Meetings and Societies

Observation and Interpretation

Do the processes of physical observation and measurement have absolute limits of some kind, or are these only an artifact of a particular interpretation of these processes? How serious are (or would be) such limits for the predicting and explanatory (interpretative) functions of science, supposing that probability statements are still available? The most interesting property of these questions is their capacity to evoke confident but incompatible answers from theoretical physicists. After more than 30 years we certainly should have some answers, and it is perhaps a little embarrassing that we cannot come near to agreeing on *the* answers. These questions are on the borderland of philosophy and physics and, like their ancestors which produced the theories of inertia and relativity, are the keys to many doors; but their answers are the keyholes. The 1957 symposium of the Colston Research Society [a group of Bristol (England) citizens who finance the venture] invited a number of the most capable physicists and philosophers in Europe to reexamine these issues, and an excellent program resulted. The symposium was held at the University of Bristol, 31 Mar.–5 Apr. The papers and the subsequent discussions will be published, and I shall therefore confine myself to listing them and giving some general comments, which must be understood as the personal impressions of one observer.

The main issue was the Bohr-Einstein dispute over the status of quantum mechanics, which is held by the former to be in some sense final and by the latter to be essentially an *incomplete* account of micro-processes. Among those who delivered papers, the Copenhagen school was represented particularly by Rosenfeld (Manchester) and Süssmann (Göttingen and Munich), a student of Heisenberg's. The Einstein position was developed by Bohm (Haifa) in his paper "A proposed explanation of quantum theory in terms of hidden variables at a subquantum-mechanical level" and was supported by Vigier (Institut Henri Poincaré, Paris). Among the other contributions that were in the category of theoretical physics, indirect support for the first position was provided by Groenewold (Groningen) ("Objective and subjective aspects of statistics in quantum description") and for the second, by Bopp (Munich). Fierz (Basel) ("Does a physical theory comprehend an 'objective, real, single, process'?") and Feyerabend (Bristol) ("On the quantum theory of measurement") had their sympathies with the former viewpoint, one inferred. The papers were commendably brief, and the discussion periods were considerably longer, with the result that the party lines were quite soon made clear and a vigorous dispute continued from one session to the next. Only on the last day was there a feeling that the possible variations were exhausted and that a period of reconsideration would be required to produce new arguments.

It is very interesting to notice the role of the philosophic slogans adopted by the two sides in directing their arguments and their search for physical explanations; the Copenhagen school proclaimed the irrelevance of intuitive models to quantum events, and the "hidden variablists" insisted on the existence of a definite state in a system, regardless of the presence or activity of an observer. The importance of the slogans is not their logical relationship, for they are compatible, but the way in which they were the theme and last resort of each disputant; clearly, it was the interpretations and not the observations which were in question. Körner (Bristol) ("On philosophic arguments in physics") brought out well the strength of this linkage between the hard-pressed theoretician and the philosopher. Polanyi (Manchester) ("Beauty, elegance, and reality in science") attempted to explicate some of the formal criteria which enter into the judgment of theories at this level of great generality, where they become almost philosophic. (One recalls again the debates on absolute space, phlogiston, atoms, the continual-creation cosmologies, and so forth). Other logical problems of the borderline were taken up by Gallie (Belfast) ("The limits of prediction"), by Kneale (Oxford) ("What can we see?"), and by Ryle (Oxford) ("Predicting and inferring").

The dependence of interpretations of quantum theory on a particular (usually unstated) philosophic analysis becomes especially clear in connection with the concept of probability, since, for example, the debate over "information-waves versus real waves" is, in great part, a debate about the nature of probability. On this topic Popper (London School of Economics), Ayer (University College, London), and Braithwaite (Cambridge), as logicians, produced three good papers, whose relationship to the quantum theory could well have been discussed at greater length.

