Schmidt, Carleman, and Hammerstein. Standard real-variable tools, the Lebesque integral, the L_2 theory, orthonormal systems, and the transforms of Laplace, Fourier, and Mellin are used systematically but without ostentation, so as not to repel the physicist, engineer, or technician. Topological methods are not used. The style is attractive and is enlivened by some interesting personal comments (concerning Volterra, Fubini, and others).

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Light, Colour and Vision. Yves Le Grand. Translated by R. W. G. Hunt, J. W. T. Walsh, F. R. W. Hunt. Wiley, New York, 1957. xiii + 512 pp. $11.

The French original of this book, published in 1948, was the second of three volumes which serve as a textbook in the Institute of Optics in Paris. The first volume (of which there have been two editions) dealt with the geometrical optics of the naked and corrected eye—material which we have abundantly available already in English. The third volume, concerned with spatial vision from the point of view of a physicist, is not one for which an English version would be wanted.

This translation of volume 2 of *Optique Physiologique* is superlative. The translators, with help from the author and three other consultants, have updated the contents to create what amounts to a second edition. The extent of this amendation is indicated by the fact that there are about four times as many references as in the French original, although the text is no longer. The translators introduced only one important error ("wave-length" for "purity" in the caption of Fig. 74.)

The briefest statement of the coverage of the book would be that it deals with photometry and colorimetry: "The eye is a selective receptor, and the way it behaves under radiation is the subject of this volume." Physiological optics is commonly taught, in our schools of optometry and teaching departments of ophthalmology, with ophthalmic optics excluded and taken care of in a separate course. This book, even with its volume 3 appended, could not serve as a textbook in such places. This is sad, for a good, well-rounded textbook is badly needed. The present work is both too narrow and too deep, and too preoccupied with "mathematical" modes of expression, for broad use by American students. It is, however, very welcome indeed as an aid to the researcher in visual science in understanding those aspects of vision which Le Grand, a physicist with a deep interest in vision, is eminently equipped to elucidate.

The first three chapters deal with light and the measurement of visible radiation qua radiation, artificial sources (including the full radiator) and the sun, and the receptoral properties of the eye that make necessary a photometric system. The next three are concerned with photometry. Chapters 7, 8, and 9 cover (and deeply) colorimetry for "standard" and individual observers. This discussion is strung on the thread of the observed "trivariance" of vision, which is independent of all theory. Le Grand's only large blind spot shows up here (doing no practical harm): his curious inability to see that there is no connection whatever between two kinds of trivariance which he lumps together—the kind that requires a monochromatic colorimeter to have three controls and the kind that makes a tricolorimeter possible. The fact that a color sensation has a hue, a saturation, and a brightness is quite unrelated to the fact that mixtures of three primary color stimuli can afford all hues, and all saturations below their own. Le Grand also, perhaps without realizing it, puts complementation on a sensory basis, whereas it pertains strictly to stimuli. Colored *lights* can be mixed; but since their *colors* cannot be mixed, they cannot be said to neutralize each other. Otherwise, the "errors" in this first half of the book consist mostly of tiny sins of omission, together with unacceptable definitions of "simultaneous contrast" and "purple."

Chapters 10, 11, and 12, dealing with absolute and differential intensitive and chromatic thresholds, are particularly strong. Only slightly less satisfying are chapters 13 ("Time effects") and 14 ("Spatial interactions"). From there on the book tends to come apart.

Chapter 15, on the color blindnesses, is spoiled by the naïveté of the physicist and by ignorance of the implications of genetics for the interrelations of the defects. Chapter 16 commences section B, entitled "Theories of Vision"—although its first three chapters, on the anatomy, photochemistry, and electrophysiology of the retina, respectively, deal essentially with basic facts and belong earlier in the book. The reader will absorb so many little errors about the retina that he had best get his information elsewhere. The whole of chapter 17 is already antiquated. In chapter 18, the paucity of sensory correlates reveals the poverty of the whole field of retinal electrophysiology. There is not even any mention of the controversy over whether the electroretinogram is not entirely generated by stray light.

