

## F. GAYNOR EVANS—A SHORT BIOGRAPHY

ANDRUS VIIDIK

Department of Anatomy, University of Aarhus,  
DK-8000 Aarhus C, Denmark

Francis Gaynor Evans was born on 7 December, 1907 in Le Mars, Iowa. His father came from Georgia, while his mother was from an Iowan family, the ancestors having arrived in Plymouth, Massachusetts in 1622. The name Gaynor is Irish in origin, and stems from his mother's family, while Evans, a Welsh name, stems from the paternal side of the family.

He attended Coe College in Cedar Rapids, Iowa, and in 1931 received his Bachelor's degree in Zoology. He continued his education at Columbia University (New York, NY), where he received his Master's degree in 1932 and his Doctorate (Ph.D.) in 1939 (both in Zoology). He worked with William K. Gregory, who in addition to being the head of Vertebrate Zoology at Columbia was also Curator of Comparative and Human Anatomy at the American Museum of Natural History. His first paper (together with Gregory) was on 'Williston's Law' and dealt with the evolution of skull bones in the vertebrates. The subsequent scientific publications also involved comparative aspects of the skeletal system.

He was Lecturer in Zoology at Columbia 1935–1937 and also taught comparative anatomy in the Evening Extension Program at the College of the City of New York. In the summers of 1935 and 1936 he served as Chief Biologist on the Rainbow Bridge-Monument Valley Expeditions in Arizona and Utah, collecting small mammals, reptiles and amphibians for the American Museum of Natural History in New York City (and was subsequently, in 1937, elected member of The Explorers Club).

For three terms (1931–32, 1933–34 and 1935–36) he was Lydia C. Roberts Fellow at Columbia University and in 1938 the New York Academy of Sciences awarded him the A. Cressy Morrison Prize in Natural Science for his Ph.D. Thesis 'The morphology and functional evolution of the atlas-axis complex from fish to mammals'.

In 1938 he left New York City for Durham, New Hampshire, to assume a position as Instructor of Zoology and to teach human anatomy and comparative anatomy for three years at the University of New Hampshire. Then followed two years in Durham, North Carolina, as Instructor of Zoology at Duke University, where he taught comparative anatomy and general zoology. In 1943 he moved to Baltimore and the Medical School of the University of Maryland to take a position as Assistant Professor and to teach gross anatomy. His interest in comparative osteology

continued, with functional aspects added.

Two years later (1945) he left Maryland for Michigan, where he was to spend the longest and most recent part of his university career. First he went to the College of Medicine at Wayne State University in Detroit and advanced from Assistant Professor to Professor in charge of Gross Anatomy. Here he established a long-lasting and fruitful collaboration with Herbert R. Lissner of the Department of Engineering Mechanics. Their first joint paper dealt with studies on 'stresscoat' deformation of the femur under static vertical loading. These studies were expanded to dynamic loading, regional differences in bones, various loading conditions and bone orientations as well as fracture mechanisms and tensile loading. This work was later summarized in his classic book *Stress and Strain in Bones* (1957). He went in the academic year 1956–1957 to Italy as a Fulbright Fellow (Research scholar A) and worked in the laboratory of Rudolfo Amprino (Department of Anatomy) at the University of Bari.

At Wayne State University he served on several committees at the College of Medicine. While in Detroit he wrote *A Laboratory Manual for Human Gross Anatomy* (1950) and an *Atlas of Human Anatomy, Simplified* (1957) as well as teaching art anatomy by lecture demonstration courses with the living model to students in painting and sculpture at the Cranbrook Academy of Art (Bloomfield Hills, MI).

In 1959 he accepted the invitation to take up a position as Professor of Anatomy at The University of Michigan Medical School in Ann Arbor. From 1967 to 1973 he also served as Research Professor of Anatomy in the Department of Biomechanics at the University of Michigan Highway Safety Research Institute. He continued his research on bone biomechanics, diversifying into a number of approaches and techniques. It is impossible to describe in detail his research achievements (the development of a substantial part of the science of bone biomechanics, and collecting and analyzing a wealth of important data in this field) within the limited space available here. This account will, therefore, be limited to indicating the research areas. The reader is referred to his second classical book, *Mechanical Properties of Bone* (1973), for a detailed discussion of the field. The articles in this issue further reflect aspects of his impact on the science of biomechanics. His bibliography is printed elsewhere in this issue.

The earlier part of this set of research programs put emphasis on experimental stress-strain analyses of intact human bones (mostly long bones, pelvis, vertebral column and skull) within and out of the human body, using materials testing machines, strain sensitive lacquers ('stresscoat'), electric strain gauges, extensometers, accelerometers, oscilloscopes and high-speed motion picture cameras. Other series of experiments dealt with impact studies (not only tolerance and energy absorption but also influence on intra-cranial pressure and damage to internal organs). Later, the properties of cortical bone tissue (in contrast to whole bones) were studied, using standardized test specimens of human compact and spongy bone (the methods used in the testing of structural engineering materials modified and the influence of various experimental conditions on the biological specimens analyzed). These studies included analyses of gender and age differences as well as differences between tensile, compressive and shear modes of loading, variations with changing orientations of specimen sampling from the bone (also influence of the histological structure, e.g. collagen fiber orientation), influence of speed of loading and fatigue patterns at repetitive loading. Further, the histological components of cross-sections of the test specimens, as close as possible to the fracture site, were studied by polarized light microscopy, scanning electron microscopy and by radiology. These data were correlated to the mechanical properties recorded and analyzed. Variables influencing the mechanical properties of human bone were also investigated and analyzed as were the correlations between the mechanical properties of bone and fracture mechanisms. A recent part of his research programs included soft tissues, the examination of histological changes in the content of the carpal tunnel with reference to biomechanical implications.

