Meetings

Comparative Pathology: An Opportunity for Biologists?

Faculty members of 20 domestic and two foreign schools of medicine and of veterinary medicine, chiefly representing pathology, met recently with officials of the National Institutes of Health and associated agencies to explore current opportunities for research training in veterinary and comparative pathology and the possibilities for expanding these opportunities. Naturally, opinions at this conference ranged widely. Nevertheless, these opinions can be highly useful to agencies of the National Institutes of Health in stimulating and guiding developments in these areas of pathology.

To this end, the pathology training committee, Division of General Medical Sciences, National Institutes of Health, has asked for summaries of this conference from the viewpoints of research training for "human pathology," for "veterinary pathology," and for "comparative pathology." Robert E. Stowell, scientific director of the Armed Forces Institute of Pathology, Washington, D.C., will prepare the first of the summaries. Thomas C. Jones, director of pathology, Angell Memorial Animal Hospital, Boston, will prepare the second. The third is given here.

This review is addressed primarily to biologists, who may not be aware of the opportunities that "comparative pathology" offers, even in its present undeveloped state. "Comparative pathology" is given here in quotation marks to emphasize current uncertainty as to its scope. But, to attempt a definition: Pathology is the study or understanding of disease, and disease is dynamic—that is, a disturbance in the living. Therefore, comparative pathology must encompass the study of disease in all organisms, including man and domesticated animals.

Obviously, however, an understanding of disease in any species must depend upon an understanding of physiological and biochemical mechanisms by which that species maintains itself. Accordingly, pathology has developed largely through studies of disease in man and domesticated animals and is oriented to immediate application. Thus it has become more an adjunct to the practice of medicine and surgery than an independent discipline.

Comparative pathology, to develop adequately, must be free of these restrictions. It must be oriented solely to the study of disease as a natural phenomenon. Only then will the mechanisms of disease and the phenomena of advancing age be understood.

At present, few institutions are prepared to guide the biologist who may wish to begin a study of disease as a natural phenomenon. Current understanding of physiological and biochemical mechanisms, even in man and domesticated animals, is quite incomplete.

Nevertheless, imaginative inferences have often led to profitable ventures in comparative pathology. For example, study of the response of hatchery fish to iodine deficiency, combined with studies of many other species, suggests that the response of vertebrates to this deficiency may be highly stereotyped (*1*). Similarly, the response of Pacific salmon to sexual maturation and the spawning migration illustrate other endocrine mechanisms that may be common to the vertebrates (*2*).

Certainly there are many avenues by which research careers in comparative pathology might be fostered. But since I have had considerable experience with the manifestations of disease in zoo animals, I am best qualified to outline the opportunities offered by a laboratory in a zoo.

Studies in comparative pathology at the Penrose Research Laboratory of the Zoological Society of Philadelphia have been continuous since 1901 and illustrate the potential that a zoological garden offers for studies of disease as a natural phenomenon. For example, cautious extrapolation from the records of this laboratory has eliminated nutritional disease from the collections of mammals and birds in the Philadelphia zoo and demonstrates that infectious and parasitic diseases usually are indices of inadequate nutrition (*3*).

Subsequent studies at the Penrose Laboratory have also shown that adequately nourished mammals and birds in the zoological garden develop a highly uniform pattern of disease, which corresponds closely to that of urban man. This pattern of disease has been interpreted tentatively to mean failure of physiological adaptive mechanisms in response to environment (*4*). Considerable uniformity in the physiological adaptive mechanisms of mammals and birds is suggested by this interpretation.

The Penrose Research Laboratory is unique. It has been developed in close collaboration with the schools of medicine and veterinary medicine of the University of Pennsylvania. Its staff members hold joint appointments on the faculties of the university.

The records of this laboratory also are unique. They represent observations on disease in over 18,000 animals, about half of which have been examined since nutritional deficiencies ceased to be a cause of morbidity and mortality. At the same time, other environmental factors have been documented.

These records have always been used in research and teaching for which the university gives full academic credit. Recently, however, personnel and facilities for research and teaching have been expanded considerably through support from the National Institutes of Health.

Students now in residence include "post-doctoral trainees" who are not candidates for advanced degrees in comparative pathology, whose research is largely independent, and "pre- and post-doctoral trainees" who are candidates for advanced degrees in this area. Space limits the number of senior investigators to three and the number in training to about ten.

Course requirements for advanced degrees in comparative pathology include essentially all subjects (or acceptable substitutes) in the curriculum for the first and second years in the School of Medicine. In addition, participation in seminars and conferences and an adequate course in statistics are required.

Seminars are designed to acquaint the student with publications that per-

tain to current and projected areas of research. Conferences allow detailed review of the many examples of disease found on post-mortem examination of animals that die in the zoo. The purpose of these conferences is to develop skills in interpreting signs of disease and in formulating dynamic concepts of disease that may be tested by experiment.

This program is flexible. It has been combined with residency training in the schools of medicine and veterinary medicine. However, it is also designed for the graduate student who wishes to take an advanced degree in this area.

