Salivary Secretion

By virtue of its functional versatility, the salivary gland continues to attract the attention of an unusual variety of experimental biologists. Three aspects of salivary gland activity —secretion of electrolytes and enzymes, biochemical differentiation, and neural regulation of secretion, differentiation, and growth—were extensively considered by a gathering of physiologists, pharmacologists, biochemists, and pathologists at an International Conference on Mechanisms of Salivary Secretion and Their Regulation held in Birmingham, Alabama, at the University of Alabama Medical Center, 9–11 August 1966.

Two major problems which currently engage workers in secretion of electrolytes are, first, determining the loci in the gland at which transfer of salts occurs and, second, elucidation of the transport mechanisms involved. J. A. Young (Free University of Berlin) presented impressive new results from micropuncture and perfusion studies of the submaxillary gland in the rat. An isotonic, plasmalike, primary secretion occurs in the acinar-intercalated duct region of the gland. Ductal reabsorption of sodium and secretion of potassium are as active processes. An interesting new regulatory pathway, involving centrally located osmoreceptors, was reported for electrolyte and water secretion by H. Yoshimura (Kyoto Prefectural University of Medicine).

A. S. V. Burgen (University of Cambridge) discussed cellular mechanisms involved in transport of electrolytes, while L. H. Schneyer (University of Alabama Medical Center) described an in vitro slice system in which some cellular aspects of secretion of potassium in vivo could apparently be duplicated. The role of Na^+-, K^+-stimulated adenosine triphosphatase in providing a biochemical basis for active transport was reported by A. Schwartz (Baylor University College of Medicine).

When the concept of humoral transmission was introduced many years ago, support for this was partly based on experimental findings from salivary glands, since these were known to have both a parasympathetic and sympathetic nerve supply. Indeed, most of the transmitter substance in salivary gland seems to reside in the nerves in the gland (I. Nordenfelt, University of Lund). This autonomic nerve supply apparently regulates a

variety of processes in the glands, and the mechanisms of control are still not well understood. For example, secretion of saliva is certainly controlled by the autonomic nerves; yet in some glands secretion occurs spontaneously, even in the presence of autonomic blocking agents. This aspect was discussed by N. Emmelin (University of Lund) and compared with secretion after denervation. Glands which do not ordinarily secrete in the absence of nerve stimulation become sensitized after denervation and secrete (paralytic secretion) whenever the level of catecholamines becomes elevated in the blood. However, these glands may also secrete in response to an increased leakage of acetylcholine from degenerating nerve fibers (degeneration secretion) which endures for some time after postganglionic, parasympathetic denervation. The development of sensitivity in the gland after denervation is quite enigmatic.

The autonomic nerve supply also regulates the blood flow to the glands. This flow is adjusted to the level of secretory activity. Some investigators have concluded that vasomotor control in the glands is not directly attributable to the nerves. M. Schachter (University of Alberta) disputes this. He has shown that the proteolytic enzyme, kallikrein, which has been implicated in vasomotor control, does not produce effects which duplicate the rapid adjustments in blood flow normally observed when stimulation to a gland is started or stopped.

A significant function of the autonomic innervation which is currently receiving wide attention involves regulation of the morphological and functional status of the gland and even regulation of its postnatal growth and differentiation. C. Schneyer and H. D. Hall (University of Alabama Medical Center) and H. Wells (Harvard School of Dental Medicine) discussed the controversial role of gland activity as distinct from trophic nervous influences in this function. Both groups of investigators find that the level of secretory activity induced by nerve stimulation is an important regulatory factor in maintaining normal growth and function. However, they are less certain of the role of trophic factors not related to the secretory activity. Cellular mechanisms of regulation of normal growth and morphology are even less easily understood. Wells suggested a possible role of cyclic adenosine monophosphate; G. Seifert (University of Ham-

burg) proposed a connection between β receptors and DNA synthesis, for sympathetically induced effects.

Biochemical differentiation was discussed by R. Kulka (Hebrew University of Jerusalem), W. Rutter, P. J. Keller, L. M. Sreebny (University of Washington), and L. C. U. Junqueira (University of Sao Paulo). Kulka finds that differentiation, with regard to formation of digestive enzymes by embryonic chick pancreas, occurs in separable phases. Surprisingly, secretion of the differentiating enzymes could be obtained in vitro from embryonic pancreas even before the later differentiation stage was complete.

Several interesting new hormonal relationships were presented. Shannon (USAF School of Aerospace Medicine, Texas) suggested that in some circumstances steroid levels in saliva can be pathognomic; Kraintz (University of British Columbia) reported a paradoxical increase in calcium of submaxillary saliva and gland, in rat, after parathyroidectomy.

Attendance at the conference was by invitation and was limited to 30 participants. The papers and discussion will be edited by Leon H. Schneyer and Charlotte A. Schneyer and published by Academic Press as a book entitled *Mechanisms of Salivary Secretion and Their Regulation.*

This was the second international conference to be devoted to aspects of salivary secretion and like the first, 4 years before in Seattle, was supported by the National Institute of Dental Research.

LEON H. SCHNEYER
Department of Physiology and Biophysics, University of Alabama Medical Center, Birmingham

Forthcoming Events

January

23–25. **Aerospace Science**, 5th mtg., American Inst. of Aeronautics and Astronautics, New York, N.Y. (Manager of Public Information, AIAA, 1290 Sixth Ave., New York 10019)

23–25. Society of **Thoracic Surgeons**, mtg., Kansas City, Mo. (F. X. Byron, Society of Thoracic Surgeons, City of Hope Medical Center, 1500 E. Duarte Rd., Duarte, Calif. 91010)

23–27. **Relativistic Astrophysics**, symp., New York, N.Y. (A. G. W. Cameron, Belfer Graduate School of Science, Yeshiva Univ., New York 10033)

24–27. **Comparative Pharmacology**, in-