

George S. Hammond:

Dynamic Chemist

The chairman of Caltech's chemistry division never went to school until the seventh grade, never took a science course in high school, and took chemistry in college only because physics wasn't available his freshman year. Then he made the decision to major in chemistry mostly because he needed the \$37-a-year job as lab assistant that went along with it.

If his choice of a profession appears to have been made haphazardly, it is a misleading measure of the man. Nothing in the makeup or the career of George Simms Hammond is accidental. Today the chairman of the division of chemistry and chemical engineering at Caltech has gained international recognition for his ideas about making radical changes in the teaching of chemistry. And the qualities that have made him a brilliant researcher and educator are the same ones that years ago took him away from the New England farm life he wanted to escape—Down-East determination, independence, enthusiasm, and honesty.

George Hammond was the oldest of seven children living in relative isolation on his parents' dairy farm in Auburn, Maine. He was taught at home by his grandmother for his first six school years—just as his father was before him. By the time he

got to high school George knew that he wanted to get out of farming and had already decided that a science major in college would be the way.

His father's death, when George was 13, shifted the responsibility of running the farm onto him and his chances for going to college looked slim. It was finally possible only because Bates College was seven miles away. ("Another 20 miles and I'd have been out of luck.") As it was, he worked for a year after high school to earn tuition money, and then commuted to Bates for four years, keeping up the farm along with his studies.

After graduation he went to work for a chemical firm in Philadelphia and stayed just long enough to decide that business was not for him. In the summer of 1943 he filled out applications to 12 graduate schools, and, with one exception (the University of Illinois didn't answer), they all offered him teaching assistantships.

"I was convinced there must be something charismatic about me—on paper," he recalls. "But the truth was that the government had just dumped hordes of Army and Navy trainees into the colleges, and there was a crying need for anyone who could function as a T.A. They probably would have snapped up my grandmother."



At Harvard, a decision to work under the well-known chemist Paul Bartlett put Hammond's scientific life into focus. Bartlett's nondirective brand of leadership was one that fit perfectly with George Hammond's independence. He still remembers with pleasure a period when Bartlett didn't talk research with him for 18 months.

Hammond now uses the same approach on his own students. "I'm interested in what my research students are doing, and I want to participate in it intellectually, but I'm not going to tell them what to do and have them miss all the fun."

"Of course," he adds, "this system only works because the people in the group are extremely talented and enthusiastic."

Hammond has held to this philosophy for many years, in both teaching and research. After a year of postdoctoral work at UCLA, he taught at Iowa State College in Ames for eight years. In 1957 he and his wife, Marian, and their five children spent a year on a Guggenheim and NSF fellowship at Oxford, Basel, and at Caltech. The next year he returned to Ames for one year before joining Caltech permanently as professor of organic chemistry. In 1963 he became Arthur Amos Noyes Professor of Chemistry, and, in 1968, division chairman.

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"It bothers me, now that I've become division chairman," he says, "that my opportunities for interaction with my research group are cut down. The personal and intellectual interaction with students is one of the best things I have."

But the job of chairman does not deter him from pursuit of other interests, such as his current crusade—curriculum revision.

Basically, he is convinced that the traditional subdivisions of chemistry are inappropriate for modern research and that their overwhelming influence in the standard undergraduate curriculum is stultify-

ing. He thinks that a more realistic categorization of chemistry would be into structural chemistry, chemical synthesis, and chemical dynamics—his own field—which he predicts will soon surpass structural chemistry in importance.

About two years ago, Hammond decided it was time to put his ideas into practice, and he began to design a new course in freshman chemistry. He recruited his colleague Harry Gray as a "believing collaborator," and together they made their own chemical mix and served it to a group of 16 Caltech freshmen as an experimental chemistry course. About 40 percent of the course was devoted to an introduction to chemical dynamics. "Chemical reactions," Hammond says, "have just about disappeared from freshman courses. We put them back in, with enough system to intrigue most of the students."

This year Hammond and Gray are giving a sophomore course—their own brand of structural chemistry that Hammond describes as "a mishmash of organic, inorganic, and physical chemistry." But out of it they hope to bring a new coherence based on experimental and theoretical structural chemistry.

Hammond sometimes finds that there is more interest in his ideas in faraway places than at Caltech. This summer, at the invitation of the government of India, he will take part in a planning conference in Bangalore to revamp the teaching of chemistry in the universities of that country—a conference based largely on his ideas.

Maybe the Hammond approach will revolutionize the teaching of chemistry. Or maybe it won't do anything of the kind. Hammond himself is philosophic about the possibility of failure.

"Why should we always be so uneasy about failing?" he asks. "The real pioneers of human thought and action are forever trying new things and settling for partial success. If we'd talk to each other more about our oddball interests, we might learn something—and have fun trying. Maybe we'll look ridiculous part of the time. So what's new about that? If nothing else, we might learn to live with the feeling of foolishness."

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"After all," he admits with a grin, "in a straightforward way, what I want to do is change the world."