Graduates in medicine or in veterinary medicine who combine this training in comparative pathology with the residency training in pathology will find many opportunities awaiting them. Biologists who complete this program creditably will be equally well equipped for research, but possibly would not be accepted so readily for teaching-research positions in schools of medicine or veterinary medicine. However, a consensus of the conference was that, as the trained persons become available, so will the opportunities.

HERBERT L. RATCLIFFE
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References

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3. H. L. Ratcliffe, *Zoologica* **25**, 463 (1940); ———, *Am. Rev. Tuberc. Pulmonary Diseases* **54**, 389 (1946); P. R. Cannon, *J. Am. Med. Assoc.* **126**, 360 (1945); R. W. Wissler, R. L. Woolridge, C. H. Steffer, P. R. Cannon, *J. Immunol.* **52**, 267 (1946).
4. R. L. Snyder, *Proc. Natl. Acad. Sci. U.S.* **47**, 449 (1961); H. L. Ratcliffe, *Circulation*, in press.

Forthcoming Events

September

19–20. **Industrial Electronics**, annual symp., Chicago, Ill. (E. A. Roberts, Comptometer Corp., 5600 Jarvis Ave., Chicago)

19–21. Rocky Mountain **Minerals** Conf., Butte, Mont. (Metallurgical Soc. of AIME, 345 E. 47 St., New York 17)

19–22. **Information Retrieval**, seminar, Minneapolis, Minn. (Director, Center for Continuation Study, Univ. of Minnesota, Minneapolis 14)

19–23. **Air Force** Assoc., convention and aerospace panorama–weapons meet, intern., Las Vegas, Nev. (Air Force Assoc., 1901 Pennsylvania Ave., NW, Washington 6)

20. **Surgery** of the Hand, intern. conf., Paris, France. (L. Gosse, c/o Hôpital de Nanterre, 3 Ave. de la République, Nanterre (Seine), France)

20–22. **Sulphur Therapy**, intern. symp., Innsbruck, Austria. (K. Weithaler, c/o Medizinische Universitäts Klinik, Innsbruck)

20–23. International Soc. for Practical **Applied Medicine**, intern. congr., Salzburg, Austria. (Sekretariat, Internationale Gesellschaft für Praktisch Angewandte Medizin, Lange Str. 21a, Oelde, Westfalen, Germany)

20–23 **Rockets and Space Flight**, symp., Coblenz, Germany. (Deutsche Raketen-Gesellschaft, Fritz-Beindorf-Allee 9, Hanover, Germany)

20–28. Intergovernmental, **Oceanographic** Commission, Paris, France. (U.N. Educational, Scientific and Cultural Organization, Place de Fontenoy, Paris 7e)

20–30. Handling and Lifting Equipment and **Industrial Electricity**, intern. study sessions, Charleroi, Belgium. (Société Coopérative de Gestion, Palais des Expositions, Avenue de l'Europe, Charleroi)

22. **Pharmacy** Assembly, annual, New York, N.Y. (J. Yellin, Hebrew Home for the Aged, Bronx, N.Y.)

22–29. International **Scientific Film** Assoc., congr., Warsaw, Poland. (F. Gazan, ISFA, 38 Avenue des Ternes, Paris 17e, France)

22–4. **Cinematographic** Techniques, intern. congr., Turin, Italy. (Salone Internazionale della Tecnica, Corso Galileo Ferraris 60, Turin)

23–26. Latin American Congr. of **Angiology**, Buenos Aires, Argentina. (E. Sales, Santa Fé 1171, Buenos Aires)

23–26. **Petroleum** Mechanical Engineering, conf., Dallas, Tex. (American Soc. of Mechanical Engineers, Meetings Manager, 29 W. 39 St., New York 18)

23–27. **Electrochemical** Soc., Boston, Mass. (ES, 1860 Broadway, New York 23)

23–27. **Metal**, intern. congr., Vienna, Austria. (Metall-u. Farben A.G., Kärntnerstrasse 7, Vienna I)

23–27. **Microcirculation**, symp., Pavia, Italy. (G. Pellegrini, Inst. of Medical Pathology, Univ. of Pavia, Pavia)

24–26. European Assoc. Against **Poliomyelitis**, symp., Prague, Czechoslovakia. (P. Recht, EAAP, 56 rue Charles Legrelle, Brussels 4, Belgium)

24–26. National **Power** Conf., Baltimore, Md. (American Soc. of Mechanical Engineers, 29 W. 39 St., New York 18)

24–26. World **Veterinary Poultry** Assoc., conf., Cambridge, England. (W. M. McKay, Cyanamid of Great Britain, Ltd., Bush House, Aldwych, London, W.C.2, England)

24–28. International **Astronautical** Federation, congr., Sofia, Bulgaria. (J. A. Stemmer, IAF, P.O. Box 37, Baden, Switzerland)

24–28. **Organometallic Derivatives**, intern. colloquium, Paris, France. (H. Normant, Faculté des Sciences, Université de Paris à la Sorbonne, 47 rue des Ecoles, Paris 5e)

24–29. International Committee on Electrochemical **Thermodynamics and Kinetics**, Rome, Italy. (N. Ibl, c/o Laboratory of Physical Chemistry, Federal Polytechnicum, 6 Universitätsstrasse, Zurich, Switzerland)