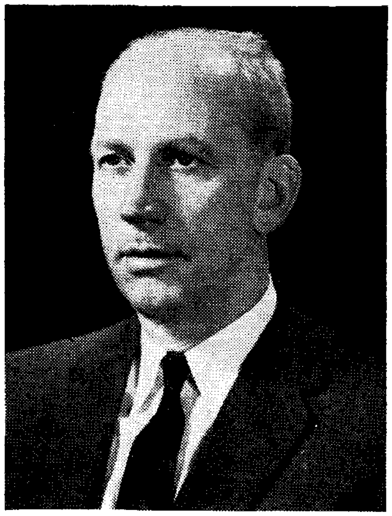
PERSONALITY PORTRAIT—XIX

ACHELESS TOOTH PROPHET

Professor Roy Orval Greep Says Decay Is Preventable



—*Harvard News Office.*

ALTHOUGH American dentists are the best in the world, nearly all Americans have tooth trouble. As the population increases, and a higher percentage of the people seek dental care, it will become more difficult to make a date with a dentist. The colleges cannot produce enough of them. The alternative to increasing the number of dentists is to improve the quality of dentistry, and this is the goal of Dr. Roy Orval Greep.

Dr. Greep is a member of a long list of professional and scientific societies, chairman of the Committee on Dentistry of the Division of Medical Sciences of the National Research Council, and editor of one of the nation's leading scientific journals—*Endocrinology*. He never expected to become a dentist, and has never practised dentistry. He is dean, nevertheless, of the Harvard School of Dental Medicine.

Now in his early fifties, a father of three, Dr. Greep is a tall, blond man who speaks slowly and diffidently. New friends are surprised by his wry sense of humor; old friends respect him for his scholarly research—and also recall the near-beer that he spiked at a graduate-student picnic. He writes on such topics as "the morphological autonomy of the zona glomerulosa of the adrenal cortex in the rhesus monkey," but could easily be mistaken by the panelists on "What's My Line" for a Kansas farmer.

His unplanned academic career began in a one-room country schoolhouse near Badger Creek, eighteen miles north of Abilene, Kansas. He is now an honorary fellow of the Obstetrical Society of Boston, but he was born in a farmhouse at Longford without obstetrical aid. His schooling was interrupted for three years by farm work. He was captain of a basketball team that terrorized its territory while he was in high school, and his teachers encouraged him to think of becoming a newspaperman.

Now he is doing work which the newspapers have trouble interpreting. It includes, for example, studies of the action of hormones in vertebrates. A growth hormone taken from the pituitary glands of cattle will induce growth in various animals, but not in man. Thousands of tiny glands from monkeys that were being used to produce polio vaccine recently became available. Dr. Greep and his associates took growth hormone from these glands. They injected this into monkeys whose growth had been interrupted and the monkeys began to grow again. This inspired others to see what could be done with growth hormone from monkey and human sources in man.

What does this have to do with teeth? Maybe nothing. No one knows. But the growth of teeth is a phase of the growth of the human body, and better understanding of the phenomenon of growth could help to explain how teeth grow.

In any event, Dr. Greep is professor of anatomy at the Harvard Medical School in addition to being dean of Dental Medicine. He is not just interested in teeth. In this respect he is merely continuing the study of glands and secretions which he began in a general science course at Kansas State College. And he is still as fascinated by the subject as he was when, as an undergraduate assistant in zoology, he cheerfully hauled tubs of cow urine from the college farm to the chemistry laboratory.

At the University of Wisconsin (where he earned his master's degree and doctorate) Roy Greep mastered the surgical skill necessary to remove the pituitary gland from a rat. He went on to Harvard with a team of scientists who were studying pituitary substance. After serving as a research assistant and instructor in zoology there, he became an associate in pharmacology at the Squibb Institute for Medical Research in New Brunswick, New Jersey, in 1938, continuing his work in endocrinology.

Dr. Greep took the pituitary glands out of about 20,000 rats during those years—and one of those rats led him into the ranks of dental educators.

To hold each rat's head in place for the surgery, he usually put a rubber band around his operating board and inserted it into the rat's mouth. The band kept slipping out of one rat's mouth. Dr. Greep peered into this rat's mouth. It had no teeth. So he saved this rat, bred it, and produced a strain of toothless rats.