The 25 symposiasts who did not read papers provided a critical and enlightened audience, whose selectivity avoided a good deal of the usual time-wasting that is associated with convention meetings on these topics. I found myself particularly interested in the comments, either on or off the floor, of Cohen (Dundee), Hesse (University College, London), Mackay (King's College, London), Müller (Braunschweig), and O'Connor (Liverpool). Of course, others would make other choices, but I doubt that there would be much dispute over the outstanding grasp of the field exhibited by Groenewold, whose introduction of the Einstein-Podolski-Rosen paradox as a difficulty for Bohm's interpretation and whose analysis of the von Neumann proof were very impressive. Although he argues that the von Neumann proof tells us nothing about the possibility of subquantum theories which include the quantum laws as derivations, he also thinks that any such theory is *very likely* to collapse over one or more of a range of special difficulties—a view which he supported by a verbal analysis of the mathematics of the three best contemporary candidates.

It remains to be seen, of course, whether Bohm can derive the Dirac equations and the other well-established formulas and then whether some differentiating experiments support his position. One interesting result of the discussion was a design for such a differentiating experiment, which was accepted by both sides. But Groenewold's objections would still make it impossible to regard the theory as deterministic in the usual sense, which in this case constitutes a serious conceptual difficulty.

It remains only for me to say that the symposium was organized with great courtesy and efficiency by Korner, assisted by Pryce, Edgeley, and Feyerabend, of the host university; that the hospitality provided by the Colston Society and the university was very generous and cordial; and that all who listened learned.

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American Institute of Physics

The American Institute of Physics (AIP), founded in 1931, is a federation of the major societies of physics in the United States. The member societies are the American Physical Society, the Optical Society of America, the Acoustical Society of America, the American Association of Physics Teachers, and the Society of Rheology. The combined membership of these societies, together with some associate members of the institute, now totals more than 18,000 individuals. All of these societies are affiliated with the AAAS, and the American Institute of Physics has recently become an affiliate.

The institute is governed by a board whose members are nominated by the member societies, except for three who are elected by popular ballot of the individual members. The board appoints an executive committee, and the institute has a director and an executive secretary, with a supporting professional staff. The AIP was the first of a number of similar federations in various fields of science and served in some respects as a model for the others. The member societies are fully autonomous. They control their own terms of membership, elect their own officers, arrange their own scientific meetings, and edit their own journals. The societies delegate to the institute the mechanics of all their publishing work as well as various developmental and representative functions which can best be accomplished on behalf of physics as a whole by combining the strength of the societies through the institute.

The major activity of the institute is publication of the following journals: for the American Physical Society, *Physical Review, Reviews of Modern Physics,* and *Bulletin of the American Physical Society*; for the Optical Society, *Journal of the Optical Society of America*; for the Acoustical Society, *Journal of the Acoustical Society of America* and *Noise Control*; for the American Association of Physics Teachers, *American Journal of Physics*; under AIP sponsorship, *Review of Scientific Instruments, Journal of Chemical Physics, Journal of Applied Physics,* and *Physics Today.*

To this list of journals, the institute has recently added four periodical translations of journals that are published in Russian by the Academy of Sciences of the U.S.S.R. These journals, all subsidized by the National Science Foundation, are *Soviet Physics–J.E.T.P., Soviet Physics–Technical Physics, Soviet Physics–Doklady,* and *Soviet Physics–Acoustics.*

By arrangement with the member societies, the institute supplies secretarial, clerical, and fiscal services, as desired, to the secretaries, treasurers, and other officers of the societies, and frequently assists the societies in some aspects of the business of arranging their meetings.

Among the general services that are rendered by the AIP to physics and to the general community are the distribution of vocational information about physics, the sponsoring of student sections at universities and colleges, the maintenance of the physics section of the National Register of Scientific and Specialized Personnel, sponsored by the National Science Foundation, and cooperation with societies and institutes in other fields of science in such joint enterprises as the Scientific Manpower Commission. The institute also operates a number of projects on grants from the Government or from private foundations; all of these are designed to develop the science of physics, to improve education in the science, or to attract suitable students to careers in physics.

