LIFE HISTORIES OF HONORARY IHSS MEMBERS

MICHAEL H. B. HAYES

Michael Hilary (Bermingham) Hayes was born on January 14, 1930, in Lisbawn, Kilmihil, Co. Clare, Ireland. His family (on his mother's and father's side) had been farmers for as long as could be traced. Michael received his early education in a local, rural National School. Instruction at that time was in Gaelic. At 12 Michael was taken for secondary schooling to Dublin. The school was host to persons who became presidents and many great authors. The vast number of excellent pupils meant that MH's secondary school days were more memorable for his extracurricular activities than for any academic excellence. He satisfied the entrance requirements to College at 16 but was too young to enroll.

Because the Hayes area in Co. Clare had a mixture of mineral soils and peatlands, and because the peatlands were not productive agriculturally, it was from the age of 8 the ambition of Michael to 'make the bogs bloom.' Thus, the subject of Soil Science was his major reason for enrolling in the Faculty of Agriculture of University College Dublin. However, the amount of instruction he could obtain in Soil Science at the time was about the equivalent of a Soils I course in a Land Grant College in the USA. But, none the less he greatly enjoyed his undergraduate career, and especially his involvements with Gaelic Football, Track and Field, and with the Agricultural Science Society and its debates and fund raising (for field trips) social activities.

In 1950 a visit to Dublin of the Cornell and Princeton track team opened Michael's eyes to Agriculture at Cornell. Then after graduation when a library search alerted him to an Organic Soils Group in the Agronomy Department of Cornell, led by Dr. Jeffrey Dawson, the dye was cast. There was also a very attractive entry about Organic Soils led by Dr. Rouse Farnham of Minnesota. But when the legendary Dr. Richard Bradfield offered an assistantship to work with Dr. Dawson at Cornell, he knew where his destiny lay.

In the Summer of 1952 MH happened by chance to be in University College Dublin when the International Peat Society Symposium was taking place. He was not aware of the Society, or

of its interests, and so he saw this meeting as an opportunity to find out about peat science. He attended a lecture given by a dark haired, hugely enthusiastic young German who spoke of phenols and quinones, and of their contributions to the genesis of humic substances. The young German was Wolfgang Flaig whose interests and enthusiasm continued to be inspirational. About six years later Michael learned much more in a day with Wolfgang at Ohio State, and at a time when he was better prepared to understand the Organic Chemistry. About the same time (at OSU) he met the charismatic Jack Bremner whose concepts of SOM solubilization had 'sown seeds 'of interest' in humic isolations and fractionation.

At Cornell in 1953, Michael met Ed Clapp who already was a student of Jeffrey Dawson. He and Ed became close friends, and the friendship and collaboration born then has endured the tests of time. Ed was also from a farm background, and knew all about making hay and milking cows, and as well Ed had run cross country and competed in track at U. Mass, while Michael ran and threw in Dublin. Michael persisted with his involvement with Gaelic Football in New York, and he represented Cornell at rugby football (not a varsity sport and so graduates could take part).

In 1956, Dr. Jim Mortensen offered Michael an assistantship to replace Gunther Stotsky (who had replaced Frank Stevenson) at Ohio State. Some of the leisure activities at Cornell (which may have exceeded at times the quota for a dedicated student) were replaced by more intensive academic pursuits at OSU. In the period of intensive study and research at OSU, Michael had taken course work to meet requirements for a PhD in Organic Chemistry and possibly for Biochemistry. He had been fascinated by the Waksman concept of humic acid as a 'ligno/casein' complex, and the words of Jeff Dawson kept ringing in his ears 'no one has ever isolated a protein from soil.' And so, as a sideline to his major research project (Subsidence and Humification in Peats) he made an oxidized lignin/casein complex following the procedure of Waksman and Iyer. The signals obtained from DTA were composites of those from the oxidized lignin and casein, and totally different from that for humic acids from peats. That influenced his search for an understanding of the compositions/structures/reactivities of humic substances.

Professor Maurice Stacey, FRS, a world leader then in the field of Carbohydrate Chemistry, of the Chemistry Department of the University of Birmingham gave a series of seminars in the Chemistry Department of Ohio State in 1959. Michael had just taken the M.L. Wolfrom (another of the World's great Carbohydrate Chemists) course on Carbohydrate Chemistry, and he saw how techniques outlined by Maurice Stacey could have applications for studies of Soil Polysaccharides. Ed Clapp had alerted Michael to interests in Soil Polysaccharides,

and for his PhD at Cornell Ed had completed a study of Soil Saccharides that was outstanding, and unique at a time before GC had arrived as an analytical tool.

Maurice Stacey offered Michael an ICI Fellowship in his Chemistry Department in Birmingham. For many then an ICI Fellowship was comparable to a tenure track position in the US. Michael came to England with a view of staying for two years. After that he hoped to return to Ireland to continue his 'dream', or to return to the US, a land and a people he had grown to love, and to pursue his academic dreams there. But, in any case Birmingham had cast its spell. He was with colleagues who were willing to share knowledge and equipment, and to help when asked. Many of these colleagues were 'household names' in courses in Chemistry at OSU, and in particular the Colloid Chemists, Carbohydrate Chemists, and Analytical Scientists such as Gilbert, Peaker, Stacey, Foster, Barker, Belcher.

In addition, the University had excellent facilities for track, but little organisation for the sport. In the 1960 to 1998 period 70 international athletes were Birmingham graduates and about half of these were Olympians, and some were members of the Research Teams of Michael. In 1980 Michael was appointed to the Presidency of Lake Hall, where the 1984 IHSS Conference was based, and he greatly enjoyed that position for 17 years. Ed Clapp joined him as a member of the Senior Common Room during his sabbatical in 1988.

