city having undertaken to erect a building for the Institute at a cost of 125,000 Marks.

THE annual horticultural exhibition was held in Paris from the 18th to the 25th of May and a Congress of Horticulture met in conjunction with the Exposition on May 20th and 21st. The Royal Botanic Society, London, held an exhibition of plants and flowers in their gardens at Regent's Park on May 11th.

WE learn from *Natural Science* that Mr. Edouard Foa has travelled across Africa by the basin of the Zambesi, Lake Tanganyika and the Congo, and has brought back numerous specimens of anthropological interest from the region of the great lakes. Dr. Hugo Bücking and Dr. L. van Werneke have started for an eight months' expedition to the Netherland East Indies on behalf of a Dutch Society.

WE receive monthly the *Sei-i-kwai Medical Journal*, edited and published by the Society for the Advancement of Medical Science in Japan, the articles of which, partly in English and partly in Japanese, are doubtless instructive to the Japanese, while those in English are certainly amusing to the English reader. The general style may be gathered from the following:

"Diseases of the animal sphere (or the nerves, senses and muscles). Regarding Japanese pathological constitution the writings of medical and elthnographic authors are not lacking in general remarks which are meant to express in the usual sense. * * * * It would also be an essential task of the surgeon to separate such easings of the treatment of wounds as really are due to censtitutional causes, from the consequences of the possibility that perhaps the causes of infection working against the healing art is some way different extra European countries. * * * * The spleen is all malarial, typhus, variola diseases and in those called και ε'ξοκγυ splenetid diseases, the seat of strong swelling and all corresponding symptoms. Let us observe here that unusually great swellings of the spleen are seldom found, either in post-mortion or clinical examination."

UNIVERSITY AND EDUCATIONAL NEWS.

IT is said that Mrs. Phœbe Hearst will erect a building for mining engineering for the University of California at a cost of $300,000.

MR. HENRY WILDE, F.R.S., has proposed to endow in Oxford University a readership and a scholarship in mental philosophy. They are to be designated the Wilde readership and the John Locke scholarship.

HOBART COLLEGE, Geneva, N. Y., received $6,000 for a scholarship by the will of Mrs. Augusta M. Williams, of Newport, R. I.

THE appointments for the coming year in the botanical department, Cornell University, are as follows: Dr. E. J. Durand is reappointed instructor in botany and assistant curator of the Cryptogamic Herbarium, and Mr. K. M. Wiegand, assistant in botany and assistant curator of the Phaneogamic Herbarium. Mr. B. M. Duggar, now assistant cryptogamic botanist to the Experiment Station, has been appointed instructor in botany, with special reference to experimental plant physiology, his time to be divided between instruction and work in the Experiment Station. Two graduate assistantships in botany have been established, the holders to divide their time between assistance and investigation. Mr. W. A. Murrill, B.S., A.M., the present scholar, and Mr. G. T. Hastings have been appointed to these positions for the coming year. Besides these, a fellow, or scholar, is appointed in the department.

THE second summer session of the New York State Library School, Albany, of which Mr. Melvil Dewey is Director, began this year on May 30th, and will continne in session for five weeks.

AMONG the docents who have recently qualified are Dr. Fischer in anatomy and Dr. Mayer, of Vienna, in chemistry at the German University at Prague; Dr. Formanek in applied medical chemistry in the Bohemian University at Prague, and Dr. Haussner in mathematics in the University at Giessen.

DISCUSSION AND CORRESPONDENCE.

COLOR-VISION.

IT is not often that a letter appears in SCIENCE that presents the particular combination of characteristics of one of the recent communications on Color Vision. Professor Titchener says expressly that until the recent papers of Müller in the *Zeitschrift für Psychologie* on Her-

ing's theory of Color Vision he has been content for several years to know the subject only in the compendiums of Helmholtz, Wundt and Hermann, and in the original paper of Hering of 1874, and yet he finds himself able to lay down the law in an *ex-cathedra* fashion that one would usually not be willing to indulge in, in regard to a confessedly undecided question, after a long devotion to the subject. That his reading has been cursory, and has been apparently to a certain extent forgotten, is evident from his making in a few lines such mistakes as to attribute the idea of the shift of excitability in photo-chemical substances to König, and to refer to the Helmholtz theory as a three-fibre theory. Fick is usually and not improperly credited with the idea of the 'shift of excitability,' as it is he who first made much of it in the explanation of color-blindness, but the idea is originally due to Helmholtz himself, and occurs already in the first edition of his 'Optics.' To say, therefore, of Helmholtz's theory that 'its original and most attractive simplicity has been given up in favor of König's shift of excitability' is to show a rather unusual degree of ignorance of the facts of the case. It is also doing much injustice to the Helmholtz theory to designate it as a three-fibre theory; the assignment of the three chemical substances to three separate fibres was, in the first edition of the 'Optics,' expressly stated to be merely a mode of facilitating speaking about them, and since the time of its experimental disproving in Helmholtz' own laboratory it has naturally been abandoned by him.