The Swedish Ministry of Education invited him as Visiting Professor of Anatomy and he worked most of the academic year of 1962-63 at the University of Göteborg in the laboratories of Carl Hirsch (Department of Orthopaedic Surgery) and Bo Eric Ingelmark (Institute of Anatomy) but briefly also at the University of Lund (Departments of Anatomy and Orthopaedic Surgery). In 1968 he spent the autumn months as Visiting Professor of Anatomy at the Kyoto Prefectural University of Medicine in Japan, where he edited Hiroshi Yamada's *Strength of Biological Materials* for publication in English (supported by an N.I.H. grant). The international character of his research activities is further illustrated by the 72 invitations (lectures, seminars, papers) he received from 48 different organizations in seven different countries, and by his laboratory log for an 11 year period showing visits of 46 scientists from 16 different countries.

His research in bone biomechanics, started at Wayne State University and continued at the University of Michigan, was supported continuously for 30 years by the National Institutes of Health:

'Physical properties and biomechanical behavior of bones' (1949-1959), 'The effect of acceleration on the human skeleton' (1959-1964), and 'Structure and physical properties of bone' (1959-1978). His research was also supported by research contracts from the Air Force, 'The mechanical strength of the human body' (1952-1955) and Ford Motor Company, 'Crash injury research' (1955-1956, 1959-1962) as well as a University of Michigan Faculty Research Grant 'The relation between bone displacement, as revealed by holography, and its microscopic structure'.

From 1961 to 1971 he served as editor for the American Lectures in Anatomy Series, published by Charles C. Thomas (Springfield, IL). In 1967 Verne L. Roberts (then at the Highway Safety Research Institute) and he founded the *Journal of Biomechanics*. He served as its Co-Editor-in-Chief until 1980, when he became Editor Emeritus. During this period of time the Journal expanded from 353 pages published in four issues to 950 larger size pages divided into twelve issues.

Although being more inclined to work in his research laboratory than to attend committee meetings, he served on the Health Sciences Divisional Research Committee and General Committee Division of Biological Sciences as well as a number of doctoral committees at the Horace H. Rackham School of Graduate Studies and the Bioengineering Advisory Committee at the College of Engineering apart from several committees at his Department of Anatomy. He also served on committees of a number of professional societies. His early enthusiasm for teaching, as evidenced by the two books written for students, in later years evolved into a silent agreement between himself and his students in gross anatomy dissection classes: 'If you do not disturb me [being busy with research], I will leave you alone'. As a lecturer he remained engaging and stimulating; a number of his students went into orthopaedics and sports medicine.

The scope of his wide field of interests is reflected in a partial list of his professional society memberships: the American Associations of Anatomists, Automotive Medicine (honorary member) and Physical Anthropologists, the American Physiological Society, the American Society of Biomechanics (co-founder and its first president), the Orthopaedic Research Society (Senior member) and the Society of Vertebrate Paleontology (charter member). Another part of this list demonstrates the international scope: Association des Anatomistes (France), Biological Engineering Society (United Kingdom), Biomeca (France, charter member), The Royal Society of Medicine (United Kingdom) and Academia Medicina di Roma (Italy).

He became Professor Emeritus on 1 January, 1977 but stayed on as Consultant in the Department of Anatomy 1977-1978. The highest award of the Bioengineering Division of the American Society of Mechanical Engineers, the 'H. R. Lissner Award for Outstanding Contribution in Biomedical Engineering', was awarded to him in 1980. The same

year he received the Founder's Medal, the highest alumnus award of his alma mater, Coe College.

He lives now together with his wife of 49 years, Harriet Elizabeth Terry, and enjoys his walks with Jenny, their current purebred Welsh terrier, in Irvington, VA, a few miles from the Rappahannock and Chesapeake estuaries. Having been an ardent traveller all his life (his log contains visits to 35 different countries, to a number of them more than once and including off the beaten track places like the Galápagos Islands) he has not lost that habit after retiring from the University of Michigan. In 1981 he went to Kenya, in 1982 to China and Japan and last year he visited a number of Central American countries. He has always travelled pursuing his interest in animal life, which he has had since his days at Columbia University. The sights of his hunting 'weapons' have always been cameras (for many years his beloved Zeiss Contax, now a modern Japanese 'marvel'). He is a member of the World Wildlife Fund – U.S.A.. The other members of the local community enjoy his activities, which include contributions to the local newspaper and lectures on his world-wide travels.

It is difficult to describe Gaynor Evans with any

standard stereotype. A modest man with nothing to be modest about he treats the most junior person in the research environment as his equal, gently but firmly correcting mistakes. His peers never had anything to feel uneasy about; his principle of peaceful coexistence is as strong as his conviction of using nothing more violent than the camera when studying wild-life. It is difficult to perceive that he could ever have had an enemy. He shows his profound knowledge (be it biomechanics, anthropology, comparative zoology, travel to exotic places or whatever) with gentle narratives or of-the-cuff remarks, spiced with low-key humor. He is one of the rare persons, who do not age perceptibly through the years: his walk is perhaps a little bit slower now, his hair has a slight touch of gray, and his handwriting (which was not too easy to decipher 25 years ago) is slightly less legible than then. Otherwise he has not changed during the 26 years it has been the privilege of this 'biographer' to know him. He remains a true scholar, a dependable friend to his friends, and has every qualification for being called 'a jolly good fellow', when he celebrates his 80th birthday and we wish him many more active years.