Light in the gloom for cell biologists

Opportunities abound throughout the world for young people interested in cell biology. The most successful will be those who can learn new skills and work collaboratively. But Europe needs to learn an urgent lesson from the United States if there is to be any future for biomedical research in the next millennium.

Brendan Horton

There should be more faculty positions for biomedical PhDs in US academic institutions over the next ten years: research funding from the National Institutes of Health (NIH) has outstripped inflation over the past decade and is likely to improve significantly in the next, and there are more jobs in industry. That was the message in last year's graduate education consensus conference report, published by the Federation of American Societies for Experimental Biology (FASEB), giving gloomy graduate students and postdocs grounds for optimism.

Pessimism about research careers may have resulted from unrealistic expectations and a lack of timely information about available employment (see table under CPST). After all, FASEB now reports that the number of tenure-track and tenured academic positions in the United States has remained fairly constant since 1981. During this time, the number of biomedical PhDs awarded increased from 3,845 in 1981 to 5,878 in 1995, dramatically increasing the competition for available positions.

The low turnover of faculty positions means that people stay longer as postdocs: in 1981, 23.6% of employed biomedical PhDs were on postdoctoral fellowships four years after receiving their degrees, compared with 32.1% in 1995. But the percentage of postdocs employed in research in industry has risen, and unemployment among biomedical science PhDs who are US citizens has remained remarkably low at 1.0-1.9% between 1973 and 1995. Improved reporting of career data should help keep expectations among career researchers more realistic.

Randy Schekman, chairman of the department of molecular and cell biology at the University of California, Berkeley, says: "There's a lot of gloom that the media spreads about prospects for academic positions and funding of junior faculty. In fact, things are better now than when I started over 20 years ago." He says recent reports have "contributed to the bad feelings" among young biomedical scientists. "When I started in the mid-1970s, the competition for the key positions was already pretty keen."

Schekman feels that news about federal funding is encouraging. The NIH budget has more than kept pace with inflation during the past ten years and many feel it will double in the next ten. Schekman says the young faculty members hired at Berkeley and other first-class institutions are often as successful as senior researchers at securing funds from the NIH. (This is not necessarily true in Europe, see p. 821.) And junior faculty are now typically offered set-up packages, often exceeding $0.25 million. Before 1985, these funds were almost non-existent. "I had no set-up package when I started at Berkeley in 1976," says Schekman. Once a successful application has been made to the NIH, grants can also be obtained from private foundations, such as Pew, Searle, Packard, McKnight or Burroughs Wellcome. There are almost a dozen private organizations that give grants to junior faculty to bridge the postdoctoral and early faculty years. "The American Cancer Society, a major player among private foundations, has gone to providing competitive grants only to untenured faculty," he says.

Schekman: sees encouraging signs.

For young researchers not in this select group, there are other opportunities, including careers in biotechnology, research in the government sector, patents work, investment consulting and teaching.

Industry has created many opportunities for PhDs in the United States. According to the FASEB report, the percentage of biomedical PhDs employed in industry more than doubled between 1981 and 1995, to almost 32%. Schekman says these are often attractive positions, offering several years of freedom from looking for funds, involving research similar to that done in universities. "A lot of students see that chasing money, teaching and doing a lot of administration is not what they want to do," he says.

On the trail of scientists interested in doing research outside the academic sphere is Ken Johnson, a staffing consultant for Hoechst Marion Roussel. He is looking for bachelors, masters and PhD graduate researchers to fill scores of positions (see table), as the company has built a US$70 million research centre on its 110-acre campus in Bridgewater, New Jersey, scheduled to open this month. These days, Johnson has to move quickly. "Companies no longer have the luxury of interviewing 20 candidates over six months." Competition for talent is fierce and good candidates typically find a job within six or eight weeks.