The present discussion of color-vision in SCIENCE has been occasioned by Professor Patten's having had the temerity to bring out an entirely new theory, the main feature of which is that it is an endeavor to take account of a peculiarity of the structure of the retina which is certainly there, and which as certainly does not exist without having some function. Professor Patten's full paper on the subject has not yet appeared; when it does it will no doubt receive a due measure of attention from the physiologists and the anatomists, to whom it makes its chief appeal; any great psychological inadequateness is hardly to be looked for, at the hands of its author, in view of the full discussion which considerations of this sort have received in recent years. But it seems hardly courteous to condemn a theory before it has had a chance to be heard; any new theory, from the nature of the case, makes its appeal to those only who have the leisure and the open-mindedness (or the idle curiosity, as it may turn out to have been) to give it a fair share of attention. For a fresh theory to be set down as unnecessary and absurd is no new experience; the most recent (and classical) example of the sort is the notice with which Kolbe greeted Van 't Hoff's conception of the different positions of atoms in space, which has since assumed such fundamental importance for chemistry. He said: "If any one supposes that I exaggerate this evil [of erratic speculation] I recommend him to read, if he has the patience, the recent fanciful publication of Van't Hoff and Hermann" (Hermann being the German translator). It cannot, therefore, be looked upon as altogether a bad omen that the first feeling excited by a new theory is one of irritation and impatience.

My own theory met with the great good luck that, at the end of a year after it was brought out, the President of the British Association happened to take, as the subject of his presidential address, a topic which included color-vision; after full and careful discussion of the subject, he stated that the known facts in the case (and especially those recently discovered) were best explained by my theory. It is a piece of good fortune, again, that the physiologists of this country have happened just at this time to bring out a large and important general work on Physiology; this has given Professor Bowditch occasion to give my theory generous space and a very fair showing. As a Vice-President of the American Association, Professor Le Conte Stevens has also happened to have color-vision for the subject of his inaugural address; and the author of the best English compendium on sight, Professor Joseph Le Conte, has happened to bring out a new edition of his little book; I have to thank them both for the courteous treatment which they have given my attempt to account for the phenomena of the sensation of light. All this I regard as a piece of good fortune, such as does not always attend upon

merit in this too busy world, and I hope that Professor Patten, if he happens to have hit upon a fruitful idea, will have an equally early opportunity to secure a hearing.

While my theory has had much good luck in the way of a favorable reception, it has hitherto been rather lacking in the honor of being attacked. I am, therefore, very glad of the opportunity which is now given me for elucidating some of its features. Professor Titchener disposes of my hypothesis in summary fashion by saying, first, that my assumed molecules have a suicidal tendency, and, second, that there is experimental evidence against the theory. The reply in the case of both of these counts is very simple. I take the second one first:

1. There is no experimental evidence against my theory. There is experimental evidence against the four-color component theory of Donders, but it does not hold against my theory, in which there are not two different kinds of white-sensation. Moreover, the attempt which has been made to show that this same evidence does not hold equally against the four-color theory of Hering can hardly be said to be successful.

2. It is incorrect to say that I assume, among the properties of my photo-chemical substance, a suicidal tendency; it should be said at most that it has a *semi-suicidal* tendency. The photo-chemical substance which I assume is as stable as any other physiological substance in its first estate; it is only that it becomes unstable after it has suffered a partial decomposition. As a matter of fact, after we have had a vision of blue for a certain length of time we find that it is followed, even though the eyes be closed, by an after-vision of yellow. This is a marked defect in the optical apparatus with which nature has provided us, and a defect from which we do not suffer (to any appreciable extent) in the case of the other senses; the sound-sensation of a given note is not followed by an after-clap of a definite other note. Nature might have done much better for us if she had provided some light-process which was not open to this source of error, but as she has not we must do the best we can to make out the character of the process which she has given us. Whatever that process may be, it is plainly something such that, after the external world has sent in to us information regarding a given colored surface, retinal equilibrium has to be restored by a subjective vision of the complementary color, even at the cost, if the eyes be open, of making objects which are really white take on a deceptive appearance of being colored. This fact of nature is mirrored in my theory by supposing that after having undergone a partial decomposition the photo-chemical substance concerned becomes unstable and breaks down completely. This is *zweckmässig*, because the retina becomes in this way a *tabula rasa*, and is thus able to give us correct information regarding the color that next impinges upon it. It had not occurred to me that the idea of a chemical compound which, on being partly decomposed, left an unstable residue was so recondite a conception as to need to be fortified by authority or by example, and, upon consulting the chemists whom I have access to, I find that I am right in this view. But if examples are needed they can easily be given in any quantity. Many unstable phenols, as pyrocatechin and pyrogallic acid, form stable compounds when treated with acid chlorides as benzoyl chloride or acetyl chloride. When these compounds are decomposed, so that benzoic acid or acetic acid, as the case may be, is formed, and the stable acids are removed, the very unstable phenol is left in solution. And it is not even necessary to go so far as to organic chemistry to find instances. So elementary a process as the removal of an atom of oxygen from sulphuric acid leaves an unstable remainder which gradually separates into water and sulphurous anhydride.

