he must take the road or railway which is in existence. Thus one of our hormones in the blood passes by a number of different cells before arriving at that kind which is sensitive to it, just as a letter sent by post is only received at that house to which it is addressed. A definition on the lines suggested would exclude such a constituent of the blood as carbon dioxide, called by Gley a "par-hormone." Carbon dioxide would be produced by all active cells whether the respiratory centre happened to be sensitive to it or not. A train (the blood) carrying soldiers (carbon dioxide) to a port for foreign service (the outer air) might pick up men at various stations (organs of the body) through which it passed. At one station there might be on the platform a nursemaid (the respiratory centre) who greatly admired soldiers. She would be excited by the passage of the train, but it would scarcely be held that the soldiers were sent for that purpose. The development of the special sensibility of the respiratory centre is of course another question.

While each of the books before us is provided with a good index, Dr. Harrow alone gives a list of original works, which, however, does not profess to contain more than the most important ones. Considering that Prof. Vincent's book is especially valuable for reference, it seems unfortunate that he has omitted in this second edition the bibliography contained in the first. It may be putting too great a burden upon him, but it would have been of great service if he had given the titles of papers which seemed to him to contain definite new knowledge, rejecting those numerous ones which have no real value. Perhaps we might ask him to reprint in the next edition the original bibliography, adding to it papers which appeared up to 1915 and referring to *Physiological Abstracts* for the subsequent literature. Although many of the current text-books of physiology serve well for the use of junior students without references, it must not be forgotten that the more advanced of these books are often referred to by research workers and teachers, and information as to the place of more detailed description would greatly increase their value.

The great difficulty of exact research in the problems dealt with is impressed upon readers of either of the books before us. Sensational reports as to the transplantation of organs from one individual to another, or even from one species to a different one, are put in their proper place. It seems certain that individual characters are so highly marked, at all events in the higher mammals, that the only permanent grafting occurs when a tissue is taken from one part of an individual and planted in another part of the same individual. Occasional success has been obtained by L. Loeb between closely related persons, brothers for example.

Otherwise the graft always degenerates sooner or later. All the effect it has is the temporary addition of just that amount of the special hormone present in the cells of the graft when inserted. This appears to be the only basis of the much-talked-of transplantations of Prof. Voronoff.

That part of the subject about which the evidence is most conflicting is the interrelation of the various "ductless glands." Both books deal with this in a duly cautious manner. Prof. Vincent gives a valuable account of the morphology of the different organs and tissues. His views as to the nature of the Islets of Langerhans will perhaps not be generally accepted, but it must be admitted that he brings good evidence.

The only points in Dr. Harrow's book which invite criticism are (1) the undue importance ascribed to adrenaline and to the nervous system in the production of wound shock—we find no reference to the toxæmic aspect, which would seem to be more appropriate to the subject matter; and (2) the reference to the liver as "the seat of carbohydrate metabolism in the body," in connexion with diabetes. The views of Langfeld are quoted, but the reversibility of the action of the liver enzymes is not taken into consideration. It seems to the reviewer that this word "metabolism" is used far too frequently in a loose way and often when other expressions would convey the meaning much better. The "metabolism" of carbohydrates, for example, should refer to the complete series of chemical changes which take place from the time of their introduction to their final elimination as carbon dioxide and water. When measurements of the oxygen intake are made, what is really done is to determine the whole oxidative processes and should be called "oxidation," not "metabolism" as is common. Similarly, valuable measurements of output of heat have been made. It would be more useful to speak of such determinations as of heat production, not as of metabolism. One also hears sometimes of mere nitrogen estimations in urine as "metabolism experiments." However this may be, it is certainly misleading to suggest that the liver is the most important place of chemical changes in carbohydrates. The whole problem of diabetes is still in a very unsatisfactory state. May it not be that we have given our attention too much to changes in particular compounds, such as glucose or fat, while the fundamental defect is a general failure in oxidative capacity? Thus the pancreatic hormone might be an oxidation-promoter, possibly for glucose, since there is evidence that the combustion of fat and protein is inadequate except in the presence of and as part of a kind of coupled reaction with that of sugar. "Acidosis" rather than "ketosis" should not now be regarded as the cause of diabetic intoxication, as Prof. Vincent suggests.

The multitude of the physiological phenomena concerned, as well as their practical importance, may serve as some excuse for the length of this review. We may conclude with a list of those organs or tissues which appear to Prof. Vincent to have established their claim to be regarded as producing true hormones. These are the thyroid, pancreas, reproductive organs, adrenals, pituitary body, and the intestinal mucous membrane ("secretin"). The evidence as to the parathyroids (which seem to act otherwise), the thymus, kidney, and pineal body is conflicting. It is to be remembered that the chemical nature of two only of the hormones has been discovered. Even active extracts have not been prepared in all cases. Still more uncertainty exists as to the way in which hormones act. There is much yet to be discovered.

W. M. BAYLISS.

The Origin of Worlds.

Origine et Formation des Mondes. Par l'Abbé Th. Moreux. Pp. xii + 401. (Paris: Gaston Doin, 1922.) n.p.

THE Abbé Moreux has essayed, in the volume under notice, the ambitious task of giving a complete explanation of the origin of all the orbs in the solar system. Works on cosmogony have this advantage that no one can positively assert that any particular system is wrong, since certainty is quite unattainable. Hence a reviewer is not called upon to pronounce a theory of cosmogony right or wrong, but merely to note how far it appears to fit in with known facts.

The author uses as his materials nebulae and meteoric swarms; he attributes the dark lanes in the Milky Way and regions where stars are unusually sparse to meteoric clouds, and supposes the outbursts of Novæ afford examples of the collisions between nebulae and meteoric clouds which he assumes to be the origin of systems. He uses the spiral nebula analogy in tracing the distribution of the matter scattered by the collision. At this point he notes the fact that the planetary orbit-planes are arranged alternately on opposite sides of the plane of maximum areas. He also conjectures that the two arms of the spiral were in slightly different planes, and that the planets were developed alternately from one or other of them. This idea seems somewhat fanciful; it is fairly obvious that the two most massive planets, Jupiter and Saturn, would have their orbit planes on opposite sides of that of maximum areas, while the same would probably hold for Uranus and Neptune. Another criticism is that his theory, like that of Laplace, makes Neptune much the oldest planet. It was pointed out by the late Prof. Lowell that