Comparing Experimental Systems: Protein Synthesis in Microbes and in Animal Tissue at Cambridge (Ernest F. Gale) and at the Massachusetts General Hospital (Paul C. Zamecnik), 1945–1960

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It is, however, one of the delights of scientific research that the answer to each problem raises new ones.¹

Biochemistry and Molecular Biology

The present paper aims at exploring, through the use of examples, two different approaches taken between 1945 and 1960 toward characterizing the mechanism of protein biosynthesis. I will pay special attention to the experimental systems and their technical boundaries. Radioactive tracing and centrifugation were instrumental as the basic biochemical practices by means of which a “first generation” of test tube systems for the incorporation of amino acids into proteins took shape. I will also discuss the local, institutional, and practical contexts in which these experimental systems became articulated. The paper is centered on a comparison between the work of Paul Zamecnik and his colleagues, based on rat-liver tissue, and that of Ernest Gale and Joan Folkes, based on disrupted Staphylococcus preparations. Some general considerations will be derived from this comparison concerning the structure of experimental events and the dynamics of experimental systems at one specific point of conjuncture between protein biochemistry and molecular biology.

Anyone who becomes immersed in the details of the biochemical studies on protein synthesis during the decade between 1947 and 1957 gains the impression of a maze from which there seems to be no easy way out. Gunther Stent has pointed to the pejorative attitude of the first generation of molecular biologists toward the messy and sometimes literally bloody procedures of

traditional biochemistry. Mahlon Hoagland, in his autobiography, has spoken
of a "wide gulf" that, during the 1950s and well into the early 1960s, separated
the experimental culture of biochemists from those who regarded themselves
as molecular biologists. Yet it appears that much of the work that established
the molecular details of replication, transcription, and translation between
1953 and 1963 was the result of biochemical endeavors in the classical sense
of the word, which had not at all been set up from the perspective of molecular
genetics. The success of what Stent called the "dogmatic phase" of molecular
biology largely rested on the fact that, in the late 1950s, many molecular biol-
ogists, with James Watson's laboratory at Harvard taking the lead, resorted to
the previously denounced procedures and experimental systems of biochem-
istry in elucidating the details of the molecular flow of genetic information.

The relation between biological chemistry and the emerging discipline
of molecular genetics is a complex one, and it has taken different shapes
according to local research traditions, institutional structures, disciplinary
affiliations, national research policies, and philosophical commitments. In this
respect, the present paper aims at adding just one more facet to a long-standing
and ongoing historical discussion. I will look at and focus on two different
experimental systems that came to occupy a central place in clarifying the
mechanism of the biosynthesis of proteins. They emerged out of two largely

2 Gunther S. Stent, "That Was the Molecular Biology That Was," Science, 160 (1968),
390–395.
3 Mahlon B. Hoagland, Toward the Habit of Truth: A Life in Science (New York: W. W.
Norton, 1990), p. 82.
4 See, e.g., Pnina Abir-Am, "From Biochemistry to Molecular Biology: DNA and the Accul-
ident., "Themes, Genres and Orders of Legitimation in the Consolidation of New Scientific
73–117; Jean-Paul Gaudillière, "Biologie moléculaire et biologistes dans les années soixante:
La naissance d’une discipline. Le cas français," Thèse de doctorat, Université Paris VII, 1991;
Pnina G. Abir-Am, "The Politics of Macromolecules: Molecular Biologists, Biochemists, and
Rhetoric," Osiris, 7 (1992), 164–191; Richard M. Burian, "Technique, Task Definition, and the
Transition from Genetics to Molecular Genetics: Aspects of the Work on Protein Synthesis in
Gaudillière, "Molecular Biology in the French Tradition: Redefining Local Traditions and
Disciplinary Patterns," ibid., pp. 473–498; Richard M. Burian, "Underappreciated Pathways
toward Molecular Genetics as illustrated by Jean Brachet's Cytochemical Embryology," in
New Perspectives on the History and Philosophy of Molecular Biology, ed. Sahotra Sarkar
(Dordrecht: Kluwer Academic Publishers, 1996), pp. 67–85; Soraya de Chadarevian,
"Sequences, Conformation, Information: Biochemists and Molecular Biologists in the 1950s,"
J. Hist. Biol., this issue; Angela N. H. Creager, "Wendell Stanley's Dream of a Free-Standing
Biochemistry Department at the University of California, Berkeley," ibid.
5 A more comprehensive account than the one presented here would have to include at least
the work of Henry Borsook and his group from the Kerckhoff Laboratories of Biology at the
California Institute of Technology; that of David Greenberg from the Division of Biochemistry
at the University of California Medical School, Berkeley; that of Tore Hultin at the Wenner-