It cannot be too much insisted upon that the after-image which follows the vision of a colored surface is something peculiar and consequently demands something *sui generis* in the chemical conception which is to account for it. Müller, in fact, points out that, if the after-image is to be explained by the play of assimilation and dissimilation, the evident objection presents itself that corresponding after-effects ought to occur in other regions of the animal mechanism as well. The only way he has of meeting this objection is to say that *any* explanation of the

visual process which was based upon *general* properties of the nervous substance would be open to the same objection. This is true, and it applies to Müller's own explanation of the phenomenon in question with peculiar force. But the conclusion to be drawn is not that one visual theory is sure to be just as good as another, but rather that that theory which posits a chemical process which is *not* exactly like what goes on everywhere else in the body has by so much the advantage over another theory. The idea of a photo-chemical substance which is unstable after a partial dissociation, which it is as far as possible from being a remote idea to the chemist, is *just as far* removed from our conception of other physiological processes as it *must be*, in a well-devised theory, in order to account for anything so extremely distinctive as is the visual after-image.

But even though it had been necessary to go very far afield for the conception of a semi-suicidal chemical substance, this could not have been counted, by any one who had given a moment's consideration to the subject, as a point of superiority on the part of Hering's theory over mine; for his assumed photo-chemical substance is 'suicidal' from the start. If blue is the color of assimilation, then after we have looked at a blue surface for a few moments there has been piled up in the retina, according to Hering, a large amount of the blue-yellow substance, and it is the going to pieces of this immediately afterwards which is the cause of the after-image; this assumed process is not in itself an objection to the theory, but it is 'suicidal' to the last degree.

Professor Müller's recent papers in the *Zeitschrift für Psychologie* are a monument of learning and acumen, as I have already said in the pages of *The Psychological Review*. How far they are from substituting for the original theory of Hering a theory which can lay any claim whatever to being considered an adequate account of the phenomena of color-vision I am about to show in connection with a general discussion of color theories. Meantime I rejoice in the fact that Professor Titchener has renewed his study of the subject of color. It is to be hoped that this will lead him to remodel the brief statements regarding color which are found in his book on Psychology; what he says there (while it is not incomprehensible to one who has the clue to his secret meaning) must seem contradictory and confusing in the extreme to the ordinary reader, and certainly constitutes a serious blemish in a book which is otherwise not simply a good text-book, but a valuable contribution to the science of psychology.

C. Ladd Franklin.

Baltimore.

A PRECISE CRITERION OF SPECIES.

To the Editor of Science: I thank you for the suggestions contained in your kind discussion in Science, No. 178, of Mr. Blankinship's and my paper on a 'Precise Criterion of Species.' Our paper was concerned with a method which, if applied, will constitute a small, but, we think, important, step toward giving greater precision to the defining of particular species and to the distinguishing of varieties from species. To my mind the only important objection urged so far, an objection which was anticipated, is that it is impracticable to use in systematic work so great precision as our method calls for; it takes too much time and too large a number of individuals. *A priori* argumentation cannot dispose of this formidable objection; only the demonstrated advantage of the method in practice can avail against it. I should like to urge anthropologists, mammalogists, ornithologists, ichthyologists, malacologists and others who have already gone some way in the direction of applying statistics to species to put the method to practical test. Mr. Blankinship and I are doing so. I should be very glad to assist those who meet with difficulties in the application of the method, as, for example, in the measurement of color and complex forms. The ingenious naturalist will find, however, as anthropologists have found, few, if any, specific differentiæ which are not measurable.

C. B. Davenport.

ELECTRICAL ANÆSTHESIA.

To the Editor of Science: While making some experiments on the sensations derived from sinusoidal currents I noticed (April 12, 1898) that anæsthesia of the tissues resulted