The work of the institute has grown to such magnitude—involving the publication of 19,000 pages per year, service to its 18,000 members, and the carrying on of various assigned projects—that it has become necessary to move to larger quarters. A drive for a "development fund" of $500,000 is now in progress. Half of this is for the conversion of a building, which has been purchased, into enlarged office space for the institute's work. The remainder is for a needed expansion of publishing services and for other activities designed to strengthen the profession of physics in the United States. Early in June, the institute will move from its present quarters to the new location at 335 E. 45 St., New York.

HENRY A. BARTON
American Institute of Physics, New York, New York

Society Elections

■ Association of Vitamin Chemists: pres., Orton F. Hixson, Laboratory of Vitamin Technology; v. pres., Claire E. Graham, The Wilson Laboratories; treas., Buford H. Barrows, Hales and Hunter Co.; sec., Arnold E. Denton, Research Laboratories, Swift and Co., Chicago 9, Ill. Representative to the AAAS Council is Henry C. Spruth.

■ South Dakota Academy of Science: pres., John Willard, South Dakota School of Mines and Technology; 1st v. pres., S. W. Howell, Yankton College; 2nd v. pres., V. R. Nelson, Augustana College; sec.-treas., John M. Winter, Dept. of Botany, State University of South Dakota, Vermillion. The representative to the AAAS Council is Raymond Greb, South Dakota State College.

■ Population Association of America: pres., Harold F. Dorn, National Institute of Health, Bethesda, Md.; pres. elect, Dorothy Swaine Thomas, University of Pennsylvania; 1st v. pres., Kingsley Davis, University of California, Berkeley; 2nd v. pres., Dudley Kirk, Population Council, Inc., Scarsdale, N.Y.; sec.-treas., Daniel O. Price, University of North Carolina, Chapel Hill.

■ American Association of Colleges of Pharmacy: pres., Tom D. Rowe, University of Michigan, Ann Arbor; v. pres., J. F. McCloskey, Loyola University, New Orleans, La.; exec. comm. chairman, Louis C. Zopf, State University of Iowa, Iowa City; sec.-treas., George L. Webster, University of Illinois, Chicago 12.

■ Virginia Academy of Science: pres., William G. Guy, College of William and Mary; pres. elect, John C. Forbes, Medical College of Virginia; sec., Paul M. Patterson, Hollins College, Hollins, Va.; treas. and representative to the AAAS Council, Foley F. Smith, Virginia Alcoholic Beverage Control Board; asst. sec.-treas., William B. Wartman, Jr., American Tobacco Company Research Laboratory.

Forthcoming Events

July

10–17. International Union of Crystallography, 4th genl. assembly, Montreal, Canada. (G. A. Jeffrey, Chemistry Dept., Univ. of Pittsburgh, Pittsburgh 13, Pa.)

11–13. Applied Cytology, European Symp., Brussels, Belgium. (Secretary, Comm. on International Cong., American Cancer Soc., 521 W. 57 St., New York 19, N.Y.)

14–19. International Assoc. of Gerontology, Merano, Italy. (A. I. Lansing, Dept. of Anatomy, Univ. of Pittsburgh, Pittsburgh 13, Pa.)

14–20. Clinical Pathology, 4th internatl. cong., Brussels, Belgium. (M. Welsch, Service de Bacteriologie et de Parasitologie, Université de Liége, Blvd. de la Constitution, Liége, Belgium.)

15–18. Biochemistry of Lipids, International Colloquium, Oxford, England. (Dr. Sinclair, Laboratory of Human Nutrition, Oxford.)

15–19. Institute on College Administration, annual, Ann Arbor, Mich. (A. D. Henderson, 2442 U.E.S., Univ. of Michigan, Ann Arbor.)

16–19. American Malacological Union, annual, New Haven, Conn. (Miss M. C. Teskey, P.O. Box 238, Marinette, Wis.)

16–24. International Cong. for Pure and Applied Chemistry, 16th, Paris, France (R. Morf, Secy. Genl., IUPAC, Sandoz, S.A., Basel, Switzerland.)