Doing a postdoc in industry can be a way for young researchers to test the water in this sector. David Bowen, currently a senior scientist with NeuralStem Biopharmaceuticals of College Park, Maryland, was nearing the

Developing 'chemical genetics'

The idea of an institute where synthetic chemists and biologists work together on common problems has for some time been a dream of Stuart Schreiber, of the department of chemistry and chemical biology at Harvard Medical School (HMS). That dream will be realized later this year as a result of an initiative involving Schreiber, Dan Tosteson, the outgoing dean of HMS, and Marc Kirschner (also at HMS).

The mission of the Harvard Institute of Chemistry and Cell Biology (ICCB) will be to understand protein function *in vivo* by using ligands that inhibit and/or activate proteins at controlled times. The co-directors are Schreiber and Timothy J. Mitchison from the department of cell biology at HMS, and the faculty will include Eric Jacobsen, Kirschner, Matthew Shair and Gregory Verdine, with Rebecca Ward as director of research affairs.

Traditional research approaches use gene mutation to discover how proteins function, but small cell-permeable molecules that bind to target proteins can also be useful, and may be as powerful as gene mutations. In principle, ligands can cause any of the effects of genetic mutations but, at present, there are not enough ligands with known characteristics. "We believe the best way to find new protein ligands is to design libraries of synthetic molecules based on insights from a study of natural products known to bind to proteins. It is this equivalency of ligands and mutations that suggested the name 'chemical genetics'," states the institute's literature.

Research at ICCB will aim to discover large numbers of proteins that act as inhibitors, activators and gain-of-function ligands. The founders hope that "chemical genetics will become a major method for identifying gene function, as well as an important tool for drug discovery".

The institute will be a training ground where chemists and biologists can educate each other. It is expected to employ about 50 researchers and staff, half of them students and postdocs. There will be four fellows, each with a team of two or three researchers from backgrounds such as cell and molecular biology and synthetic organic chemistry. B.H.

Table Sites of internet interest for cell biology

Organizations and societies	
Federation of American Societies for Experimental Biology	www.faseb.org/
American Society for Cell Biology (placement)	www.faseb.org/ascb/place/place.htm
FASEB Consensus Coference on Graduate Education report	www.faseb.org/opar/educrpt.html
Commission on Professionals in Science and Technology (CPST)	www.aaas.org/opst/
Academic laboratories	
Institute for Chemistry and Cell Biology	www.hms.harvard.edu/iccb/
UC Berkeley Department of Molecular Cell Biology	mcb.berkeley.edu/
Corporations employment	
Hoercst Marion Roussel	www.hmri.com
Eli Lilly	www.lilly.com
Incyte Pharmaceuticals	www.incyte.com
Grants and funding (private)	
The Pew Charitable Trust	www.pewtrusts.com/
Packard	www.packfound.org/packhome.htm
Burroughs Wellcome	www.bwfund.org/index.html
Howard Hughes Medical Institute	www.hhmi.org
American Cancer Society	www.cancer.org/grants/index.html
Vanderbilt Medical Center	www.mc.vanderbilt.edu/vumc/biosci/fundag.htm
Tram Research Funding Opportunities	tram.rice.edu/TRAM/fund/index.html
The Foundation Center	www.fdncenter.org

end of his graduate work at the University of California, San Francisco when he started to investigate the various options for using his degree. His scouting produced a collaboration in neurobiology with Regeneron of Tarrytown, New York. After several months of work in California, Bowen volunteered to continue the work at Regeneron for three or four months. The success of the project resulted in him doing a two-year postdoc at the company with George Yancopoulos.

Bowen warns that a postdoc in industry can vary considerably from one company to the next, and even within a company. "Through good planning and good fortune," he ended up doing projects that gave him creative control as well as experience in research. He advises people looking at postdocs in industrial research to establish whether the position will allow them to make decisions or whether they will be executing someone else's plan.