This intensified his curiosity about the way that the body forms such intricate and difficult-to-replace parts as teeth. Although often regarded as though they were inanimate objects, the teeth are unique and challenging biological structures. There are no cells, nerves or blood vessels where decay begins. The dynamic and metabolic relationships between the teeth and the rest of the body still are not well understood. The toothless rat prompted Dr. Greep to think a great deal about the mysteries in the oral cavity.

ABOUT that same time, President James Bryant Conant of Harvard was taking a hard look at the dental profession. He noted that it was a medical specialty which could be entered without first studying medicine, that more basic research regarding dentistry was needed, and that few dentists were qualified to tackle such problems as Dr. Greep and others had encountered.

Dr. Conant concluded that it was futile merely to go on trying to train enough men to fill the cavities, build bridges, and otherwise compensate for the deterioration of people's teeth. So, in 1940, he shocked alumni and leaders of the dental profession by closing the Harvard Dental School and dismissing most of its staff.

To replace it, Dr. Conant created a School of Dental Medicine which was clearly a satellite of the Harvard Medical School. To enter this school, a young man had to be fully qualified for admission to the medical school and also have the special qualities needed for proficiency in dentistry. There was seldom a full class. Nevertheless, Harvard recruited during those years a faculty of men who were interested in increasing knowledge of the teeth, as well as in repairing them, and in evaluating such knowledge and applying it to the treatment of patients.

This faculty is now nearly as large as the student body. Dr. Greep joined it as an assistant professor in 1944, and also became a teaching fellow in anatomy and lecturer in endocrinology in the Harvard Medical School. He became a professor in 1949, and was made dean three years later.

On one floor of his school, Dean Greep can show you the usual rows of spotless dental chairs for clinical practice, and all of the latest tools of the practitioner. On another floor, you will find an electron microscope and the radiation counters and shielding needed for work with radioactive isotopes. Here, too, you will find room after room full of rats, hamsters, baby chicks and rhesus monkeys.

You may see students operating on animals which seldom have toothaches. You may also see a stack of cages of rodents called gerbils, that are especially subject to periodontal disease. You may even be taken into one tiny, tidy operating room and shown the only chair in the world that was especially tailored and built for dental work on monkeys.

"We are on hard ground," Dean Greep is likely to explain while showing a visitor these facilities. "We are on the biochemical, physiological, anatomical levels, looking at basic structure and bacterial effects in the oral cavity.

"We must understand what causes the diseases to which our teeth and their supporting tissues fall prey if the diseases are to be prevented. It is this philosophy of prevention that is followed today in essentially every avenue of public health.

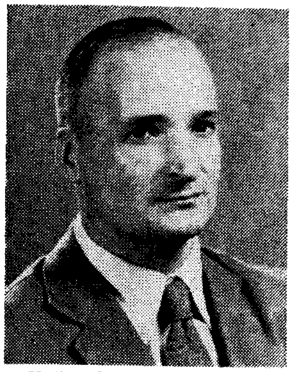
"It has become increasingly evident that tooth restoration alone is an inadequate measure. The answer to the dental problem still clearly lies in prevention."

The medical profession's leaders in its recent period of rapid development were men in strategic centers of learning, who were familiar with the problems of caring for patients, research and teaching. Under Dean Greep's leadership, Harvard is striving to produce similar leaders for the dental profession and to create an equally favorable environment for them. This fall a three-year postdoctoral study program is being launched to prepare young dental graduates for careers in academic dentistry.

Research of the sort that Dr. Greep, his faculty and his students have undertaken may not only reduce the frequency of our trips to the dentist's office but also add to the pool of knowledge from which our physicians are benefitting. The inadequacies of that pool led Dr. Greep to his post in Boston—and possibly account for many of our toothaches.

—VOLTA TORREY.

THE RESEARCH FRONTIER



—*National Bureau of Standards (Boulder).*

WHERE IS SCIENCE TAKING US? *To escape Earth's atmosphere and free himself to explore the neighboring planets, man must travel at speeds beyond even remote approximation in his past experience. What happens at such speeds he can do no better than guess, and his closest guesses must come from watching streaks of light in the sky at night. Only meteors hurtle the empty vastness future spaceships will traverse. Can man copy, or perhaps improve upon, their durable characteristics? On this almost limitless frontier of research the Smithsonian Institution, with financial help from the National Science Foundation, has assembled scientists from many disciplines. The result is the new science of astroballistics.*

RICHARD N. THOMAS
(National Bureau of Standards, Boulder, Colorado.)

