RETROSPECTIVE

David T. Gibson: From biodegradation to biocatalysis

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David T. Gibson (1938–2014). Image courtesy of the Gibson family.

Some bacteria have the remarkable ability to grow on aromatic hydrocarbons such as benzene, toluene, and naphthalene. This is remarkable because the resonance energy of benzanoid rings renders these compounds extraordinarily stable to biodegradation. It turns out bacterial dioxygenases can relieve ring resonance by a unique reaction involving molecular oxygen as a substrate. No person contributed more to our knowledge of bacterial dioxygenases than David T. Gibson, who died on July 24, 2014, of unknown causes, likely related to paralysis that he suffered in 1983 from an unidentified illness. He was 76 years old.

Gibson spent his early years in Redcar, a small town on the northeast coast of Yorkshire, England. There he excelled at sports, especially cricket and boxing. As an undergraduate at the University of Leeds, he was the nationwide University Lightweight Boxing Champion. Inspired by reading about the fields of thermodynamics and kinetics as they relate to living cells, Gibson took up graduate studies in the Biochemistry Department at the University of Leeds. At the time, this was an epicenter of research on bacterial aromatic compound degradation. For his thesis work, Dave elucidated the *meta* pathway for the degradation of hydroxylated aromatic compounds. There were highs and lows during this period as Dave realized that he was competing with Professor Osamu Hayaishi and colleagues from Kyoto on *meta*-cleavage. In fact, Dave's advisor Stanley Dagley sent him on his first ever trip to London for discussions with Professor Hayaishi. After an afternoon of drinks and cordial conversation, Dave realized that he had done most of the talking and the Professor most of the listening, but thankfully, the Professor never capitalized on his advantage.

Dave and his wife Janet immigrated to the United States in 1964, and he eventually joined Reino Kallio as a postdoctoral fellow at the University of Illinois. Kallio gave him the mandate to demonstrate the involvement of oxygen in hydrocarbon degradation. Dave isolated a strain of *Pseudomonas putida* that grew on toluene from Boneyard Creek in Urbana and set about using it in biochemical studies. At Illinois and in subsequent years as a faculty member at the University of Texas at Austin, Dave and his students discovered that the product of toluene oxidation was an arene *cis*-dihydrodiol, an entaniomerically pure compound that cannot be made by conventional chemical synthesis. More than 300 vicinal arene *cis*-diols have since been identified as products of the bacterial oxidation of aromatic hydrocarbons ranging in size from benzene to benzo(*a*)pyrene. Some of these have been used as synthons in the development of drugs, including prostaglandin E2a and Indinavir, an HIV protease inhibitor. In an early example of synthetic biology, Dave and colleagues at Amgen discovered that recombinant naphthalene dioxygenase, expressed in *Escherichia coli*, converts indole to the blue dye indigo. This game could be played with other indoles and dioxygenases, and Dave was especially proud of his ability to produce Tyrian purple, which was used to dye the togas of Roman senators. Produced from a Mediterranean snail, Tyrian purple was among the most precious materials in the Roman Empire.

Dave was a tough, but fair boss who was completely intolerant of shoddy science and exacting in his writing and speech. He also loved to have a good time, and he brought his laboratory members into his family fold for parties and holiday dinners. Dave was devoted to his family and loved Janet and his two daughters, Christine and Karen, intensely. He was also devoted to fishing, and most family vacations involved a visit to a fishing destination. He and faculty colleagues at University of Texas at Austin belonged to The Society for Applied Piscatology (SAPS). Their meetings took place on the Texas Gulf and included fishing, drinking, card playing, and a little discussion of science. As he grew in stature and in age and possibly as a consequence of his paralysis, the quality of gentleness and grace that was at the core of Dave's personality came to the fore.

In 1988, Dave moved to the University of Iowa as the Edwin B. Green Chair in Biocatalysis and Microbiology, a position he held until his retirement in 2004. At University of Iowa, he was driven by the basic question of how dioxygenase enzymes can activate a compound as reactive as molecular oxygen to accomplish such highly stereospecific reactions. He amassed a volume of data that allowed him to see and communicate the answer to his central question by encouraging members of his laboratory to approach this question as they saw fit using their own particular skill sets in site-directed mutagenesis, crystallography, recombinant biology, immunology, and molecular evolution.

Because of the far-reaching implications of his scientific accomplishments to the pharmaceutical and bioremediation industries, Dave garnered many awards and honors. Among the most prestigious of these were the Procter and Gamble Award in Applied

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and Environmental Microbiology in 1996 and election to the National Academy of Sciences in 2004.

David T. Gibson was born in Wakefield, England, on February 16, 1938, the son of Thomas Henry and Mary Ann Gibson. His dearly beloved wife of 51 years, Janet, his daughters, Karen Gibson of Washington, DC, and Christine Ruddy and husband Kevin of Needham, MA, and grandchildren Elizabeth, Nathan, and Nicholas survive him. He leaves legions of colleagues, students, and postdocs who were touched by his generosity of spirit and caring mentorship. He is missed.