number to give a standard scale of white pine growth in the area, these Sutton pines gave a record that cross-identified well but not perfectly with nearby white pine records of the period 1867–1934.[3] The presence of 260 rings was notable for white pine and important for the problem because of the wide overlap made possible even with trees buried more than a century.

The accuracy of the cross-identification is shown by the following facts. Of the six wide rings in the buried wood, five checked perfectly with the Sutton pines, while each record for the 128 years showed one maximum not represented in the others. In the same way and for the same 128 years, of the 16 narrow rings in the buried trees, eight checked with lows in the Sutton trees, four checked with years marked by lows in the hemlock record of the Wolfeboro district and by drouths recorded in a diary, two missed agreement with the Sutton record by one year, while only two stand alone.

This relatively unimportant problem demonstrates the possibilities of the method for the area and the extent to which significant narrow and wide rings appear in sensitive trees of the New England area. The cross-identification is apparently less perfect here than in the Southwest, but valid solutions of archeological problems seem possible, particularly when the material includes a long series of rings from a native "softwood" tree.

CHARLES J. LYON

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NOTICE OF POSSIBLE SUSPENSION OF THE RULES OF NOMENCLATURE IN CERTAIN CASES (A.(n.s.) 1)

IN accordance with a resolution adopted by the International Zoological Congress at their ninth meeting held at Monaco in 1913, prescribing that not less than one year's notice is to be given by the International Commission on Zoological Nomenclature of all applications received for the "Suspension of the Rules," the attention of the zoological profession is hereby invited to the fact that requests for the "Suspension of the Rules" have been received by the commission in the undermentioned cases:

(a) ECHINODERMATA.—*Diadema* Humphreys, 1797 (type *Echinometra setosa* Leske, 1778) to be added to the Official List of Generic Names (see Mortensen, 1937, *Ann. Mag. nat. Hist.* (10) 19: 463–469) (reference Z. N. (S.) 52).

(b) INSECTA, Neuroptera.—To be added to the Official List of Generic Names with types as shown in brackets:—*Hemerobius* Linnaeus, 1758 (*Hemerobius humulinus* Linnaeus, 1758); *Chrysopa* Leach, 1815 (*Hemerobius perla* Linnaeus, 1758) (see Cowley and others, 1937, Generic Names of British Insects, Pt. 4) (reference Z. N. (S.) 42).

(c) INSECTA, Lepidoptera.—To be added to the Official List of Generic Names with the type as shown in brackets:—*Actinote* Hübner, [1819] (*Papilio thalia* Linnaeus, 1758) (see Hemming, 1936, *Proc. R. ent. Soc. Lond.* (B) 5: 56–57) (reference Z. N. (S.) 63).

(d) REPTILIA.—*Bitts* Gray, 1942 (type *Vipera* (*Echidna*) *arietans* B. Merrem, 1820), to be added to the Official List of Generic Names, and *Cobra* Laurent, 1768, to be suppressed (Stejneger, 1936, *Copeia,* 3: 140) (reference Z. N. (S.) 121).

In adopting the resolution referred to above, the International Zoological Congress expressly stated that their object was thereby to render it possible for zoologists, particularly specialists in the group in question, to present to the commission arguments for or against the suspension of the rules proposed. Any such representations should be furnished to the Secretariat to the Commission (British Museum (Natural History), Cromwell Road, London, S.W. 7) as soon as possible and in any case within one year of this day's date. Every such communication should be clearly marked with the commission's reference number as given above.

BY ORDER OF THE COMMISSION,
(Signed) FRANCIS HEMMING,
Secretary to the Commission

SECRETARIAT OF THE COMMISSION,
BRITISH MUSEUM (NATURAL HISTORY),
CROMWELL ROAD, LONDON, S.W. 7.
27TH JUNE, 1939

SCIENTIFIC BOOKS

QUANTUM MECHANICS

Introductory Quantum Mechanics. By VLADIMIR ROJANSKY. Prentice-Hall, Inc., New York, 1938. $5.50.

