from St. George Island to St. Paul Island, but there is no evidence to show that they survived in their new habitat.

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APROPOS THE "WHITE INDIANS" OF DARIEN

THE following is a quotation from Joseph Esquemeling, "The Buccaneers of America,"[1] Chapter XXV, published in 1699. Esquemeling is describing his own personal observations.

> We sailed from thence [Bocca del Toro] March 23, 1679, and in our way touched at the islands called Zambles. These islands reach eight leagues in length, lying fourteen leagues westward of the River Darien. Being here at an anchor, many of the Indians, both men and women, came to see us. . . . The men here go naked, . . . The men paint themselves sometimes with streaks of black, and the women with red: The women have in their noses a pretty thick ring of gold or silver, and cover themselves with a blanket only: they are generally well featured; *among whom I saw several fairer than the fairest of Europe, with hair as white as the finest flax; 'tis reported of them, that they see better in the dark than in the light.*[2]

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SCIENTIFIC BOOKS

Helmholtz's Treatise on Physiological Optics. English Translation from the Third German Edition. Edited by JAMES P. C. SOUTHALL. Volume II, "The Sensations of Vision," 1924, viii + 480 pp.; Volume III, "The Perceptions of Vision," 1925, x + 734 pp. Published by the Optical Society of America.

THE appearance of the third volume of the English translation of Helmholtz's great "Handbuch der physiologischen Optik" completes one of the most notable scientific publications of recent years. Helmholtz's "Optik" is a unique book from many angles. It is unique in the thoroughness with which it displays the versatility of the master scientific mind of the nineteenth century. It is unique in the completeness with which it summarizes and establishes the science of physiological optics. Even more, it is unique in its longevity; originally decades in advance of its times, its friends have not permitted it to grow old; they have dressed it in many new chapters and appendices and its original vigor has carried it on for seventy years. The present English translation, by Professor Southall, provides the English-reading public with something more than a newly intelligible classic; it offers an up-to-date compendium of the most fascinating branch of optics. In its field, Helmholtz's treatise has no rivals and is unlikely to have any for years to come. What modern scientist would dare to write a book like this, even if he were able to do so? What publisher would dare to print it as a commercial venture?

To review the contents of so classical a work seems supererogatory and anachronistic, yet there may be those to whom such a review may convey an impression which they had previously lacked. The first German edition appeared in three parts, during the years 1856, 1860 and 1866, respectively; forming *Band IX* of Gustav Karsten's "Algemeine Encyclopädie der Physik." The work was combined into a single volume with the imprint of Leopold Voss, of Leipzig, in 1867. (The reviewer has a copy from the library of William James, marked "Dresden, June, 1868" and containing the personal cards of "Dr. Hermann von Helmholtz, Präsident der Physikalisch-Technischen Reichsanstalt. Berlin, 16. Neue Wilhelmstrasse," and "Frau von Helmholtz geb. von Mohl.") A translation into French was published in 1867. A second German edition began to appear in 1885 but was not completed until after the death of Helmholtz, which occurred in 1894. As a single volume, under the editorship of Arthur König, it was published by Voss in 1896. This edition had been extensively revised and brought up to date by Helmholtz and König. It met with less favor from critics than did the first edition, and when Gullstrand, von Kries and Nagel prepared the third German edition (1909–1911), they based it upon the original text.

The present English translation is from the third German edition. It offers all the detailed appendices which were added by Gullstrand, von Kries and Nagel, and is further supplemented by new appendices and notes, some of which are by the German editors just named. It is perhaps regrettable that certain of Helmholtz's theoretical discussions, peculiar to the second edition, could not have been included. This is especially true of the second part or volume, dealing with visual sensation, to which Helmholtz made some very interesting additions. However, the subject-matter of these additions is treated in the appendices in a manner technically more adequate than that of Helmholtz, if lacking in the touch of his master mind.

The first of the three volumes of the English edition has already been reviewed in these pages. It deals

[1] Edition of 1853, Benjamin B. Muncy & Co., Boston, pages 180–.

[2] Italics mine.

with the anatomy and dioptrics of the eye, with appendices by Gullstrand. Its standpoint is primarily physical and physiological. The second and third volumes are concerned with problems which are essentially psychological in character.