Chapter 19, on theories of color vision, very thoroughly expounds the situation of the Young-Helmholtz theory as of about a decade ago. All other theories are allotted only two pages, which is about what one expects from a physicist. In the final chapter (chapter 20, on threshold theory) the quantal and probabilistic elements are well developed, and Crozier's law is tactfully divorced from its original entanglement with "neural effect" and applied to things it may really describe.

There is a good index, a triple bibliography which "just grew," and a section of exercises (with solutions) which leads a teacher in one of our schools of optometry to envy the quality of student which the Institute of Optics is able to attract.

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Lectures on Nuclear Theory. C. Landau and Ya Smorodinsky. In English translation. Consultants Bureau, New York, 1958 (original text published by State Technical–Theoretical Literature Press, Moscow, 1955). 83 pp. $15.

This brief survey of nuclear physics is based on ten lectures given to experimentalists by Landau in Moscow in 1954. There appears to be little, if any, elaboration of the lectures' incisive, though necessarily fragmentary content. Numerous computations, none of them lengthy, are carried out, simplified frequently by approximate and intuitively reasonable arguments. The discussion, unhurried, is almost entirely self-contained. It assumes familiarity only with ordinary nonrelativistic quantum mechanics and, in lectures 7 and 10, with some thermodynamics and statistics. The presentation is rather consistently a statement of experimental results followed by theoretical analysis.

Lectures 1 to 3 are on nuclear forces. As an illustration, the first lecture starts by presenting the evidence for charge symmetry of nuclear forces, then discusses the deuteron bound state. Scattering of spinless particles is reviewed, phase shifts are introduced, and sign determination by Coulomb interference is mentioned. The general velocity-independent nucleon-nucleon interaction is developed, and tensor interaction is defined and its presence is inferred from the deuteron's quadrupole moment. Typical is the careful note, at the end of the first lecture, of the fact that for a loosely bound structure, such as the deuteron, even its small quadrupole moment requires a larger tensor interaction.

Nucleon-nucleon scattering at up to 20 Mev is discussed in lecture 2, and at

higher energies (up to 590 Mev) in lecture 3. The structure of light nuclei, in terms of the shell model, occupies lectures 4 and 5, and that of heavy nuclei, in terms of rotational states, is treated in 6. Lecture 7 is devoted to the statistical theory of nuclear reactions, and 8, to the optical model of (high-energy neutron) nuclear reactions and to deuteron reactions. Lecture 9, entitled "π-Mesons," deals largely with invariance principles, and 10 concludes the series with a discussion of pion-nucleon interactions and multiple meson production.

There is no index or bibliography, and references to the literature are rare. The format is agreeably uncrowded; the translation is clear and, although not entirely free of errors, is generally of good quality. It is unfortunate that this survey, which is of great value not primarily to the specialists but rather to graduate students, is priced prohibitively ($15 for 77 text pages) beyond their reach.

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Physico-Chemical Effects of Pressure. S. D. Hamann. Academic Press, New York; Butterworth, London, 1957. ix + 246 pp. Illus. $8.50.

The author states in the preface: "There are a number of books and reviews dealing with the physics of high pressures and there are several concerned with the practical use of pressure in the chemical industry, but it seems there has been no serious attempt to bridge the gap between physics and applied chemistry. The present book is intended to remedy this situation by presenting a survey of the effects of pressure in the field of physical chemistry." The author is well qualified by his experience to make this attempt, and it seems to me that he has been eminently successful.

There is and can be no sharp dividing line between physics and physical chemistry. Some of the topics treated here—for example, viscosity and optical absorption—have a strong physical component and are included here because certain of their aspects have, by tradition, been treated by physical chemists; this, in turn, is explained by the participation of these phenomena in topics of primary chemical interest. For example, viscosity is an important factor in determining the rate of many chemical reactions, and optical absorption can be used as a tool in determining the degree of progress of a reaction. The only topics not treated in this book to which a physicist might lay exclusive claim are electrical phenomena in metals—resistance and thermoelectricity and also various magnetic effects.