The FASEB report says: "If faculty retire soon after they reach 65, a significant number of jobs in academia is predicted for the next 10 years." However, as retirement is no longer mandatory at 70, the University of California at Berkeley offered an early retirement incentive scheme more than five years ago. This resulted in 30% of the faculty in molecular and cell biology retiring early. "Fortunately, we've been able to recycle most of those positions," says Schekman. Some universities are implementing similar schemes, including Cornell, North Carolina, Pittsburgh and Southern California.

Reasons for maintaining, or even expanding, faculty numbers include the projected increase in college enrolment from 14.2 million in 1995 to 16 million in 2005, and increased interest in the life sciences. According to Schekman, there is a nationwide trend showing that more students are interested in medicine and biotechnology. At Berkeley, molecular and cell biology is the most popular undergraduate course, accounting for nearly ten per cent of students. □

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Favouring the brave

Potter Wickware

With US university science departments saturated and postdocs vigorously competing for the scanty number of faculty openings, does the discouraging proverb "Many are called but few are chosen" describe the lot of job-seekers in cell biology? "Not at all!", asserts Mina Bissell, director of the life sciences division at Lawrence Berkeley Laboratory in California and past president of the American Society for Cell Biology.

But many cell biology jobs are now in new areas: information management, computer science and engineering are becoming integral components of the discipline. High-resolution microscopy, for example, relies heavily on computational biology, a dynamic new subdiscipline rich with opportunity, yet the traditionally trained biologist may not have these skills.

Research problems are becoming so complex that collaborative projects are inevitable, Bissell observes. She believes that agencies such as the National Science Foundation, the space agency NASA and the Department of Energy should significantly complement the National Institutes of Health (NIH) by supporting interdisciplinary research. And universities' criteria for granting tenure must also change to reflect the newly collaborative nature of cell biology.

Are we training too many biologists? "We need all the talent we can get," Bissell emphasizes. She does not believe the gloomy prediction originating in the physics community that the end is nigh for growth in science ventures. "We have only scratched the surface. The Human Genome Project will be completed in 2005 and that will be just the beginning. Looking ahead we see magnificent problems that will keep us busy for decades."

But it must be acknowledged that certain opportunities are limited. The traditional route of academic tenure track at a research institution is a diminishing option. The path chosen by Michael Goldman is an example of the changing career landscape in cell biology. He works on X-chromosome inactivation and trains cell and molecular biologists at San Francisco State University. "When I left the ivory tower in 1988, one of my mentors said 'You're leaving the priesthood'. Not many people would put it that baldly," Goldman says, but it's undeniable that this mindset lingers on.

Goldman observes that in northern California, at least, the job market is strong. Masters and bachelors students are able to land technical jobs within four weeks as research assistants and scientists in the San Francisco Bay area's three main research universities, two large government labs or more than 500 biotechnology companies. The problem is not in placing students, but in ensuring that they complete their university courses, says Goldman. "We're not near the point of saturation in cell biology as a whole, although the academic faculty paid with hard money is at its limit." There are plenty of 'soft' money jobs, a trend that is likely to continue, particularly if the NIH fulfils its promise of increased funding in future.

Gerard Manning did research at Stanford and now develops genome analysis software at Molecular Applications Group, a bioinformatics company in Palo Alto, California. He agrees that the west coast job market is healthy: "There's lots of technician mobility. I've heard of good people getting multiple offers from the first few resumés. Personal contact always helps. In some fields there is an acute shortage — bioinformatics, people with gene-array chip experience." But he notes that cell biology is increasingly being defined by the ability to access, manipulate and interpret huge amounts of data.

How should cell biologists train in information management? It's easier said than done, says Joel Bellenson, who used his Stanford BA in biology and programming skills to co-found Pangea Systems, a bioinformatics company in Oakland, California. "Formalized training is hard because things are changing so fast." Nevertheless, the problems are fairly straightforward. "The DNA and protein patterns and the signalling pathways will always be there, as will the strategy of reasoning from observations derived from