Volume II treats of "The Sensations of Vision." The chapters by Helmholtz consider successively: "Stimulation of the Organ of Vision," "Stimulation by Light," "The Simple Colors," "The Compound Colors," "The Intensity of the Light Sensation," "The Duration of the Sensation of Light," "Variations of Sensitivity," "Contrast" and "Various Subjective Phenomena." There is an interpolated chapter by Nagel, dealing with "Changes in the Retina due to Light." A separate appendix by Nagel discusses "Adaptation, Twilight Vision, and the Duplicity Theory," and in about eighty pages brings this part of the subject quite well up to date. A second, somewhat shorter, appendix by von Kries is concerned with "Normal and Anomalous Color Systems" and "Theories of Vision." Under the first caption are treated "Laws of Mixture of Light" and "The Phenomena of Daylight Vision under Conditions that make it Difficult or Impossible to recognize Colors"; while under the second are considered "Modulations of the Organ of Vision" and "Temporal Effects of Stimulation," as well as the principal theories of color vision.

A new chapter on "The Nature of the Color Sensations," by Christine Ladd-Franklin, forms an important addition to the volume. After discussing the inadequacies of the Helmholtz theory of color vision, Mrs. Franklin stresses the importance of what she calls the Helmholtz-König *facts* of color vision. These are embodied in the curves of the three fundamental sensations, as computed to fit the view that the two species of dichromatic vision are "reduction systems" in which the green and red sensations, respectively, have dropped out. Here, Mrs. Franklin does the important service of presenting the exact graphs of the three sensations as found by König, compensating to some extent for the absence of certain significant portions of the second edition. Finally, she expounds anew her well-known developmental theory of color vision as a resolution of the combined difficulties of the Helmholtz and Hering views. The exposition is clear, concise and convincing. A chemical substance, a rosaniline carboxylate, has been noted which has decomposition reactions accurately paralleling those of the completely differentiated molecules postulated by the developmental theory.

The translator has added a valuable bibliography of papers which appeared between 1911 and 1924 treating topics allied to those of Volume II. There are also numerous new foot-notes, which distinctly modernize the discussion. One of the editors of the third German edition, von Kries, has contributed three long notes, bearing the date of 1924. The first (p. 300) deals with explanations of simultaneous contrast and favors the view that this phenomenon does not rest exclusively upon a physiological interaction of adjacent retinal areas, but has also a central or psychological basis, as advocated by Helmholtz. The second (pp. 411–413) discusses the recent papers of Hess directed against the classical view that normal, protanopic and deuteranopic color vision represent three distinct species without transition forms. Von Kries argues that Hess's observations are not adequate to refute the classical doctrine and that many of his facts are quite consistent with it. The third note (pp. 422–425) treats of recently proposed methods of heterochromatic photometry, including Pulfrich's stereophotometric scheme, which is discussed critically in some detail.

The third and final volume of the treatise bears the title: "The Theory of the Perceptions of Vision," and considers the processes—both physiological and psychological—by which visual sensory data are organized into a visual knowledge of the world about us. The translation presents in English the entire text of the third volume of the third German edition, with all the original notes and appendices by von Kries. There are also many new notes by the editor and his collaborators and two new contributions by von Kries. The volume comprises 734 pages, ending with a new bibliography of works on visual perception bearing dates between 1911 and 1925 and an index to the complete treatise.

The sections by Helmholtz have the following titles: "Concerning the Perceptions in General," "Movements of the Eyes," "The Monocular Field of Vision," "The Direction of Vision," "Perception of Depth," "Binocular Double Vision," "Rivalry between the Visual Globes" and "Review of the Theories." There are detailed notes to all these sections by von Kries, with the exception of the first section. The original appendices by von Kries concern "the spatial configuration in vision, with special reference to the questions of innate dispositions and experience," as well as "the theory of binocular instruments."

The two new notes by von Kries deal with illusory phenomena of binocularly perceived motion and binocular color mixture, respectively. In the first note (pp. 398–400), he discusses the experiments of von Szily, in which oscillating objects were observed with a reversing prism in front of one eye. In the second note (pp. 530–531), he reviews Trendelenburg's recent work, which indicates that binocular color-mixture is not only possible but yields the same results qualitatively as does monocular mixture.

