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## Introduction

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The idea for a composite study of biology at the University of Chicago was triggered by Elihu Gerson's remark that a number of historians, philosophers, and sociologists of science were individually pursuing questions related to the life sciences at Chicago. A 1987 session at the International Society for the History, Philosophy, and Social Studies of Biology meeting in Blacksburg, Virginia, provided an initial opportunity for many of us working on Chicago biology to come together and explore areas of overlap and mutual interest. The possibilities for focusing those interests eventually led to a special symposium at the University of Chicago in 1991, held in conjunction with the university's centennial celebration and sponsored by the Morris Fishbein Center for the History of Science and Medicine, the University of Chicago Centennial Office, and the University of Chicago Press.

We began planning for the symposium by addressing Maienschein's query "whether there is a style of Chicago biology." In a 1988 essay, Maienschein argued that style is perhaps best conceived as a set of concerns regarding "what scientists ask, what problems they consider worth solving, what techniques they employ, what approaches they adopt, [and] what organisms they choose." Similar to a research tradition, Maienschein suggests that style is "influenced . . . by local setting, individuals, and organization and by non-rational factors." At Chicago, this style was reflected in a "commitment to the study of organization of whole organisms (and populations) and to cooperative and comparative study" (Maienschein 1988, pp. 152, 173). However, some basic historiographic issues quickly surfaced as those of us working on Chicago biology began to address Maienschein's question. While Maienschein contends that demonstrating a characteristic approach to

science is sufficient to establish the existence of a style, even though elements of that approach may be present elsewhere, others disagreed. They insisted that attribution of style requires comparative analysis to demonstrate that what is identified as characteristic is actually unique. Differences of interpretation remain among the authors of these articles as well as in the science-studies community more generally. What does it take to establish the "style" or "character" of a place, and why would one want to do so anyway? How does it relate to the problem of national styles (Daston and Otte 1991)? Is the notion of "style" distinct from that of a research school, and if so, how (Geison and Holmes 1993)?

Without a clear consensus on the historiographic usefulness of "style," we refocused our discussions. It was apparent that each of the authors was in his/her own way trying to understand how contingent factors and contextual forces that prevailed within local cultures, be they within a departmental, university, or urban setting, influenced the development of biology at Chicago. Richard Burian has aptly summarized the set of questions guiding these papers as follows: "How did the local culture of the city and the university (and perhaps, the physical geography) interact with, or affect, the development of particular disciplines, the drawing of disciplinary boundaries, the overall shape of the research undertaken (problems, tools, organisms, etc.), the ways in which cooperation and competition (the crossing of disciplinary barriers, etc.) played out? How did the interests of scientists in the larger social agendas of the university, the city, their churches affect their work? Was there something about the structure or practices of the university that protected certain groups, or styles of work, or pockets of unorthodox work? Or something about Chicago against the eastern establishment?" (R. Burian, personal communication to Mitman, February 9, 1993).

Indeed, the approaches taken by each of the authors in his/her analysis of Chicago biology touch on some of the key issues that defined Chicago pragmatism and interactionism in the early part of the century. The studies of Chicago urban sociologists such as Robert Park drew on ecological metaphors in attempts to study the nature of social organizations within local geographically bounded areas such as the urban community, gangs, the ghetto, and the Gold Coast. The social structures evident within these areal organization fields were understood by Chicago interactionists as the consequence of people's activities sustained over time. More recently, Chicago interactionism has been developed by Anselm Strauss and others to include social worlds/arenas theory (Strauss 1991) and applied to the field of science

studies by Clarke, Fujimura, and Star (Clarke 1990; Fujimura 1988; Star 1989). Bound through a shared discourse, individuals within a social world constitute an "interactive unit," a "universe of regularized mutual response" (Clarke 1991, p. 131). The boundaries of social worlds are not limited by geography; they can cross-cut formal organizations, and individuals themselves are often participants in multiple social worlds. The value of this theoretical approach when applied to our understanding of Chicago biology is that, while all of these Chicago biologists were members of professional communities both national and international in scope, they were also participants in the university and in local communities, social worlds that also had impacts on the ways in which their science was done.