THE current literature of modern physics is of such a character that one can not in general appreciate the arguments without an understanding of the physical ideas, and in many cases the mathematical methods, peculiar to quantum mechanics. Hence it is necessary that a graduate student of pure physics acquire this knowledge early in his career. While the new physical notions can and should be presented in advanced undergraduate courses on the phenomena of modern physics, the mathematical treatment must perhaps in general wait for the fuller experience of graduate study, but should certainly be begun in the first graduate year if the doctorate is to truly represent a maturity of knowledge and ability. But at this stage the study and teaching of a subject as fundamental as quantum mechanics is greatly facilitated by the use of a textbook. This volume by Rojansky represents in the re-

[3] L. Goldthwait and C. J. Lyon, *Ecology,* 18: 406–415, 1937.

viewer's opinion, the first suitable book of this sort. The few volumes designed for use as introductory text-books which have appeared in the past have been concerned almost exclusively with Schrödinger's differential equation. But very many, perhaps even a majority, of the applications employ matrices and operational methods. There are subjects such as theoretical spectroscopy in which the solution of Schrödinger's equation by the ordinary methods of the calculus of differential equations occupies only a small fraction of the papers and treatises. Hence it is undesirable to spend almost the whole of an introductory course on a detailed discussion of Schrödinger's equation, as such. This is especially true, since it seems to have the result that most students never grasp the general ideas of the quantum-mechanical method but cling to Schrödinger's differential equation as to a lone friend in a strange land. They try to write and employ horrible-looking differential equations where a few operational ideas would save many complicated pages. While this sort of thing has ample precedent in important early work of competent physicists, particularly in papers on spectroscopy, it should have been ended by the brilliant expositions of Dirac. But now for the first time do we have an introductory text-book which follows in Dirac's footsteps.

In examining this book one is appalled at the bulk, when presented in a truly introductory fashion, of the material which the student has to learn, has to have at his fingertips, before he is prepared to follow easily the literature employing quantum mechanics. The mathematical methods employed will seem to the student strange, but not more difficult than the courses in pure mathematics he is prepared to study. This is especially true since in an introduction to quantum mechanics, just as in an introduction to classical theoretical physics, neither too rigorous a mathematical treatment nor too logical a development of the physical postulates is necessary. In this connection Rojansky's book "makes little pretense to rigor and often aims to make plausible rather than to prove."

But in spite of the fact that the book succeeds in presenting very well and in a fashion as elementary as possible the tremendous machinery necessary to the understanding of the applications of quantum mechanics, it is not quite the ideal elementary text-book which one would advise a beginner to study by himself without benefit of lectures. For one is shocked at the idea of studying through the whole book and finding as little concrete physics as is there contained. As the book stands now it is a course in which one is taught to make many different mathematical manipulations on commands couched in physical terms, but has little idea as to why he is learning to make them. This is partly unavoidable, but can often be remedied by informal classroom discussion concerning the fields in which the various ideas are of particular use. Since this text makes no claim to logic or rigor, more of this informal discussion might well have been introduced to keep alive the student's interest. To give a few examples: the application to the nuclear vibration of molecules of the energy levels and transition probabilities found for a harmonic oscillator might have been discussed; the importance of the potential well for the study of metals and of gases might have been explained; cold emission could have been used as a second example (in addition to radioactivity) of the tunnel effect; and the diffraction of an electron beam passing through an idealized metal surface would have furnished an excellent application of de Broglie waves.

As we have noted, the book has practically nothing in the way of applications of the theory. It does get to the point of treating the hydrogen atom, including spin-orbit interaction and nuclear motion. But in general, as is proper, its function is to carry the student exactly to the point where specialized treatments of the applications of quantum mechanics are likely to begin. It discusses one-particle problems only, has no mention of the exclusion principle and practically nothing on radiation theory.

The commendable introductory chapter on classical mechanics is designed not so much for review as to introduce terms and notions fundamental in quantum mechanics but not usually employed in elementary classical mechanics. Thus the student, while still in familiar surroundings, encounters potential wells, distribution functions, expectation or average values, the uncertainty of the result of a measurement, the state of a system, probability packets.

This chapter is followed by an excellent formulation and discussion of the fundamental assumptions of quantum mechanics directly from an operational point of view; then a detailed treatment of the Schrödinger method in one dimension. One might refer to the particularly clear treatment of composite states, the brief but convincing exposition of the Heisenberg uncertainty principle, and the first treatment in an elementary book of the one-dimensional potential lattice.

Then follows an excellent treatment of operational and matrix methods. The student is gently introduced to the two sorts of matrices of particular interest—those representing Hermitian operators and unitary transformations—by a geometrical discussion of "mappings" and "frame changes."