It appears that the primary and ultimate interest of the physical chemist is in reactions, and the discussion is, throughout, slanted in this direction. This discussion strikes me as most illuminating—the author has succeeded in directing attention to the underlying mechanisms in such a way as to give real understanding of many of the complicated effects of pressure on chemical equilibrium and kinetics and to give an insight into the most promising field for future exploration.

On one minor point I permit myself to disagree with the author. On page 62 he states that "first order transitions greatly outnumber second order transitions." It is my opinion that this is only apparently the case, and that when experimental accuracy has been sufficiently improved, second and higher order transitions will be found to greatly preponderate.

There is an impressive bibliography of 582 items. A hasty scanning of this bibliography leaves the impression that industry in England has been much more active in the investigation of high-pressure chemistry than industry in this country. This impression is by no means correct but is the result of a less liberal policy of publication in the United States. "Secrecy" was not invented in this country to protect our priority with the atomic bomb; the impulse to seek protection through secrecy is much older. It appears that this is, in a certain sense, a national trait.

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Infrared Absorption Spectra of Steroids. An atlas. vol. II. Glyn Roberts, Beatrice S. Gallagher, R. Norman Jones. Interscience, New York, 1958. viii + 95 pp. + charts No. 309 to 760. $20.

This volume from the National Research Council of Canada in Ottawa and the Sloan-Kettering Institute for Cancer Research in New York contains charts showing the infrared absorption spectra of 362 steroids, recorded on the same format as those reproduced in volume I [see *Science* **120**, 339 (1954)], and supplementary curves for 90 steroids described in volume I. The compounds examined include steroids needed to complete series of related isomers, new steroids of special clinical and biochemical importance, and a useful collection of D-homosteroids. With the exception of potassium bromide disc spectra for 50 less-soluble specimens, all the spectra are for solutions. The quality and standard of reproduction of the spectra are of the same high order as in volume I, but unfortunately no physical data that might indicate the purity of the samples examined are given.

The charts are preceded by a valuable introduction containing a section on the analysis and interpretation of steroid spectra, a set of 17 tables listing characteristic group frequencies for steroids, and a comprehensive bibliography. The tables are the most complete yet published and will be welcomed by all laboratories concerned with the isolation, synthesis, and structural identification of steroids and related substances.

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The Growth of Logical Thinking from Childhood to Adolescence. An essay on the construction of formal operational structures. Bärbel Inhelder and Jean Piaget. Translated by Anne Parsons and Stanley Milgram. Basic Books, New York, 1958. xxiv + 356 pp. $6.75.

Every parent who has attempted to fix the mind of a young child attentively upon an intellectual problem for more than ten seconds will read of the accomplishments of Bärbel Inhelder with mixed admiration and disbelief. Perhaps Swiss children are different, but it is more likely that Inhelder has a rare and sensitive skill for finding problems, devising situations, and asking questions that permit her young friends to show to best advantage. How else could she explore with children (ages 5 to 15) such problems as angles of incidence and reflection, density and specific gravity, flexibility of rods, the pendulum, falling bodies on inclined planes, effects of hidden magnets, chemical reactions, conservation of motion, hydraulic equilibria, the law of the balance, projection of shadows, centrifugal force, probability, and statistical correlation?

Inhelder's collaborator in this remarkable book is none other than Jean Piaget, the most imaginative and prolific child psychologist alive today. Piaget assumes the task of isolating and analyzing the formal or propositional structures underlying the children's attempts at understanding. Consequently, there are 15 chapters which conform to the same pattern: first, Inhelder's data; second, Piaget's analysis. The book ends with 100 pages on the structural integration of formal thought, where Piaget has a chance to develop his ideas more systematically.