This is most evident in one of the overarching themes of the articles: the extent to which many Chicago biologists adhered to an interdisciplinary ideal. For whatever reasons, different groups repeatedly sought to make interdisciplinary connections or tried to pursue research or instructional agendas that crossed disciplinary boundaries. Interdisciplinary work was a common conceptual and organizational ideal throughout the life sciences, particularly during the interwar years. Cooperative research and exploration of borderland problems was a theme actively promoted by the National Research Council and by philanthropies such as the Rockefeller Foundation (Bugos 1989). Chicago biologists were participants within this social arena of professional organizations and funding agencies promoting such interdisciplinary ideals. However, as the articles by Clarke, Blustein, and Kingsland clearly demonstrate, interaction within local communities shaped conceptions of interdisciplinary approaches in particular ways.

In her article on Frank R. Lillie and reproductive biology at Chicago, Clarke argues that Lillie's approach to biological practice, which he inherited from his mentor Charles Otis Whitman, was characterized by a conceptual and methodological framework attentive to complex interactive relationships that defined the organism as a whole, while simultaneously valuing and pursuing reductionistic biochemical studies. Clarke also links the nature and success of Lillie's reproductive enterprise to local resources—to the availability of research materials and funding from the Chicago meat-packing industry and pharmaceutical companies, in addition to Lillie's stature within the Chicago social elite through his marriage to Frances Crane, daughter of plumbing magnate Charles Crane. The importance of the development of physiology within the zoology department nonsubordinated to the demands of medicine (because of the university's inability to establish a medical school until 1927) was also an important factor that helped

shape Chicago reproductive biological research (Pauly 1984). The ambiguous relations of the zoology department to the medical interests of the university resulted, Clarke suggests, in an interdisciplinary venture in reproductive biology pursued "in tandem" by the zoology, physiological chemistry, and anatomy departments, rather than one combined into a single research enterprise.

Lillie's redirection of the National Research Council Committee for Research Problems in Sex away from human sexuality toward biological problems of sex indicates the extent to which he had an interdisciplinary model in mind that encompassed the borderlands between the biological and social sciences. Yet it was a model that was essentially reductionistic in its attempt to explain social problems in light of biology. The articles by Blustein and Kingsland similarly point to an interest among Chicago biologists in a holistic approach to mind, life, and society, yet one that minimized the importance of the social sciences. A similar argument has been advanced by Mitman in his study of the history of animal ecology at the University of Chicago (Mitman 1992). In fact, efforts by biologists at Chicago to advance an interdisciplinary approach to social problems rooted in biological science may well have been modeled after and a direct response to the Local Community Research Committee. This interdisciplinary research group at Chicago drawn from faculty members in political science, sociology, anthropology, history, economics, and political science received \$80,000 to \$100,000 per year between 1924 and 1927 (Bulmer 1984). Some biologists seemed hopeful of a life sciences parallel such as the Institute of Genetic Biology formally proposed by Lillie to the Rockefeller Foundation in 1934, an interdisciplinary institute that unlike the Local Community Research Committee never materialized (Mitman 1992).

In her study of the failed efforts to establish a program of "psycho-neurology" at the University of Chicago, Blustein draws attention to the importance that members of this multidepartmental research group placed on the integrative functions within the organism and its interactions with the environment that bound the organism into a complex whole. Blustein analyzes how this interdisciplinary model, which embraced an essentially biological approach to human problems, foundered in an institutional setting in which the pursuit of medicine as biology and the social structure of medical practice led to a deepening rift between clinical and nonclinical faculty. Furthermore, while the establishment of the Division of Biological Sciences in the early 1930s facilitated interaction between the clinical and nonclinical departments, it also had the effect of isolating the biological from the

social sciences, which ran counter to the holistic approach to mind, life, and society adopted by members of the Neurology Club. As Blustein writes, "The centripetal force of an exciting intellectual agenda was opposed by centrifugal forces generated by the actual conditions of work." Blustein's article addresses important considerations regarding the institutional structures and local conditions that may facilitate or hinder interdisciplinary work.