MH had many outstanding graduate students at Birmingham, and some great colleagues. All members of IHSS will know Roger Swift who was one of the first (alpha) research students of Michael at Birmingham. Needless to say, Roger had ideas of his own, and all who know him will realise what a pleasure it is to reason and to argue with him. Indeed Michael will say that he learned more from many of his research students than perhaps he taught them. His last student (the omega) in Birmingham was Andre Simpson, and already Andre has made a striking mark in the humic sciences. Michael will say that if ever he could claim to have some vision in science then it is only because he was 'lifted' by those he worked with. Dr. Jim Burdon, one of Birmingham's outstanding Organic Chemists, and Dr. Colin Graham who still leads Analytical Chemistry there were colleagues who shared their expertise and contributed hugely to the efforts of the Soil and Water Colloids Group in Chemistry at Birmingham.

It had not always been possible to raise the funds needed to support a full time effort in Humic Chemistry. But Michael was never happy to stray from a 'Soils Theme'. Thus, as funds became available for studies of clays it was easy enough to convert some of his interests to studies of polymer/clay interactions, interactions of anthropogenic organic chemicals with clays (and of course with humic substances), and studies of the dynamics of

water in the interlayer spaces of expanding layer clays (with friend and colleague Keith Ross of Physics).

When Roger Swift and Michael attended the International Soils Congress in Edmonton in 1978, they observed two persons approaching with the determined looks of zealots. Roger will say how he took flight and hid. But there would not be a place to hide because the effusively bearded one soon found him. The two were the clean-shaven Ron Malcolm and Pat MacCarthy (whose career began in Galway, where blanket peats abound). There was no doubting the commitment of these men to the humic sciences, and they convinced Hayes and Swift that their subject deserved more emphasis than that given through the Soil Science Societies. Ron had the support and commitment of Bob Averett, a leading scientists in the USGS WRD, who had recognised the health hazards of the by-products of chlorination of waters enriched in humic substances. With the Averett support and blessing, Ron and a group of colleagues from the WRD at Denver obtained funds to set up a Standards Collection of Humic Substances. A meeting was called at USGS, Denver in 1981, attended by Michael Hayes, Roger Swift, Frank Stevenson, Morris Schnitzer, Pat MacCarthy, Ron Malcolm, Bob Averett, and WRD colleagues Jerry Leenheer, George Aiken, Diane McKnight, and Kevin Thorne. A broad range of aspects of the humic sciences was discussed, and especially the operational procedures for isolating and fractionating humic substances. Towards the end of the meeting it was decided to establish the IHSS, with Ron Malcolm as President, Roger Swift as Vice President, and Pat MacCarthy as Secretary/Treasurer. A procedure was agreed to set up IHSS Standards for humic substances in soils and waters, starting with the Humic and Fulvic acids from the Suwannee River (led by Ron Malcolm and colleagues), from a mineral soil, from a peat soil, and from a Leonardite coal. A Mollisol (Elliott) from Illinois was chosen as the mineral soil, and the extraction process was led by Roger Swift (then at Lincoln College, University of Canterbury, New Zealand). A Florida Peat (Pahokee) from Belle Glade was the peat soil chosen, and the isolation process was led by Michael and his colleagues in Birmingham, England. A Leonardite coal sample from Gascoyne, ND, was selected and the Humic acid (no Fulvic) was isolated by the Morris Schnitzer Group in Ottawa, Canada.

Since then newly extracted Standards and a number of Reference samples have been added to the IHSS collection.

Promotion of IHSS was difficult in the early days, and the Society grew only because of the dedicated efforts of the founding leaders. Michael was elected President in the early nineties when the foundations had been thoroughly set, and Ed Clapp was elected treasurer. The

coming on stream of the Standards has had a huge impact, and credit for this is due to the work of Pat MacCarthy, and now to Paul Bloom and Ed Clapp of Minnesota.

Eventually, on retirement from the University of Birmingham, the 'call home' could be answered, and MH was pleased in 1998 to become an Honorary Professor in the University of Limerick, 60 km from his birthplace, and the same distance from a farm on the Shannon Estuary that he had purchased in 1985. It was good to come home, and to be able to continue to work on the humic sciences. Gradually, as the Celtic Tiger grew stronger, research funds became available and he has been able to build a Research Group. His major focus is on the isolation and characterisation of the humic substances in Irish soil types, and with especial emphasis on humin. He continues to enjoy collaborating with colleagues Ed Clapp, Andre Simpson, Jim Burdon, and Colin Graham. In 2003 he was elected to Membership of the Royal Irish Academy. It does look as if the compositions of humics mixtures are simpler than they were thought to be, and it looks as if soon Humin will no longer be the 'great mystery'

Circumstances have introduced a new interest to the Group. Michael's son, Dan, was awarded a State Scholarship to study Biomass as a replacement for fossil fuels. Last year, at the 12th IHSS symposium in Brazil, Dan gave a presentation on a process that recovers levulinic acid and other potential fuel extenders and platform chemicals from lignocellulose precursors. Such technology is especially relevant if Ireland (which imports 90 % of its energy raw materials) is to sustain an economy that is ranked third or fourth in the world in terms of GDP per person of population. Also, technologies of that type will assume world-wide importance as oil reserves become depleted. It must be said that it was Dan who introduced Michael to this new theme.

The bogs now have the potential to 'bloom' and to produce an abundance of biomass, and Michael is thankful that others have brought about the realisation of the potential they hold. His major interest is still in understanding the compositions and aspects of the structures of humic substances, and to promote a better awareness of the essentiality of these in an environment that is increasingly dismissive of their importance. He is forever grateful for the inputs/sacrifices of his parents and family, and for all those that he has worked with, played with, who have inspired him, and often painstakingly led him to awareness of new concepts and mechanisms.

Ed Clapp