Retooling Academic Silos to Respond to New Opportunities

The academic units on most campuses in the United States are organized into departments and this system dates back at least a couple of centuries. The departments in turn are units of a bigger organizational entity called a college. Each department is headed by a chair while the college is headed by the dean. The faculty member is hired into a specific department that also serves as a "home" for the tenure of that person within the university. (In my own case the Chemistry & Biochemistry Department served that function and I am a tenured faculty member in the College of Science in my institution.) The education and research functions within the university both largely occur in a specific department. Thus an undergraduate student who enters the university takes a prescribed set of courses in a number of departments spread across multiple colleges. However, ultimately he/she declares a major and then takes further courses in a single department/college that offers that major. The graduate student also typically takes classes and does research in the same department. Faculty hiring is based on the perceived need for teaching specific classes (*e.g.*, analytical chemistry) and also the need for initiating research activity in a certain area of specialization (*e.g.*, electrochemistry).

In the above system, research is performed within a group headed by the mentor professor and could be experimental, theoretical, or even field-oriented, depending on the specific discipline. This higher education model has worked well as long as the knowledge dissemination (or gathering, depending on whether we are talking about a classroom learning or research scenario, respectively) occurs within the traditional boundaries set by specific disciplines such as chemistry, physics, biology, etc. It endows the student with a solid foundation and a degree of specialization that becomes progressively narrower in the training/education sequence going from undergraduate to graduate and on to the postdoctoral stage. What happens when the research problem demands an *interdisciplinary* approach? Does a student with specialization in a single discipline provide the best fit for what the industry would be looking for in a prospective employee?

In the traditional academic setting identified above, larger research opportunities have been tackled by the formation of research centers. These centers often have either a single faculty member heading it or more often are comprised of several faculty members collaborating to attack a specific problem or topic. Each center is administratively headed by a director. It is noteworthy that such centers exist in a continual state of tension within a specific college (or even in cross-cutting college situations) because of the competition for resources their existence poses vis-à-vis the traditional academic silos. Finally research institutes can be identified as campus entities that are larger than centers and are typically staffed by non-tenured or non-tenure-track researchers. Both centers and institutes can be regarded *as a trend* toward breaking the traditional academic mold based on department/college silos.

Now let us *arbitrarily* choose three random topics of societal relevance: energy, healthcare, and nanotechnology. Ask the questions: (a) How well does the traditional academic setting provide the infrastructure needed to enable faculty members to compete for funding? (b) How good a job does it do for training a student (undergraduate or graduate) in these areas? Clearly a system based on *faculty clusters* provides the solutions in both cases, and indeed many campuses (including ours) are embracing the notion of hiring faculty *in clusters* centered on specific topics such as the three identified above. The members of these faculty clusters cut across traditional boundaries set by departments and even colleges. These clusters have to be fluid and nimble enough to respond to varying technological needs, and indeed each cluster may only have a "half-life" of several years. In this regard, the situation is not entirely unlike what exists in the corporate R&D world. Thus a given cluster, for example, may consist of a synthetic chemist, a biologist, a computational specialist, and a materials physicist. Administering these campus clusters, however, can pose logistical headaches and this has thwarted universities from totally embracing this paradigm. What we have instead is a hybrid situation. Stay tuned.

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