Kingsland also emphasizes the central place that an interdisciplinary but essentially biological approach to mind and behavior had in the life sciences at Chicago by exploring the work of the neuroanatomist Charles Judson Herrick and his later collaborations with the psychologist Karl Spencer Lashley. Kingsland points to local university influences such as the pragmatism of John Dewey and the physiological developmental theories of the zoologist Charles Manning Child in shaping Herrick's understanding of the organism and behavior. But she also takes us into the city and to the juvenile courts as a place where Herrick's emphasis on the moral significance of biology was reinforced through his interactions with local urban culture. The Institute for Juvenile Research also brought Lashley to Chicago, a move that led to a collaboration with Herrick and to the development of a holistic theory of brain function. As Kingsland suggests, such small-scale collaborations were possible, facilitated by the hospitable intellectual environment of Chicago that stressed organism-environment interactions and a biology of mind and behavior, even amid an administrative structure that did not support the grand-scale organized institution for psychoneurology discussed by Blustein.

Although interdisciplinary collaborations may be a source of innovation, such work is also a source of contention, as Rainger notes in his article on vertebrate paleontology at Chicago. Vertebrate paleontology was itself an interdisciplinary subject, but in occupying the interstice between biology and geology, the field and its practitioners at Chicago became caught in power struggles and turf disputes between those who held allegiances in either biology or geology. Just as the restructuring of the university by Robert M. Hutchins adversely affected the program for psychoneurology, it also had an impact on vertebrate paleontology. Alfred Sherwood Romer, who was then head of vertebrate paleontology at Chicago, found his interests divided across three divisions—the Divisions of Biological, Physical, and Social Sciences—when his field was placed in the Physical Sciences Division with geology. Romer's inability to establish an interdisciplinary program in vertebrate paleontology contrasts with the results of his successor Everett C. Olson, who was able to create a truly unique and

successful cross-disciplinary degree program in paleozoology in the 1940s. Rainger traces Olson's success to conceptual changes taking place in the fields of evolution and systematics, to Olson's awareness of local institutional politics, and to his ability to establish joint ventures with scientists from the Field Museum of Chicago. What, if any, differences in the institutional structures between museums and universities facilitates or hinders interdisciplinary research is a question that follows from Rainger's article.

While Clarke, Blustein, Kingsland, and Rainger take us beyond the university setting into the urban environs of such places as the stockyards, the hospitals, the juvenile courts, and the Field Museum, Cittadino's study of Henry Chandler Cowles and plant ecology at Chicago situates us within the local geography of the Great Lakes region and the culture and ideology of a thriving industrial metropolis that marked the end of the frontier. Cowles's model of succession on the Indiana dunes struck a resonant chord with the belief that the confluences of a unique physical environment and people from diverse nationalities and traditions had resulted in a dynamic, creative urban culture moving along progressive lines. This shared cultural heritage, Cittadino points out, provided a common ground for Chicago sociologists and plant ecologists to develop similar theories about human and plant communities, despite any evident interaction between these two groups.

These articles raise a number of questions for scholars working in what is increasingly becoming an interdisciplinary field of science studies. For those whose professional identity is most closely aligned with the philosophy of science, one might ask, What is the nature of interdisciplinary work, and is it different in any substantive ways from disciplinary research? Are there different epistemological standards of what will count as good science for interdisciplinary work, or does it have to conform to all the standards of all the contributing communities? Is interdisciplinary research more innovative or more constraining than more traditional efforts? And is it constrained in ways that make it unlikely to succeed; is it the work itself that brought about the failure of interdisciplinary research? For those whose allegiances lie with the sociology of science, there are other questions: To what extent and in what way must interdisciplinary work be collaborative to succeed? In what ways do shared local resources and materials contribute to interdisciplinary ventures? Under what conditions does interaction across disciplinary boundaries lead to new practices or conceptual categories that restructure disciplinary domains? For historians of American science, one might ask what was it about Chi-

cago that contributed to this call for interdisciplinary collaboration and cooperation across institutional and intellectual boundaries? To what extent can efforts to develop a biology that embraced mind, life, and society be found in others institutions across the country?

We have, in short, ended with more questions than answers. Moreover we do not pretend that we have covered all of Chicago biology, so questions remain about how other fields and subareas fit in as well. Others have looked more closely at embryology, aspects of ecology, and physiology pursued at Chicago (Maienschein 1988; Mitman 1992; Pauly 1987). What we offer here is a collection of separate studies, each with a different perspective. Yet the result is not just a list of different reports. As we put them together and compare them, we do see themes and new questions emerging. Many of these could be put to biology as practiced elsewhere to begin to produce a comparative look at how the local situation and institutions affect—and are a fundamental part of—the science that goes on.

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