King: favours early introduction.

the Karolinska Institute in Stockholm, is working on the use of microbes or microbial products to study cellular processes (see *Science* **271,** 315–316; 1996). An example is how *Listeria* can move inside cells and polymerize actin. "The opportunities for cellular microbiology are enormous — it brings you to the heart of molecular pathogenesis," says Normark.

Everyone concurs that the integration of molecular biology techniques into cognitive neurobiology is one exciting area, and that the integration of cell biology into a study of pathogenesis at the tissue level is another.

Daniel Louvard, director of the research division of the Institute Curie in Paris, produces an analogy that defines cell biology and captures the flavour of the excitement and opportunity: "Imagine you are a visitor from Mars and you come across a sixteenth-century timepiece, in bits. All those wheels and springs. You know what the concept of 'time' is, but you have all these wheels and things in front of you — it would take you a long time to put it together so it works."

Jacopo Meldolesi is scientific director of DIBIT, the internationally acclaimed basic research branch of the San Raffaele Institute, which hosts the labs of various Milan University professors. He would not rule out a medical degree followed by specialization as a way in to cell biology. Solari, Geuze and Normark suggest starting with a good biological degree (covering molecular biology and genetics), and seek to encourage curiosity about the "culture of biology".

Rod King, director of studies at the National Institute for Medical Research in London, agrees: "I think it's important to introduce students to biology early on, and then they don't get afraid of it, because I don't think there's any doubt that some chemists and physicists never cotton on to biology. They're not attracted, or it remains a pile of nomenclature which is foreign. We have programmes here, for example, which are involved in using quite sophisticated chemistry to construct 'caged' molecules."

Louvard goes further: "On top of molecular genetics, we need more graduates who understand quantitative biochemistry — we also need chemists and physicists to go into cell biology." And Hopkins says: "If I were setting out on a career now, I'd want to have an understanding and a technology that was flexible enough to take me into nerve cells, or the immune system, or whatever. You need to be a card-carrying molecular biologist. You need to know how to manipulate DNA when you are an undergraduate.

"So, if you're coming to university and you want to be a cell biologist, you should make sure you have a sound education in biochemistry and a good education in molecular biology." You will then need a PhD (see box) and, as King advises, "remember, you're very much part of a team".

As with other disciplines, the 'postdoc run' follows the PhD. Short-term postdoc contracts are reasonably easy to find (see box), but permanent jobs are another matter. European governments must give urgent thought to the creation of more permanent jobs for experienced postdocs. Molecular cell biology is the key to biomedical research in all the main health-care problems of the next millennium — including neurodegenerative disease, atherosclerosis and cancer. If the most talented of Europe's young researchers are going to be attracted into, and kept in, academic science, governments need to plan for the future.

Louvard: captures the excitement.

How much money will these governments have wasted in training people to the end of a second postdoc, only to see them dropping out of mainstream science because there is no career structure? □

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Opportunities open up in Dresden

Barbara Miller

Long after political reunification in 1990, Germany is still struggling to achieve economic and social uniformity. Scientific research in east Germany is developing frustratingly slowly, but will receive a welcome boost with the foundation in Dresden of a Max Planck institute for cell biology and genetics, due to open in mid-2000. The directors are Kai Simons, Anthony Hyman and Marino Zerial from the European Molecular Biology Laboratory (EMBL) in Heidelberg and Wieland Huttner of the University of Heidelberg.

One of the fundamental principles of the Max Planck Society, Germany's main scientific research organization, is that its institutes are evenly distributed throughout the country. After reunification, institutes and departments were closed in the west to pay for 20 planned institutes in the east. But progress has not been straightforward. An institute needs a strong local scientific environment. Sadly, standards of research in east German universities are in general lower than in the west.

The fact that the new institute is in historic Dresden rather then in its rundown industrial neighbour Halle will help recruitment, according to Huttner. In Dresden there are relatively few research institutes, mainly concerned with physical sciences. But the small biology faculty at the local Technical University is expanding and will collaborate with the new institute.

East Germany does not have the western tradition of collaborative scientific research. "Combining molecular disciplines like cell biology and genetics in the east did not take place," says Simons. "The most difficult problem will be to attract the best scientists." West German scientists avoid the east because of this historical image. Jürgen Kirschner, director of the Max Planck institute for microstructure physics in Halle, says he has mainly recruited from other countries, particularly Asia. "The image problem will decrease with time," says Kirschner, "but will last at least the next ten years."

The Dresden institute will have a collaborative research programme aimed at elucidating the molecular mechanisms of tissue formation. The main individual projects will be on cell division, structure of cell organelles, membrane transport and cell polarity. The institute will also develop biochemical and microscope techniques in collaboration with the Technical University. Herwig Gutzeit, vice-dean of biology, says: "The university expects to get a large impetus to its own research from the collaboration."

Dresden has always been an important bridge between east and west. "Unified Europe still needs this gateway," says Simons, so the institute will train young scientists from eastern Europe using money from the European Union.

Simons plans to give young scientists a central role in the work of the institute: the relatively small directors' research groups will interact with 19 scientifically independent junior groups. The concept of young scientists as group leaders is revolutionary in Germany.

Simons: not curbed by tradition.

Simons has experienced the advantages of his proposed system while at EMBL, which, as a European rather than a German institution, is not constrained by national traditions. "The young group leaders change because they are hired on fixed-term contracts [for a maximum of five years] and therefore the groups are always filled with innovative ideas and enthusiasm." Recruitment of group leaders is due to start soon, and the institute will soon hold the first in a series of annual symposia. Further information can be obtained from: **dresden@embl-heidelberg.de** □

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