The motion of planets and planetoids has been for years a conventional part of study in astronomy. However, we can hardly claim a satisfactory knowledge of our planetary system until we can also specify the properties of those objects so small that they cannot be observed individually. In general, our information on these objects is wholly statistical, coming from such studies as their collective scattering effect on sunlight. One notable exception is the study of meteors; for these, the earth serves as a sampling box, sweeping up the interplanetary material, with the earth's atmosphere fluorescing in response to the entrance of each meteor.

If we completely understood all the processes that occur when a solid object moves through a gaseous atmosphere, we would have a fine method for inferring the corresponding properties of each meteor observed. We do not yet have such an understanding, however, and the science of astroballistics has arisen from our attempts to remedy this lack.

Astroballistics was conceived on the common borders of astronomy, aerodynamics, ballistics, and chemical reaction-kinetics (speed at which chemical reactions occur). Its multiple origin exhibits the trend which is changing astronomy from a wholly observational and theoretical science to one demanding extensive laboratory investigations.

Astroballistics considers the meteor only as a solid object moving through a gaseous atmosphere. When a solid moves through a gas, several things may happen. The solid loses momentum to the gas and is decelerated. The amount of deceleration depends critically upon the mass, shape, and velocity of the body, and upon the composition and thermodynamic state of the gas. The solid loses energy as it decelerates, and the energy contributes heat to both body and gas. The partition of heat between the two depends critically upon the velocity, shape, composition, surface structure, and thermodynamic state of the body, and upon the composition and thermodynamic state of the gas. The heat transfer to the solid may result in thermal radiation and ablation (either by melting or by vaporization) from the surface, as well as in a simple temperature rise throughout the interior. The heat transfer to the gas may result in excitation and ionization, and thus in radiation, if the temperature rises sufficiently. Moreover, the material ablated from the solid may interact chemically with the gaseous atmosphere.

The astronomer can make at least three types of measures on a meteor moving through the atmosphere: (1) He can measure directly time and position, and so obtain velocity and deceleration: (2) he can measure the total radiation, and possibly its spectral distribution; and (3) by radar, he can infer the ionization produced by the meteor. Ideally, he would like to have available a set of tables which he could enter with these data, and so read off the physical characteristics of a single body which alone could have produced such a disturbance. At worst, he might expect to obtain a range of such bodies, and this range would represent his uncertainty of the properties of the particular meteor observed. These properties he could compare with those rare meteors which have survived passage through the atmosphere, and been recovered as meteorites.

Unfortunately, when we attempt to prepare such a set of tables, we find a disheartening situation. Meteors impact on the earth's outer atmosphere at speeds ranging between 10 and 75 kilometers (6.25 and 40.6 miles) per second. Only during the war did the aerodynamicist develop a keen interest in speeds as high as that of sound, about ⅓ km per sec. While the ballistician customarily dealt with speeds several times that of sound, his empirical investigations were limited by his accelerating devices. The experimental investigations reported in the unclassified literature do not deal with objects of known geometry whose speed exceeds about 2 km per sec. Ballistic and aerodynamic studies of objects moving at such high speeds that ablation occurs are virtually nonexistent. From a theoretical standpoint, the situation is equally bad. The study of the aerodynamic flow pattern about a body that is losing mass at its leading surface has hardly been discussed. When we consider the data available on excitation and ionization caused by the ablated material ejected into the gaseous atmosphere, we find the bleakest situation of all.

To categorize and collate the variety of problems just described, the science of astroballistics developed. Its province includes the study of those phenomena arising out of the motion of a solid through a gas at such speeds that ablation occurs. A certain amount of development of new launching devices and considerable improvement of the old, plus the use of low melting-point materials, together have made it possible to simulate ablation from meteors. Newly developed free-flight firing ranges permit studies under varying conditions of the atmosphere through which the solid moves. Advances in high-speed photography allow us to make inferences of the spectral distribution of luminosity along the axis and trail of an artificial meteor, which we have been able to accelerate up to speeds of 6 km per sec. These first spectral observations, though crude, demonstrate that it is possible to observe details of the chemical reactions involving ablated material and atmospheric atoms. Observations of actual meteors have never provided such data. Thus we have an approach to an aerodynamic flow problem of exciting possibilities.