On August 20, 2020, at the age of 101, Herbert Tabor died peacefully at his home on the National Institutes of Health campus in Bethesda, Maryland. Herb was best known for his elucidation of the biochemical pathways for polyamines, including characterization of the biosynthetic enzymes, their genes and regulation, and the functions of the polyamines, chiefly using *Escherichia coli* and *Saccharomyces cerevisiae*. He was Editor-in-Chief of *The Journal of Biological Chemistry (JBC)* for nearly 40 years, overseeing its dramatic expansion and modernization, leading conversion from the traditional means of distribution of scientific information to the present web-based system.

Herbert Tabor was born November 28, 1918, in New York City, and was graduated from Townsend Harris High School in 1933 at the age of 14. At Harvard College he entered the Biochemical Sciences program headed by John Edsall. Graduating in 1937, Herb attended Harvard Medical School, where his work with A. Baird Hastings on the ionization constant of MgHPO4 was the subject of his first paper, fittingly in the *JBC* (1). As an intern at Yale-New Haven Hospital in 1942, Herb gave a patient with streptococcal septicemia an injection of penicillin, the first dose in the first major clinical trial of the drug in the United States (it worked!). Unbeknownst to Herb at the time (until 25 years later), that dose was prepared at Merck by Gilbert Ashwell, later to be a distinguished colleague and close friend of Herb at the NIH.

In January 1943, Herb joined the US Public Health Service and was assigned as the Medical Officer to the Coast Guard cutter *USCGC Duane*, escorting convoys between the United States and Britain. The events challenged his limited surgical training [recounted in the article, “It all started on a streetcar in Boston” (2)], but he managed without untoward sequellae.

**NIH Days**

In September 1943, Herb was transferred to the NIH in Bethesda, Maryland, at that time relocated from downtown Washington, DC, to six small buildings on land that Helen and Luke Wilson had only recently donated to the government for this purpose. Herb was assigned to work with Sanford Rosenthal, and they showed that saline infusions were an adequate substitute for the usual plasma in the treatment of burns or shock (3). Because plasma was in short supply during the war years, this was an important advance.

The atmosphere at NIH was very collegial (as I think it is now), and Herb soon became friends with Arthur Kornberg, Leon Heppel, and Bernard Horecker, each of whom had only recently arrived at NIH. In 1946, they formed a daily lunchtime seminar group, critically evaluating new papers (mostly in biochemistry) and their own work. This institution continued for many decades with a dazzling array of participants, including Maxine Singer, Gil Ashwell, Jerry Hurwitz, Vic Ginsburg, Jesse Rabinowitz, Osamu Hayaishi, Jay Seegmiller, Alan Mehler, Paul Marks, Howard Hiatt, Herman Kalckar, Bruce Ames, Jack Strominger, Hans Klenow, and Chris Raetz. This seminar series was very
central to the intellectual life of the early participants and evolved in later years into a joint seminar of Herb’s department (“Laboratory” in NIH terms), the Laboratory of Biochemical Pharmacology, and the Laboratory of Biochemistry and Metabolism led by Gil Ashwell. The vigorous give-and-take and careful examination of the paper of the day was very educational for me as a young postdoc in Herb’s group.

From the mid-1940s to the mid-1950s, Herb studied the effects of folate in hemoglobin regeneration, the mechanism of histidine degradation (via formiminoglutamate and folate intermediates), and the use of urinary formiminoglutamate to assess the effectiveness of antifolate drugs used in the treatment of leukemia. He purified diamine oxidase (histaminase) and showed that it converted putrescine (1,4-amino-butane) to Δ1-pyrroline, one of his first forays into the polyamines.

In 1946, Herb married Celia White (M.D. from Columbia University and the first woman intern in Medicine at the Massachusetts General Hospital) who was to become his lifelong collaborator. Their four wonderful children (Edward, born 1947; Richard and Marilyn, born 1949; Stanley, born 1954) have all made their mark in bioscience and computers. In 1952, Celia joined NIH where she collaborated with Herb as they focused on polyamines.

Polyamines

Herb and Celia together devoted the bulk of their careers to the study of the polyamines, putrescine, spermidine, and spermine. They described their biosynthetic pathways in bacteria and yeast, the enzymes and their regulation, and the functions of polyamines (4, 5). Putrescine is made mainly from ornithine by decarboxylation by an enzyme regulated by feedback inhibition (by ornithine: Δ1-pyrroline, one of his first forays into the polyamines).

The Tabors isolated mutants in the biosynthetic enzymes in E. coli and S. cerevisiae, and constructed polyamine-free strains whose growth was suboptimal (E. coli) or arrested (yeast) without added amines. They showed that translation, as measured by nonsense codon read-through or ribosomal frameshift efficiency was critically affected by polyamine deficiency. Moreover, the slow growth of E. coli mutants became no growth if cells also had an rpsl (ribosomal protein S12) mutation producing streptomycin-resistance. Polyamine-deficient yeast mutants were oxygen-sensitive and polyamine-deficient E. coli were sensitive to the oxygen-generating compound paraquat, showing that polyamines have an important role in protection from oxidation. Following their early discovery of glutationylspermidine in E. coli, trypanosomes were found by others to have a diglutationylspermidine that was important in protection of trypanosomes from oxidation, leading to the use of the ornithine decarboxylase inhibitor difluoromethylornithine as an effective treatment for some cases of trypanosomiasis.

Recently, with Manas Chattopadhyay, Herb showed that polyamines are critical for the glutamate-dependent acid resistance of E. coli, mediated by the alternative σ factor (poSS), the transcription factor GadE, and the two glutamate decarboxylases (8). Their 2015 paper reporting these results in JBC was 72 years after Herb’s first JBC paper.

The Journal of Biological Chemistry

The JBC was founded in 1905 (PNAS is a newcomer, starting only in 1915). Herb became a member of the Editorial Board in 1961, an Associate Editor in 1968, and became the Editor-in-Chief in 1971, a post he held for 39 years. Herb oversaw the more than 10-fold expansion in the size of the journal, along with a broadening of its scope from strictly biochemistry to include genetics, cell biology, and other related areas. Under Herb’s leadership, the JBC advanced the technology of journal publishing, with the first CD versions of the JBC in 1992, and in 1995 was the first biomedical journal to publish a completely online version (9).

As Editor-in-Chief, Herb handled many problem papers, such as complaints about the quality of the reviews, authorship issues, and referencing problems. I learned from Herb that, “There are only two kinds of scientists: Those who don’t refer to you, and those who don’t refer to you enough.”

Herb was a modest, soft-spoken man, totally devoted to science, did laboratory work himself, and worked very hard until the end. He never had a large group, and gave some of his postdoctorates a great deal of independence. For example, Chris Raetz began his work on mutants in enzymes of membrane lipid metabolism as a postdoc with Herb (10). Herb was a truly fine person, very serious, but not without a sense of humor. His exposition on some subject might end with, “I’ve told you all I know, maybe more.” Herb Tabor is already missed, but the lessons he taught us live on.

References