At the end are chapters which treat the elements of motion in three dimensions, Pauli's theory of spin and Dirac's theory of the electron.

The book contains literally hundreds of carefully chosen problems which should be of great value in familiarizing the student with the employment of the quantum-mechanical methods.

The presentation of the subject is in general ex-

tremely clear and gives the impression of having been very carefully prepared. In this regard, the reviewer would have only one suggestion—that greater use might be made of graphical illustrations of the type so convincingly employed in Gurney's book. For example, for the case of hydrogen, a plot of $-1/r+l\ (l+1)/2r^2$ for various values of l, with the radial eigenfunctions superposed on the respective energy levels, renders very plausible the coincidences of these levels in this case and the lack of coincidences if the central field departs in the least from the Coulomb value.

Finally one might remark that the typography of the book is very pleasing and should serve as a model for other American texts. It approaches the English and German books for beauty of format, avoiding the ugly fat radicals, the huge thick integral signs and the black summation signs which so clutter up the pages of most American physics books; and goes far toward making the cuts and equations fit into and become an attractive part of the page instead of standing out like trees in the middle of South Dakota. One even finds (p. 515) an equation pleasantly protruding into the margins, a thing unheard of in American typography. One still finds, however, too much blank space around short equations (*e.g.*, p. 355).

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USES OF CHEMICALS

Uses and Applications of Chemicals and Related Materials. By THOMAS C. GREGORY. vi + 665 pp. New York: Reinhold Publishing Corporation, 1939. $10.00.

TWENTY-FIVE years ago, when we entered the World War, it became necessary for the Secretary of War to commandeer all supplies of various essential chemicals and allocate them according to our war needs. This allocation was made with the assistance and upon the advice of the Chemicals and Raw Materials Division of the War Industries Board. Even in a group of experts of this kind, it was not always possible to find men who were familiar with all the varied uses of a well-known chemical or the proportionate amounts required by various industries. For example, those not specialists had no idea of the quantity of arsenious acid required by the glass manufacturers or of saccharin by the tobacco industry.

Such a book as the one under review would have been very helpful, and it seems to the writer, therefore, that its appearance is opportune, now that we may be facing problems similar to those of 1917–18.

The volume describes, in alphabetical order, the current industrial uses, potential applications and sales possibilities of 5,167 chemicals and related products. It is based upon surveys made over a period of 15 years and published in the *Oil, Paint and Drug Reporter,* under the titles *"Where You Can Sell"* (up to and including the issue of September 9, 1935) and "Industrial Uses of Chemicals and Related Materials" (from the issue of September 16, 1935, onwards). The uses are classified under appropriate sub-headings, synonyms and foreign names are given, and patent references are frequent. At the close of the volume is an extensive "Synonyms and Cross References" index. The book is an encyclopedia of useful information.

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SPECIAL ARTICLES

THE SEMIQUINONE RADICALS OF METHYLENE BLUE AND RELATED DYESTUFFS

THE occurrence of free radicals, designated as semiquinones, as intermediate reduction products of reversibly reducible dyestuffs, was considered as an exceptional case when it was first discovered for pyocyanine and some related phenazin derivatives. Meanwhile, these radicals have been shown to exist for all the more familiar classes of reversible dyestuffs, except for the thiazines and oxazines. Since methylene blue, a thiazine, is the most frequently used dyestuff in biochemical research, the failure of any report about the existence of its semiquinone was somewhat puzzling. This problem is especially important with regard to the hypothesis of compulsory univalent reduction[1] which claims that no oxidation or reduction can proceed with any appreciable speed otherwise than in univalent steps. The faculty of acting as a catalyst for oxidation, especially respiration, should accordingly also be correlated with the faculty of the catalyst to be either a univalent oxidation-reduction system, such as the iron porphyrin compounds; or if it be a bivalent system, to be reducible in two successive, although more or less overlapping steps.

This note is to give a preliminary report on the discovery of the hitherto unknown semiquinones of these dyestuffs.

According to the theory on stability of free radicals, based on the theory of reasonance, the authors came to the conclusion that the radicals of thiazines should be most stable in a very strongly acid solution. This expectation has been verified by experiment. It is easiest to demonstrate the radical of thionin (Lauth's

[1] L. Michaelis and C. V. Smythe, *Ann. Review Biochemistry,* 1938.