Studies performed in the Netherlands relate the causes for the low participation of women in science to family-related problems, such as part-time employment and its consequences, mainly fewer publications and less international mobility. More importantly, however, the Dutch investigators found that the culture of the work place—competition, lack of access to networks and subtle notions about quality ('quality is what men do')—still block the advance of many women in science. On the same note, Italian studies report that, throughout their career, the probability of a woman being promoted is half that of a man. Varda Rotter, a group leader at the Weizmann Institute in Israel, commented that, 'We do not have the problem that women with children do not stay in the workplace, they nearly all do. But they simply do not advance at the same rate as men.'

The Scandinavian example shows that quota can be an indispensable and invaluable tool if applied carefully and under the right conditions and thus can form part of the 'teeth' that Osborn found lacking. Quota are not well regarded, especially by women, but they may be necessary to kick-start the process and get a critical mass of women into higher positions. Referring to studies on group dynamics, Gábor Rossmann, co-owner of Mänz & Rossmann, a German personnel development company that performs mentoring programmes for working women, estimates that 'at a level of 30% representation, a minority starts having a real influence on the whole group.' Rees confirms that 'it isn't just the legal right for equality and the availability of child care.

These measures only take care of the most obvious obstacles towards equal opportunity. The intangible problem of culture, the fact that promotion works through networks which are dominated by men, can seemingly only be addressed by setting quota, as the Scandinavian example shows.'

But the catalogue of possible supportive measures extends far beyond quotas. Earmarked chairs, research funds and prizes can be very effective in convincing

A man's usually uninterrupted career is taken as standard, which is clearly a disadvantage for women with children

women to apply. The study 'Who applies for research funding' (www.wellcome.ac.uk/publications, or www.natcen.ac.uk for the full report) commissioned by The Wellcome Trust, the Medical Research Council (MRC) and other UK research councils has shown that women apply less frequently for scientific grants than men and that many women often hold termed positions that do not allow them to apply for additional grants. Encouragingly, if women do apply, they have an equal chance of funding in most countries, according to the statistics provided by the Helsinki group. Mary Phillips from The Wellcome Trust confirms that the Trust is looking for 'academic age' rather than 'chronological age' when judging applications and that time taken off for childcare is being taken into account when judging an application.

In the long term, gender mainstreaming may be the most effective tool. This

means that the effect of all proposed actions—legislative or otherwise—will be evaluated in terms of their effect on members of both sexes and adjusted such that no one will be disadvantaged. Clearly, these principles must be thoroughly applied to the recruitment process at universities and institutes. A man's usually uninterrupted career is taken as standard, which is clearly a disadvantage for women with children.

Additional measures include encouraging girls to study the sciences, as fostered in Israel and other countries through education and mentoring of female high-school students. Also important are measures to help women balance work with their private lives. Many women wish to resume a competitive career once their children are older, but few provisions are available for that. The Finnish government's 'Development Plan for Education and University Research' states the right to equal opportunity in education and training for everyone in accordance with the principles of life-long learning. These policies will benefit men and women as they make working life more flexible for both sexes.

It seems that it is not sufficient to make men and women equal by simply passing a law. The Helsinki study is demonstrating that countries must take more proactive measures to overcome male dominance in the higher ranks of science.

Gerlind Wallon

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Movies for teaching science

The first public database of scientific films and images for educational use went online this year

A college teacher in the USA needs to explain to his students how mitochondria produce energy by converting sugar into ATP. How ATPase uses the proton gradient across the mitochondrial membrane in order to do so is complex, so his task would be much easier if he could show a

short animation of the mechanism of this enzyme. The animation exists and is downloadable for free from a German website (<http://www.cells.de>), but the American lecturer is not aware of this.

A French physics professor is preparing a lecture on gravitational waves and how

they are distorted in space by black holes and supermassive stars—a difficult, theoretical topic that could be dramatically enlivened by images and movies. These images exist, as astronomers and physicists around the world have run computer simulations to visualise how

gravity changes in the vicinity of massive objects in space. But these data are scattered over computer hard disks all over the world, and the French professor would need to scan the literature and then contact every single author to access the images and movies that they have produced.

