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HHMI's Experiment in Changing Scientific Culture

Today's academic and industrial research models have become far too conservative, according to Gerald M. Rubin, director of the Howard Hughes Medical Institute's Janelia Farm Research Campus.

Rubin presents his provocative viewpoints on the state of biomedical research in a *Leading Edge* commentary article published in the April 21, 2006, issue of the journal *Cell*. *Leading Edge* is a new section of *Cell* that highlights the social, political, economic, and ethical concerns surrounding biomedical research worldwide.

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— **Gerald M. Rubin**

An internationally recognized geneticist, Rubin led the publicly funded effort to sequence the fruit fly *Drosophila melanogaster* genome. In 2003, Rubin was selected to become the first director of the Janelia Farm Research Campus (JFRC), where he directs scientific programs designed to speed the development and application of new tools for transforming the study of biology and medicine.

With the opening of Janelia Farm in October 2006, Rubin will head HHMI's efforts to begin shifting the conservative balance prevalent in today's academic research centers by providing an environment where leading scientists can pursue long-term, creative, high-risk research.

Traditional academic environments are suitable for a large proportion of research projects, but Rubin believes they can be too restrictive, stifling the kinds of creative, long-term projects that can lead to true breakthroughs. This is true, in part, he said, because the reliance on external funding sources forces scientists to define their research programs in advance when they apply for grants. By setting the course of the research plan up front, scientists

are restricted in their ability to pursue questions and opportunities that arise during their studies. The bulk of the scientific community is limited to projects that can be funded by peer-review committees, which tend to be very conservative, Rubin said. These grants have to be reviewed every three to five years. It makes it very difficult for people to take on high-risk, high-reward projects.

Likewise, the traditional career and reward structures at universities have similarly constrained creative research, Rubin said. Within universities, interdisciplinary research has proven to be very difficult to do, because of the division of people into departments and the fact that people tend to be evaluated for promotion on their work in a fairly narrow discipline. There's a big premium on doing things that can be assigned to a single person, he said. In some universities, you would be debating 'should James Watson get tenure, or was the idea really Francis Crick's?'

HHMI strives to free creative scientists from these limitations through its investigator program, which employs more than 300 scientists at host institutions around the country. However, the academic culture of these institutions may still be too conservative to foster certain types of research, Rubin said.

We felt we couldn't solve all these problems through the investigator program alone. Just identifying really good people and encouraging them to work on the most important problems regardless of the challenges was not enough. We felt we could and should do more. And to do that, one really has to have complete control over the way scientists are evaluated and the way the culture is set up.

To fulfill the perceived need for a scientific community that complements those currently in existence by promoting and rewarding collaborative, interdisciplinary research, HHMI has created Janelia Farm. When the \$500 million facility opens later this year, approximately 230 resident and 100 visiting scientists will work toward two main goals: Identifying the general principles that govern how information is processed by neuronal circuits; and developing imaging technologies and computational methods for image analysis. From its unique architecture, designed to provide flexibility and foster collaboration, to its extensive scientific and operational support, the campus has been designed as a place where scientists can pursue important biological questions that cannot readily be answered elsewhere.

In planning Janelia Farm, HHMI carefully studied the organization, management, and scientific culture of historically successful laboratories, focusing in particular on what were the Medical Research Council Laboratory of Molecular Biology (MRC LMB) in Cambridge, England, and AT&T's Bell Laboratories in Murray Hill, New Jersey—generally considered to have been the most successful institutions of their time in biology and solid state physics. HHMI has incorporated into its plans for Janelia Farm a surprisingly wide range of operating principles shared by these successful laboratories:

Individual research groups were small. Small group size was considered essential to promote collaboration and communication between groups, as well as good mentoring. Similarly, research groups at Janelia Farm will include two to six lab members. **Group leaders were active bench scientists.** Small group size, extensive core support, and freedom from grant writing and other professional obligations will free Janelia Farm group leaders to actively pursue their own experimental work. **Research was internally funded.** As at the MRC LMB and Bell Labs, internal funding at Janelia Farm will be dependable and generous; outside grant applications will not be permitted. **Excellent support facilities and infrastructure were provided.** Exceptional core service for routine functions, such as glassware washing, and sophisticated functions, such as instrumentation design and fabrication, will enable research groups to function effectively and focus on creative activities. **Staff turnover was high and tenure was limited.** Most scientists at the MRC LMB and Bell Labs were at an early career stage, and moved on to university positions after 5-10 years. There is no limit to the length of time group leaders can remain at Janelia Farm, but they must successfully pass a rigorous scientific review every five years. **Originality, creativity and collegiality were valued and supported.** Like the MRC LMB and Bell Labs, Janelia Farm wishes to emphasize tackling difficult and important research problems. Group leaders will be evaluated based on their ability and willingness to define and pursue these kinds of problems, their originality, creativity, and diligence in that pursuit, and their contributions to the overall intellectual life of the campus.

Rubin points out that it is not HHMI's goal to recreate any of the highly successful research institutes that already exist. Ultimately, he said, the success of this approach could be measured by a deletion test. Twenty years from now, would the scientific landscape look substantially different if Janelia Farm's contributions were to be deleted?

We think of this as an experiment, said Rubin. We don't have all the answers. We have a working hypothesis. We formulated the hypothesis by studying previously successful research institutions and analyzing what made them successful. We may not get it exactly right at first, but we'll adapt. We'll revise the hypothesis, like any good scientist would do.

My fantasy for success, Rubin said, is that in the future, people will say, 'Nothing extraordinary came out of Janelia Farm for a while, but then, truly unanticipated discoveries started coming out after five or ten years. They clearly only happened because they patiently supported very bright people to work on difficult problems. They had the right people and a synergy developed between those people—those discoveries might never have been made in another setting.'