The general make-up of the three volumes of the English translation is practically identical with that

of the third German edition. All the illustrations of the latter are reproduced. In fact, the identical cuts which were used for the German printing were employed in the American presses, thanks to the cooperation of the German editors and publishers.

Professor Southall and those who have assisted him in the translation of this stupendous work deserve the utmost praise. We must also laud the Optical Society of America and the generous benefactor who has insured the financing of a very expensive publication. Money could not and did not buy the affectionate effort which has produced this faithful interpretation of the original German; money will never repay those who have put this work into accessible form. But both the translator and the publishers receive their recompense in the knowledge that they have accomplished something tremendously worth while, which has been dreamed of for years by English-speaking scholars, but regarded by them as a practical impossibility.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

SURFACE TENSION MEASUREMENT BY THE RING METHOD

F. H. MACDOUGALL'S article on surface tension, published in SCIENCE[1] some months ago, makes an inference which if misunderstood will convey a wrong impression to the scientific worker whose investigations make necessary a measurement of surface tension. The article in question might be understood as meaning that the ring method because of supposed inherent inaccuracies is not a practicable tool in investigations that require reliable information about surface tension phenomena. Because of the fact that such an inference is far from fact, a brief discussion of MacDougall's criticism seems in order.

There will be no misunderstanding if the distinction between two kinds of accuracy is clearly made. Some investigators who are interested in the phenomenon of surface tension purely from its physical aspects will naturally think of accuracy as that attribute of the measurement by which the *n*th place in the surface tension constant becomes significant. On the other hand, to the investigator who is concerned not at all with the surface tension constant of pure liquids, but to whom surface tension values of a liquid medium tell a story of the changes that are taking place in the medium, the term accuracy as applied to his surface tension measurements will have an entirely different meaning. The former investigator will spare no pains nor time in eliminating and reducing to the utmost those factors which he recognizes as sources of error in his measurements. He may, for example, devote months to the selection of a capillary tube which is exactly right for his purpose. The latter is interested in obtaining data as rapidly as possible in terms of which he may interpret the phenomena in which he is primarily interested. Both are doing necessary and valuable work; but it is essential that their respective ideas of accuracy be not confused.

In his discussion MacDougall says, "I do not think that the simple theory of the experiment even with the procedure advocated by Klopsteg can lead to accurate values of the surface tension." The procedure to which he refers is that described in my communication to SCIENCE, XL, 319, 1924. His criticism indicates that he thinks of accuracy in terms of the *n*th significant figure in a surface tension constant. My suggestions were directed at obtaining accuracy sufficient for the purpose of the investigator who may find the ring method to be more time saving and easy to apply than any other.

Bearing in mind what has been said about the "practical" accuracy which is desired by the investigator who uses surface tension measurements as means to an end, I think it possible to show that the ring method with the procedure described in my earlier communication measures up to the requirements of such investigations. My demonstration is based on such an authority as Professor H. Freundlich, who in his "Kapillarchemie," published in 1923, gives the following table:

SURFACE TENSION OF WATER AT 18°

Method		Observer
Oscillating jets	73.0	Rayleigh
Oscillating jets	73.8	Pederson
Oscillating jets	72.4	Bohr
Oscillating jets	73.0	Lenard
Capillary waves	74.0	Rayleigh
Capillary waves	73.3	Dorsey
Capillary waves	73.8	Kalähne
Surface curvature	73.5	Lohnstein
Large air bubbles	73.0	Quincke (Reported by Worthington)
Capillary rise	73.0	Volkmann
Copper ring	76.8	Weinberg
Adhesion plate	73.1	Hall
Drop weight	73.8	Ollivier (Reported by Lohnstein)
Pressure in bubbles	75.2	Cantor
Pressure in bubbles	73.7	Magini
Pressure in bubbles	72.7	F. M. Jäger
Tensiometer, duNoüy	73.7	Klopsteg

[1] "Surface Tension determined by the Ring Method," SCIENCE, XLII, 290, 1925.