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Short Communication

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Brief Note on the Revolution of Biochemistry Based on Basic Research

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Short Communication

According to the National Science Foundation, 80 percent of jobs available in the next ten years will require math and science skills, implying that biochemistry and molecular biology programmes must be transformative, incorporating new pedagogical approaches and experiential learning to prepare students for careers in industry, research, education, engineering, health-care professions, and other interdisciplinary fields. These efforts necessitate an environment that respects each student and incorporates contemporary breakthroughs from the discipline's major literature, experimentally driven research, data gathering and analysis, and scientific writing. Critical thinking, experimental testing, computer modelling, and inferential reasoning are all current developments that must be included into these efforts. In essence, cutting-edge research must inform and integrate modern biochemistry and molecular biology instruction.

This atmosphere is dependent on long-term research funding, a commitment to provide the necessary mentoring, instrumentation, and cutting-edge facilities. In order to foster innovation in the classroom and laboratory, the academic environment must foster a culture of excellence and faculty engagement. Multidimensional programmes that increase science literacy in all facets of the population, including students and teachers in K-12 schools, non-biochemistry and molecular biology students, and other stakeholders, must not be overlooked in these efforts. We have a responsibility as biochemistry and molecular biology educators to equip students with the skills they need to be innovative and self-sufficient. The importance of scientific dissection and scientific literacy must be taught to the future generation of biochemistry and molecular biology students.

By middle school, my interests had broadened, and learning about and painting atomic orbitals was a dream come true. With one exception, the succeeding foundations in algebra, chemistry, physics, and biology in high school were conventional and lacked the excitement of previous lecturers. As a senior studying what is now known as AP Biology or AP Chemistry, I was immersed in hands-on activities that encompassed everything from pH curves and enzyme tests to animal dissections, all of which were accompanied by active conversations by groups of students about how and why. This was the foundation that developed my interests, so laying the groundwork for my college decisions and areas of study [1-3].

In the mid-1970s, as an undergraduate student, I immediately recognised the importance of basic research in biochemistry and cell and molecular biology teaching. Cell, along with other well-established journals such as the Journal of Biological Chemistry, Journal of Cell Biology, and Biochemistry, was founded in 1974 and served as a platform for linking cutting-edge research with teaching a sophomore-level cell biology course, later expanding to biochemistry and biophysical chemistry. While using primary literature was difficult, it supplied real-time data that was incorporated into core notions. As a result, during my sophomore year, it was time to join a research laboratory, which was initially intimidating, but eventually led to the development of an independent research project [4].

Graduate school provided the opportunity to use many of the same tactics while teaching cell and molecular biology labs and understanding the value of teamwork while studying primary literature. It was clear from away that one's enthusiasm for cutting-edge science was not universal, and it was critical to devise ways for teaching how to employ a research paper in a laboratory context. The question of how to teach a sophomore to read a primary research paper became critical. What is the origin of data, and how can it be interpreted? In addressing a given subject, how may a group be more effective than a single individual? And how does that data generate new knowledge to advance the field?

Working with undergraduate students interested in biochemistry and molecular biology was one of the joys of being a postdoctoral research fellow in the early 1980s. In Escherichia coli, I studied the molecular basis of fatty acid transport and its connections to fatty acid activation and oxidation. It was around this time that the true value of teamwork in research at the bench became obvious, as well as the fact that undergraduate students might be productive members of a team if given the necessary supervision. The undergraduate students were involved in critical areas of the research, such as cloning the fatty acid transport gene (fadL), identifying complementation and expression patterns, and purifying the protein FadL and demonstrating that it was local [5].

Most scientists have had similar experiences, thus these underpinnings are not unique. They did, however, inspire my desire to connect research with teaching and learning, based on the conviction that basic research informs biochemistry and molecular biology education. These connections align with science (and, more broadly, STEM) education research that emphasises the importance of asking questions, designing and conducting experiments, collecting data, drawing conclusions, engaging in scientific discourse, developing novel pedagogical tools, and communicating findings to advance the field. According to scientific education research, this experiential learning also necessitates the creation of rubrics to create goals and outputs, as well as to measure learning.

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