20–21. Medical-Sociological Aspects of Senile Nervous Diseases, internatl. symp., Venice, Italy. (S. N. Feingold, Jewish

Vocational Service of Greater Boston, 70 Franklin St., Boston 10, Mass.)

21–28. Neurological Sciences, 1st internatl. cong., Brussels, Belgium. (P. Bailey, National Institutes of Health, Bethesda 14, Md.)

23–24. Modern Electrochemical Methods of Analysis, Internatl. symp., Paris, France. (G. Charles, Ecole Superieure de Physique et de Chimie, 10, rue Vauquelin, Paris 5e.)

25–26. Structure Properties Relationships of Polymers (IUPAC), Paris, France. (International Union of Pure and Applied Chemistry, 4, Avenue de l'Observatoire, Paris 6e.)

25–29. Protein Chemistry Symp., IUPAC, Paris, France. (J. Roche, College de France, Place Marcellin Berthelot, Paris 5e.)

26–27. Experimental Psychology and Animal Behavior Section of International Union of Biology, Brussels, Belgium. (H. S. Langfeld, Dept. of Psychology, Princeton Univ., Princeton, N.J.)

26–27. Linguistic Soc. of America, Ann Arbor, Mich. (A. A. Hill, Box 7790, University Station, Austin 12, Tex.)

26–27. Military Psychology, internatl. symp., Brussels, Belgium. (National Academy of Sciences, 2101 Constitution Ave., NW, Washington 25.)

26–31. International Humanist and Ethical Union, 2nd cong., London, England. (American Humanist Assoc., Gate House, Yellow Springs, Ohio.)

26–1. International Congress on Nutrition, 4th, Paris, France. (Quatrième Congrès International de Nutrition, CNERNA, 71, boulevard Péreire, Paris 17e.)

27–3. Religion in the Age of Science, 4th annual, Star Island, Isles of Shoals, Portsmouth, N.H. (Mrs. R. Holt, Box 156, Pennington, N.J.)

28–1. Psychoanalysis, 20th internatl. cong., Paris, France. (Dr. Nacht, 187, rue Saint-Jacques, Paris 5.)

28–3. Psychology, 15th internatl. cong., Brussels, Belgium. (L. Delys, 296, avenue des Sept Bonniers, Forest-Bruxelles.)

31–5. International Assoc. for Hydraulic Research, Lisbon, Portugal. (M. Coelho Mendes da Rocha, Laboratorio Nacional de Engenharia Civil, Avenida do Brasil, Lisbon.)

31–6. Dermatology, 11th internatl. cong., Stockholm, Sweden. (C. H. Floden, Hudkliniken, Karolinska Sjukhuset, Stockholm 60.)

August

2–3. Pennsylvania Acad. of Science, Honesdale, Pa. (K. Dearolf, Public Museum and Art Gallery, Reading, Pa.)

5–11. Pan American Cong. of Pediatrics, 5th, Lima, Peru. (C. F. Krumdieck, Washington 914, Lima.)

5–17. Curare and Curare-Like Agents, internatl. symp., Rio de Janeiro, Brazil. (C. Chagas, Instituto de Biofisica, Universidade do Brasil, 458 Avenida Pasteur, Rio de Janeiro.)

6–9. Poultry Science Assoc., annual, Columbia, Mo. (C. B. Ryan, Texas A.&M. College, College Station.)

7–9. Industrial Applications of X-Ray Analysis, 6th annual conf., Denver, Colo. (J. P. Blackledge, Metallurgy Div., Denver Research Inst., Univ. of Denver, Denver 10.)

7–9. International Union against the Venereal Diseases and the Treponematoses, 31st general assembly, Stockholm, Sweden. (Secretary General, Institut Alfred Fournier, 25, boulevard Saint-Jacques, Paris 14e, France.)

8–15. International Statistical Inst., 30th, Stockholm, Sweden. (Secretary General, ISI 30th Session, Fack, Stockholm 5.)

8–15. International Union for the Scientific Study of Population, Stockholm, Sweden. (F. Lorimer, c/o American University, Washington 16.)

