

On Fields and Fences in Science

Many years ago, the second time I attended a meeting on biological rhythms, I met a fellow who asked me how long I'd been in the field and whether I was connected to Pittendrigh. I didn't really think of rhythms as a field at the time, more like a problem, maybe an area—I thought of my field as Neuroscience, subfield Neuropharmacology, area Receptors and signal transduction, system rat Pineal gland—and I'd never met Pittendrigh. He was just being friendly though, this fellow, like asking how long I'd been in town, and did I have any kin here, and was I fixin' to stay? This was home to him. As it happens, I moved away for a few years, sojourning in the lands of Neurochemistry and Retinal biochemistry, before coming back, buying a farm (a chicken farm), and settling down.

The organization of science into areas, fields, and disciplines is not as well defined as the organization of geopolitical entities into villages, towns, districts, counties, states, countries, and continents. Still, science *is* organized politically, with nested realms distinguished by territory, kinship, language, and way of life. These "polities of science," like those that appear on a map, overlap with the social organization of self-defined communities and "peoples." I don't think "biological rhythms" was a "field" at the time, but as I'll explain, I'm sure it is one now, and the *Journal* has a role in defining that field.

To begin with, the development of a field requires the generation of a sense of a community distinguishable from others, and of allegiance to it. Early on, it seems, there is an especially strong emphasis on kinship, on founders and forebears (e.g., "We are the sons of Shem!"), on distinctive local geography (e.g., "We are the Green Mountain Boys!"), and/or a way of life (e.g., as reflected in the cry "NONHUMAN TEXANS!") that provide a sense of community and homeland. Such distinction and loyalty is helped by a degree of isolation and by achievement of a critical mass. Often, the nascent field is dominated by—sometimes composed of—a handful of lineages (and of their patriarchs, living or dead), and everyone knows who belongs to which lineage. The sense of distinction and community is bolstered by shared lore and cherished

practices and beliefs, often consisting of cautionary tales (cryptic light leaks) and epic tales recounting how our forebears vanquished the unbelievers (conversion of the criticism of "temperature independence" to the canon of "temperature compensation"). A tribal jargon develops and provides slogans and shibboleths by which comrades recognize and identify each other ("We are the knights who say 'homeostasis of tau.'"). Greek letters, acronyms, abbreviations, and stock phrases are often used (tau, psi, alpha, rho; DD, PRC, *per*) and help to identify a stranger or a novice ("That's 'photoperiod refractoriness' not 'photorefractoriness'; 'dead zone,' not 'death zone.'"). Fortunately, at the time of the meeting, I had already been partially acculturated at a previous meeting by a (now) tribal elder, a scion of a major branch, who claims to have done it in one long night, and I could already lard my sentences with "type 1 PRC" and "state variable," more or less appropriately, though I still spoke with a recognizable accent.

As an area develops into a field, other considerations besides kinship come to the fore, although lineage never loses its importance ("I'm Goldberg, the tailor. You want Goldberg, the spy. Upstairs."). A rough consensus emerges on the boundaries of the field. That rough consensus distinguishes between core problems and those that are peripheral but still within the field's purview, between fundamental and trivial issues, and between relevant and irrelevant issues. Standards of quality are established ("You call that a phase shift?"), as are acceptable scientific approaches and methodology, and preferred or acceptable reductionist levels and level of concreteness. The locations of "black boxes" are tacitly decided and whether attempts to open them fall within or outside the field ("That's not my Department," says Wernher von Braun.).

Very commonly, it is the system that defines and bounds the field (cardiac physiology) or the reductionist level (electrophysiology) or the methodology (x-ray crystallography) or the problem or goal (AIDS research). Consequently, we each have cross-cutting allegiances to several fields, sometimes to several disciplines, organized around different unifying princi-

ples. For each of us, these allegiances appear nested or contiguous, but their boundaries, like those of geographic entities, are both natural and socially constructed. Circadian rhythms are core for us, and annual rhythms are well within the field, but cardiac rhythms, although acceptable, are largely left to neighbors that care much more about them. Determination of primary identification and allegiance is complex; in addition to the considerations already mentioned, both total population in an area and population density are important. Generally, as with geopolitical entities, there is at least some (inverse) correlation between population density and the size of the area occupied by a community: The sparser the population the larger the territory; conversely, the denser the population the smaller the territory.

The major determinants of primary identification and allegiance, and of the conversion of an area into a field and of a field into a discipline, are institutions. Scientific areas have lectures, meetings, and clubs; fields have, in addition, courses, societies, journals, and institutes; disciplines have, in addition, curricula, departments, degrees, and supporting foundations. Our cross-cutting allegiances generally crystallize into a hierarchy based on our (often contingent) participation in these activities and membership in these institutions. We who do biological rhythms research have lectures, meetings, clubs, courses, societies, journals, centers, and institutes but, to my knowledge, do not yet have curricula, departments, degrees, or supporting foundations. We are definitely a field.

The borders around a field are always at least partially open. New families move in, but they are not always equally welcome. Some people become concerned about the field's retaining or losing identity or credibility, or fear being overwhelmed or subsumed by immigrants who know not our ways. Others see opportunities for expansion and diversification by inclusion of, or confederation with, adjacent areas.

Some want to emphasize one direction, others another. Fields grow by expansion and subdivision of territory and/or expansion of population. Not all areas within a field are, or stay, equally prosperous. A field's core and peripheral areas shift: relative prosperity and prominence among areas change as problems are solved, soil is depleted, new crops are introduced, or new areas are brought under cultivation. ("Nevermind 'homeostasis of tau.' We are the knights who say 'autoregulatory transcriptional feedback loop.'").

One of the most attractive things to me about the field of biological rhythms is that it is defined mainly by a set of problems and phenomena and *not* by system, reductionist level, or methodology. This makes for more diversity than is found in other fields and greater openness to a range of interests and approaches. We get to have comrades with different perspectives and somewhat different ways of life. It helps keep us limber and helps prevent sclerosis.

I am mindful of the role of the *Journal* in our community: It is one of the institutions that binds us and bounds us. It participates in defining the field, what is to be included and what is to be excluded. It should encompass the whole field, both what currently seems core and what currently seems peripheral. It can be difficult to maintain representation from the most prosperous areas, as they are so much in demand by the institutions of bigger polities. It can also be difficult to maintain representation from what are seen as peripheral areas, for not everyone wants to hear from "distant cousins," but I think it's important to keep in touch with family members far afield. Finally, the *Journal* should encourage visits from our neighbors, on behalf of the field, and welcome them, as I was welcomed long ago.

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