Clearly, the teaching of science could benefit dramatically from the availability of stimulating movies or images. But although most school and colleges in industrialised countries are now equipped with video players, computers with CD-ROM drives or beamers, the problem for the teachers lies in actually finding the images that could accompany a certain topic. And if, after extensive searching on the internet, they find some material to use, they often find that it is too expensive or is incompatible with the school's equipment. This is at a time when many researchers are storing an abundance of films on video, hard disks or CD-ROMs and would not object to them being used for education. The problem is, how to get these films from the researchers to the teachers in a way that does not create huge costs for either party and is easy to use for the latter.

In this era of internet and e-business, the answer is obvious: store the films in a central location and make them accessible via an internet portal, so teachers can browse the archived films and easily download or order them. Such a tool became available this August. Dubbed 'contentport', it is a video archive set up by the IWF Knowledge and Media (the former Institute for the Scientific Film) in Göttingen, one of Germany's two public institutes for the production of scientific and educational films (<http://www.iwf.de>). Although still in development and, at the time of writing, the navigational information is only in German, contentport already contains more than 1200 scientific films and short clips covering a wide range of topics, including the natural sciences, mathematics, ethnology, medicine, psychology, engineering, education and history, many of them in English. Users can browse the database, search films by topics or keywords, download a short descriptive file containing either the whole clip or the most important scenes and, of course, buy them. And the 1200 films are just a start. The IWF is now busy improving the software and plans to triple the number of films in the database

by the end of this year, according to Michael Hanisch, one of the two project coordinators.

The contentport archive is currently the largest publicly accessible database for scientific films. 'We have a pretty unique position, even internationally,' said Uwe

The teaching of science could benefit dramatically from the availability of stimulating movies or images

Sander, Head of the IWF's Department of Online Multimedia, referring to their database of several terabytes, its broad scope and the huge number of films and images they are able to store and distribute. 'This is the first truly scientific film database that exists so far,' agrees David Shotton, a cell biologist at the University of Oxford, UK, and head of the BioImage database project (<http://www.bioimage.org>), an EU-funded database for biological images and videos that will be relaunched at the end of this year.

A large boost for the IWF, of course, was the initial funding of €2.5 million from the German ministry for research and education. 'A private enterprise would be broke if they had tried to set up something like that,' Sander commented on the advantages of this public funding. The other major advantage is the IWF's existing pool of more than 7000 scientific and educational films in all fields of science that the creators of contentport have been able to use to populate their database. 'It's without doubt that the IWF has some of the best biological videos and films in the world,' Shotton said. This would indeed be an enormous help for lecturers if they had access to these films, thinks Dan Taubman, an official at the

scientists, students and lecturers will be able to upload their own film and image material together with descriptive data. Even other carrier material, such as video or 16 mm film, would be no problem, as the institute's equipment allows them to deal with pretty much every material that stores films, said Sander. The film editors at the IWF convert the images into an MPEG format, create metadata for each clip and finally enter it into contentport's database ready for downloading by the public. The aim is to create a forum for the exchange of scientific films and thus increase the networking and communication between scientists, said Hanisch.

The IWF has had to overcome several hurdles during the development of the database. Creating the technical infrastructure, for instance, was not a minor task. Even a 1-min film clip easily amounts to several megabytes of data, so one problem was to create sufficient storage space and computer power. Half of the initial funding actually went into computer hardware, and the IWF now boasts a memory capacity of several terabytes that can store up to 500 h of film and provides enough server capacity for 100 simultaneous downloads. In this regard, the institute profited from its experience with digiclip and www.cells.de, contentport's predecessors, which provide in-house-produced movies, animations and multimedia software that have become popular among teachers, lecturers and scientists worldwide.

Furthermore, no film goes online without editorial work to ensure certain quality standards. 'Actuality is not our main concern. We have a different emphasis on quality and accuracy,' said Ulrich Roters, one of the IWF's editors, describing the standards that apply to the database. This has, in fact, been another technical

One major advantage for the IWF was the existing pool of more than 7000 films in all fields of science that the creators of contentport use to populate their database

Colleges Department of NATFHE, the UK's university and college lecturers' union. 'A good teacher can make use of films no matter what field,' he said.

