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PERSONALITIES IN MODERN SCIENCE

EDWARD LAWRIE TATUM

Edward Tatum's paternal great grandfather Lawrie Tatum was a Quaker who settled in the Iowa Territory. Besides being a community leader, he served as an Indian Agent just after the Civil War, and wrote a book on the Indians, *Our Red Brothers*. Edward's maternal grandfather was Edward David Webb, also a pillar of society, and once Mayor of Boulder, Colorado. It was in that city that Lawrie's grandson Arthur met Webb's daughter Mabel. Arthur was studying at the University of Colorado at the time. The couple married in Boulder, and the first of their three children was Edward (1909).

His father worked at and taught physiology at the universities of Wisconsin, South Dakota, Pennsylvania, and Chicago. Growing up in this atmosphere, Edward turned easily to science. "As far as careers go," he says now, "I really was never interested in anything else."

In the Beginning

He began schooling in the University of Chicago experimental grade and high schools and then did two years of college there. When his father moved on to Wisconsin as Chairman of the Department of Pharmacology, Edward followed and completed his college work there. He had first been interested in geology, but got his bachelor's in chemistry (1930).

Tatum's parental family had their own small orchestra, with Edward on the alto horn, then trumpet, then french horn. He used to play trumpet with the Wisconsin football and concert bands, and still retains vivid memories of standing in the stadium in downpours or snowstorms, "blowing that damned horn."

When the Wisconsin Alumni Research Foundation began to operate (with funds gained from sales of its vitamin-D milk-fortification patents), it supported Edward Tatum's first research work. He won his master's in 1931, his doctorate (in biochemistry) in 1934. There followed a year with W.A.R.F., and then the Rockefeller Foundation Fellowship in organic chemistry to study at Utrecht, The Netherlands.

Tatum had by this time been well launched into the exploration of nutritional requirements of microorganisms. At Wisconsin, he had shared in the first identification of the need of propionic-acid bacteria for the then recently discovered thiamine. At Utrecht, he advanced these studies and learned much about techniques from his chief, Fritz Kögl, the discoverer of biotin.

Then a former botanist-become-Drosophila-man, George Beadle, who was heading for Stanford from Harvard, invited Tatum to join him in his studies of eye pigmentation mechanisms in the flies. Tatum was signed up by cable. When he and Beadle began working at Stanford in 1937, neither knew much about microbial genetics—the subject that was to earn both of them the Nobel Prize—although Beadle had specialized in corn genetics and been working for sometime with *Drosophila*. "For myself," Tatum relates, "I honestly knew little about the subject; I'd hardly considered it in my previous work."

Many of their inquiries were conducted with the flies in a sterile environment. Examination of some anomalous results showed that a spore-forming bacterium had contaminated the sterile experiments. Having already shown that tryptophan alone had no effect on the color of flies' eyes, Beadle and Tatum were then able to verify that the effect did occur when the bacilli were present. Next, they studied the effect of injecting individual biosynthetic products of the bacillus and finally identified the amino acid kynurenine as the material responsible for inducing brown eye color in *Drosophila*. Subsequent study of uninfected flies showed that, indeed, the occurrence of brown eyes results from genetic determination of biochemical competence for kynurenine production, capable of fulfillment in the presence of adequate supplies of that substance's precursors, especially tryptophan. The hormone that Beadle and B. Ephrussi had previously supposed respon-

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granules on which zooplankton can feed.

The Woods Hole investigators, using sea water that had passed through fine filters to remove any particulate matter, forced air through the liquid. This produced a cloud of fine bubbles and a layer of foam on the surface. In the process, dissolved organic matter in the filtered sea water was adsorbed on the skins of the bubbles, forming visible particles.

These non-living organic aggregates, which Dr. Baylor described to *Science Fortnightly* as consisting of phosphates, nitrates, proteins, polypeptides, and probably carbohydrates, were then fed to brine shrimp and copepods. The tiny marine animals fed on aggregates grew normally, while controls died within five to eight days.

While the laboratory experiments were being run, Dr. Riley—in close communication with Drs. Baylor and Sutcliffe—found that bubbles were producing these organic aggregates in the open seas, especially during mid-winter storms, which increased bubbling.

He also observed that the total quantity of these aggregates grew as the phytoplankton of any specific area increased. This, he explained, happens because phytoplankton themselves secrete much of the organic matter dissolved in the sea. The balance of the organic materials comes from decay and the secretions of zooplankton.

The organic matter aggregated by bubbles is the "marine snow" often observed but never understood by underwater investigators, Dr. Riley believes.

On the basis of present findings, Dr. Riley has produced a "community" theory of evolution, based on the concept that "individual species adapt toward the form most suitable for long-term survival of the community as a whole, even though the adaptation may sometimes seem to be detrimental to the individual species on a short-term basis."

Implications

The secretion by phytoplankton of amino acids and other organic compounds that could be used for their own development would seem to be a distinct disadvantage. Dr. Riley's new theory of community evolution, however, proposes that "since the material secreted can be converted gradually to particulate food, the process insures a more stable food supply for the animals. The latter, in turn, have a distinct pattern of daily vertical migration that insures utilization of all available food, although they could feed more abundantly if they could pause at any level where plants are particularly abundant."

Both of these actions, according to Dr. Riley, help sustain a reservoir of organic matter that better assures the long-term survival of the plant-animal community.

The discoveries of Drs. Riley, Sutcliffe, and Baylor led Dr. P. J. Wangersky, a marine biologist at Yale University, to suggest that this mechanism of adsorption by bubbling may have been a key step in the evolution of life from nonliving materials. #

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sible for brown eye color in the flies was, of course, kynurenine.

Beadle and Tatum turned to the study of microorganisms, in which biosynthetic mechanisms were easier to observe and manipulate, and began looking for a suitable subject. The tip came from V. O. Dodge, then at the Botanical Gardens in New York. He had made clear that the fungus *Neurospora crassa* had a classical genetic constitution, convenient and unique reproductive mechanisms, and, otherwise, that it was "a nice organism."

Reward

The work that followed—and that of Lederberg on genetic recombination and Zinder's on transduction—received its Nobel Prize recognition in 1958. Tatum went to Yale in 1945, as associate and then full professor of botany. In 1947, he became Professor of Microbiology, but left in '48 to return to Stanford. He joined The Rockefeller Institute in 1957.

Tatum was married in 1934 and divorced in 1956. His daughter Margaret is now married and the mother of two sons; his other daughter Barbara is a graduate student in education, studying the teaching of the blind. In 1957, Tatum married Viola Kantor. They live in New York, just a few blocks from his lab at The Rockefeller. While they don't take formal vacations, they usually manage to tack on a few days of holiday to each of his business trips.

In recent years, Tatum has become more an appreciator than a performer of music—short spare time is the cause. He's become interested in swimming and, even more, skiing. For a brief period he was hooked on what he calls "screwball" cars—not antiques, but odd beasts like the Citroën 2CV.

The Tatums have the odd distinction of having been among those skiing at Zermatt during the typhoid epidemic two years ago. "We never heard a word about the epidemic until we got back to the States—that's how well the Swiss kept their secret. Anyway," Tatum says, "we didn't get typhoid." Maybe *Salmonella typhosa* owes a debt to the secretive Swiss; if Tatum had laid hold of that bacterium, who knows what its genetic makeup might now be. #