THE FACULTY OF MEDICINE
Harvard University

Donald Ian Hay

Photograph courtesy of Anne C.R. Tanner

Donald (Don) Ian Hay was born in 1933 in Peterborough, United Kingdom and died on July 10, 2016 at the age of 82 after a series of illnesses over the last several years of his life. He was Professor, emeritus, at Harvard School of Dental Medicine as well as Senior Member of the Staff, emeritus, and former Interim President of the Forsyth Dental Center. With Don's passing we lost a long-time colleague, an eminent salivary biochemist, a lover of the great outdoors, and a good friend.

Educational/Appointments:

Don's education began at the King's school - Peterborough and continued at London University, UK, where he was conferred the Bachelor's degree in 1959 and the PhD in biochemistry in 1972. Following six years as a research scientist at Unilever Ltd., in Bedford, England, and one year at Liverpool University, he was apprised of research opportunities on this side of the Atlantic by his good friend, Irving Shapiro. Soon he was recruited to Boston's Forsyth Dental Center (now Forsyth Institute) in 1965 by Department of Chemistry Head Finn Brudevold as an Assistant Member of the Staff. He joined a nexus of bright, young investigators that were responsible for the emergence of top-level oral science at this institution. Forsyth was indeed fortunate that Don chose to remain in the Forsyth/Harvard sphere for his entire professional career. At Forsyth his scientific contributions, together with his success in the grant domain, resulted in promotions to Associate Member of the Staff (1972) and Senior Member of the Staff in 1979. At Harvard his research excellence, combined with teaching/mentoring was recognized by appointment as Associate Clinical Professor of Oral Biology/Pathophysiology at Harvard School of Dental Medicine in 1983. Further acknowledging his eminence in the salivary research arena as well as his leadership of Forsyth as interim President, Harvard promoted Don to full Professor of Oral Biology in 1997.

Scientific Contributions:

Don's scientific achievements centered on an understanding of the significance of saliva and its constituents on salivary function and homeostasis in the oral environment. His early investigations explored the effect of degraded salivary components on the dietary requirements of oral flora. These studies evolved into broader questions surrounding the biochemistry/physical chemistry of saliva, salivary

protein enumeration and functional analysis, and the potential roles that salivary proteins play in the selective attachment of oral microflora to the tooth surface and the resulting consequences for health and disease. To help answer these questions Don spent much of his early career identifying, isolating and exploring the function of proline-, tyrosine- and histidine-rich acidic proteins. Later he and his collaborators continued to lead the way in resolving the structures of these important proteins and their polymorphisms, establishing bases for their structure/functional behaviors in saliva.

One of the early observations by saliva investigators was that saliva is supersaturated with respect to calcium phosphate which forms tooth enamel. This condition is thought to enable the tooth surface enamel to remineralize after daily demineralization events. Why this was the case was a puzzle. Don and his collaborator Edgard Moreno studied the precipitation kinetics of salivary calcium phosphate in solutions containing purified salivary acidic proteins, finding that several of them modified the precipitation behavior to different degrees. One of the proteins that Don had discovered, statherin, a highly polar tyrosine-rich peptide, was shown to be unique in its ability to inhibit primary precipitation of calcium phosphates under physiological conditions. Don and David Schlesinger from Harvard Medical School went on to sequence this important protein. These studies revealed the importance of acidic salivary proteins in providing a protective environment for the teeth.

Don also gave his attention to the role of salivary proteins in bacterial aggregation and their selective adherence to oral surfaces. He had previously demonstrated that salivary proteins had a high affinity for tooth enamel structures, thus helping to form the salivary pellicle, a proteinaceous covering of the tooth surface. Working with Ronald Gibbons at Forsyth, he showed that these salivary proteins were critical to the initial attachment of bacteria to dental materials. The melding of Hay's biochemical experience with salivary dynamics and Gibbon's background in oral microbiology resulted in a series of important studies exploring the binding affinities of salivary protein receptors with several bacteria known to initially colonize the dental pellicle. These studies showed a clear specificity in salivary protein-bacterial interactions. He and Gibbons further proposed that the initial binding of salivary proteins in the pellicle exposed bacterial receptors not found when these proteins were solution, thus providing a landing site for bacterial binding to adsorbed protein, rather than when free in saliva. Don and his group later expanded these studies to show bacterial strain specificity in adhesion to individual salivary proteins and described the underlying biochemical basis for several oral bacterial-salivary protein interactions. Collectively, this work was foundational in developing the concept of selective bacterial adherence to biological surfaces and informs our understanding of the development of the oral biofilm.

Administration:
Don played important roles in the administration of Forsyth. His personal grant administration brought Forsyth millions in grant support. He was the founding head of the Department of Biochemistry (later Bioadhesion) and continued in that position until his retirement in 1999. In the 1990's Forsyth found itself in need of a stable and knowledgeable interim Director as it sought leadership into the new century. Don was that man, first as Associate Director of the Institute for Research from 1991-1999, then as interim President of the Center (1996-1997). In that role he brought his long experience working in Forsyth's Research Division and with the Forsyth School for Dental Hygiene to bear on several thorny issues that needed a steady, thoughtful hand. During his tenure as interim President he encouraged Forsyth's initial NRSA Institutional Postdoctoral Research Training Grant from NIH, a program that has continued at Forsyth into the 2020's. The NIH(NIDR) funded Boston Oral Health Clinical Resource Center was inaugurated during Don's Presidency. Hay also oversaw several major construction projects including a complete rebuilding of its core research space as well as renovation of the 4th floor tower to

house the newly established Harvard/Forsyth Department of Oral Biology, chaired by Dr. Bjorn Olsen.

Many awards and honors were accorded Dr. Hay during his career. He was elected a Fellow in the Royal Society of Chemistry in 1974. NIH(NIDR) acknowledged his outstanding salivary research excellence in 1987 with a MERIT award in order to continue long-term support for his program. Later he was elected Fellow of the American Association for the Advancement of Science in 1990 and conferred a Distinguished Science Award by the International Association of Dental in 1997.

Personal comments:
Next to his love for chemistry and his family, Don sought the outdoors for exercise and regeneration. If there was snow on the ground, he would likely be cross-country skiing. Otherwise he could be found hiking in New England, scrambling up rugged terrain in the Rockies or the Andes, or climbing the "Bens" of Scotland. Don's son Ian reflected that steadiness, self-control and strength characterized his father. "I think rock-climbing hardens a person up and then they are not easily shaken", said Ian. Don's early interest in computers was reflected in his membership in the Boston Computer Society. Although Don seldom passed up a dessert, his daily five-mile walk before work kept him trim. For a quarter of a century his walk would be followed by carpooling to Forsyth with capable and loyal research associate, Susan Schluckebier, with whom he published many papers, and fellow Forsythian, Dan Smith. Don also welcomed students and visiting scientists into his group, sharing his wit, wisdom and extraordinarily well-equipped laboratory. That he published with well over fifty colleagues speaks not only to his value as a scientist but also to his collegiality. He is missed.

Survivors:
Don is survived by his son Ian Michael Hay, but predeceased by his wife Valerie Butterworth. He is also survived by his siblings John Brian Hay and Lesley Hay, Judith Hay La Frentz and Robert John La Frentz, and sister-in-law Yvonne Hay and their children. Don is also survived by his partner Anne CR Tanner, her son Brian Worthington, his wife Kara and their children.

Respectfully submitted,
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Anne C. R. Tanner, BDS, PhD
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