But contentport is supposed to be more than just an archive of IWF films for lecturers. 'We will offer a new distribution channel for all audiovisual media in all [scientific] fields,' said Hanisch. Eventually,

challenge. Every film contains additional information, some of which will be visible on the final internet portal, such as subtitles, a short description, speech text, copyright information, etc. In addition, shorter sequences and descriptive images are created from each film to give the user additional visual information. Much of this data generation is done automatically,

but it still requires human input, because 'you cannot trust machines,' as Roters put it. As films also need to be citable for scientific use, the IWF adds time codes that allow exact identification of events taking place in the film.

All this comes with a price tag. And since the German government has stated that it will not provide any further money beyond the initial seed funding, the IWF has had to produce a business model. Teachers, lecturers and scientists can either buy a 1-year subscription or buy films on a pay-per-view basis. Prices, as given on the website, range from €4 to €32, but these are the maximum for a one-time user who orders films on CD-ROM, explains Hanisch, and universities as well as subscribers will get a wide range of discounts.

The owners of the images will retain the copyright, which allows them to sell their material to third parties, but they will not get any returns if the IWF sells their films to individuals or non-profit-making institutions. 'We grab this money,' Roters said, 'for the purpose of maintaining the system.' However, if commercial enterprises buy a film, the IWF charges normal market prices that can amount to several thousands of euros per minute, and the institute shares this income with the film owner.

The project is the result of a change of strategy within the IWF. Traditionally, the institute's mission was to produce educational films for high schools and universities, but it is now moving more towards acquiring material rather than producing it in their own labs. 'The idea is to get away from the in-house production because this can only cover punctual aspects,' Sander explained. 'We now rather invest our efforts in acquiring these things from other sources.' This is actually a response to recent developments in light microscopy, particularly the advent of new technologies such as GFP and confocal laser scanning microscopy, explains Shotton. 'It is understandable why the

IWF is doing this,' he said, 'because the sophisticated imaging equipment is now all in the scientists' lab,' he said. Consequently, active acquisition of film material will be an important part of the project's first stage, Sander said.

This may indeed be necessary. 'The IWF always had problems getting original material,' Steffen Lindek, a former interim development manager of BioImage, commented, because 'this works exclusively on personal contacts. Some authors like to have exclusive control about the use of their images,' he said; however, 'there is a willingness in general [to provide images and films] because they expect synergies from doing so.' Another potential source might be teachers and lecturers who have already prepared film material for their students. But again, they might also be inclined to keep control over their work. 'I think it is an attractive idea, but teachers might get worried about doing all the work and then not getting any credit for that,' Taubman cautions. Hanisch, however, is confident that the service will become attractive for scientists, particularly as they hold the copyright on their films. 'We don't want to take it away from

Shotton agrees that the IWF's product is an immensely helpful and unique tool to meet the demands of teachers and lecturers, but he remains cautious about whether it will become the main video and image database for the scientific community. One point he makes is that scientists would have to pay to get access to the stored films, which would set the IWF in competition with other image databases that provide their content for free. Furthermore, the metadata that is created for each film may not be sufficient for all scientific purposes, Shotton maintains, particularly for microscopic images and videos that come with a large amount of additional data describing the experiment so that it can be reproduced by other scientists.

Nevertheless, databases holding images and movies are seen as an increasingly important tool for the scientific community, particularly as the traditional infrastructure of scientific publishing is not currently able to cope with this new material. Massive amounts of data need to be stored and made accessible for scientists worldwide without restricting their access. And the amount of film and image

Databases for images and movies are an increasingly important tool for the scientific community, as the traditional way of publishing is not able to cope with this material

them,' he said, 'just the opposite,' namely helping scientists to distribute their films. Also, by including data from other scientific film and image databases into contentport, Hanisch hopes that it will become a central portal and the first stop for people searching for scientific films. 'Our aim is to include everything in our database,' he said, 'and we know that our product provides a very good basis for that.' He envisages that other databases will provide the metadata of their archive films for contentport to include in their database, and they would link to the original site if a user requests one of these films.

data is expected to grow. 'I think it will increase, simply because the technology [to create films] is getting cheaper,' Lindek expects. Databases such as contentport or BioImage are thus meeting a definite need and may be the forerunners of a new trend as the amount of film data increases. 'Now it is necessary to create the infrastructure, simply to maintain order,' Lindek said.

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