11–14. Heat Transfer, national conf., University Park, Pa. (G. M. Dusinberre, Pennsylvania State Univ., University Park.)

11–17. World Federation for Mental Health, 10th annual, Copenhagen, Denmark. (Miss E. M. Thornton, 19 Manchester St., London, W.1, England.)

12–16. Canadian Teachers' Federation, annual, Edmonton, Alberta, Canada. (G. G. Croskery, 444 MacLaren St., Ottawa 4, Ont.)

12–18. Theory of Functions, internatl. colloquium, Helsinki, Finland. (B. Eck-

mann, École Polytechnique, Federale, Zurich, Switzerland.)

12–25. International Soc. of Soil Mechanics and Foundation Engineering, 4th Conf., London, England. (A. Banister, Institution of Civil Engineers, Great George St., London, S.W.1.)

18–21. American Astronomical Soc., Urbana, Ill. (J. A. Hynek, Smithsonian Astrophysical Observatory, 60 Garden St., Cambridge 38, Mass.)

19–21. National Council of Teachers of Mathematics, Northfield, Minn. (M. H. Ahrendt, NCTM, 1201 16 St., NW, Washington 6.)

19–22. American Veterinary Medical Assoc., annual, Cleveland, Ohio. (J. G. Hardenbergh, AVMA, 600 S. Michigan Ave., Chicago 5, Ill.)

19–23. Clay Conf., 6th natl., Berkeley, Calif. (Dept. of Conferences and Special Activities, Univ. of California Extension, Berkeley 4.)

19–23. Clinical Chemistry, 2nd international European cong., Stockholm, Sweden. (K. Agner, Box 12024, Stockholm 12.)

19–24. Finite Groups, internatl. colloquium, Tübingen, Germany. (H. Wielandt, Faculty of Mathematics and Natural Science, Eberhard-Karls-Universität, Tübingen.)

(See issue of 17 May for comprehensive list)

LETTERS

The editors take no responsibility for the content of the letters published in this section. Anonymous letters will not be considered. Letters intended for publication should be typewritten double-spaced and submitted in duplicate. A letter writer should indicate clearly whether or not his letter is submitted for publication. For additional information, see Science **124**, *249 (1956) and* **125**, *16 (4 Jan. 1957).*

Literature, Science, Manpower Crisis

Unusual importance attaches to the article on "Literature, science, and the manpower crisis" by Joseph Gallant [*Science* **125**, 787 (26 Apr. 1957)]. If it could be read by all those who are engaged in building high school curriculums, by a large proportion of those who teach in upper primary and secondary schools, by those who write textbooks for these grades, by those who train teachers, and by key members of state and city boards of education, the shortage of scientists and technologists would surely soon be reduced; and, even more far-reaching and contrary to present reasonable expectation, a start might soon be made toward making basic scientific concepts acceptable in American culture. During the 50 years that I have been a reader of *Science* I have found neither in its pages nor elsewhere an equally cogent statement of the prime sources of present educational deficiency or failure in the sciences.

Two sentences will recall the core of the contribution: The problem centers in the high school. Involved there is practically the whole of the curriculum —not merely science and mathematics, but literature, history, and other of the humanities as well. Fortune has left it for a scholar in literature, and one actively teaching in a famous New York high school, to *document* satisfactorily the definite (and ultimately persuasive) prescientific bent of humanistic teaching in our high schools and, to point sharply to the resulting dichotomy in the basic thought and motivation of our people, involving an over-all denigration of the status and concepts of science. I quote: "But the humanities sweepingly ignore the role played by scientific insight and thinking in the ideology of our times and disdainfully march on their archaic way as though the atomic and electronic age had not arrived. . . . students must be attracted to the study of sciences, not *after* they are enrolled in the colleges, but *before*; not after they have elected physics and chemistry in the secondary schools, but before they do so. Moreover . . . they must be endowed with a perspective that will provide them with a profound and continuing motivation to apply themselves."

A clear, persuasive, and unhedged statement illuminating this much-