And so we are building a mountain of knowledge that at once says much and little. But how do we communicate this to the public? People are still in the process of grasping *Mendelian* genetics; it is a further conceptual step to accept the *complex* genetics and interplay with the environment involved in the development of behavioural traits. While the benefits of medical genetics are important to emphasize, we need to be sensitive to the public's concern for privacy of data and integrity of use of those data. Furthermore, we must acknowledge their fear of the re-emergence of eugenics in the form of prenatal testing for inherited diseases. Knowing and analysing the sequence of the human genome holds great promises as well as great dangers. Knowledge *per se* has no value without a worthy application. It is up to us to develop the promises

and thwart the dangers. As Britain's Prime Minister, Tony Blair, said in his statement on the human genome project: 'With the power of this discovery comes, of course, the responsibility to use it wisely.' Perhaps what he meant was '...must come the responsibility...'

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JBIC will pool Japanese genomics research

Japan's efforts to catch up in bioinformatics

Last month, the Japan Biological Informatics Consortium was officially established as an independent, non-profit organization after having reached all of its planned goals within its first 3 years. JBIC is a consortium of academia, government and industry, and its aim is to pool Japan's research resources in bioinformatics. Founded in 1998 by the Japan Biotechnology Association (JBA) with financial support from the Japanese Ministry of

International Trade and Industry (MITI), it will now contract with governmental institutions and biotechnology companies to pursue and support genomics research and application. JBIC is part of a growing Japanese effort to catch up

with the USA and Europe in the rapidly emerging field of bioinformatics.

'There has been no infrastructure for bioinformatics, the interdisciplinary science. Research activities were not integrated. We have to join forces,' Kazuo Katao, director of the Biochemical Industry Division, Basic Industries Bureau of the MITI, explains why the Japanese government decided to provide funding for the establishment of an interdisciplinary organization. To close the gap particularly with the USA, Katao, a former chemical engineer, created JBIC in 1998 with a phone call. 'I called JBA to establish the head of the body to fix the lack of infrastructure in Japan,' he recalls. 'We don't have many [management] resources to invest, so I called on the JBA council,' he explains why MITI was asking the Japanese industry for help.

The industrialization of biotechnology with heavy support from the government is a legacy of the late Prime Minister Kenzo Obuchi and falls under 1999's 'Millennium Project'. However, the intense co-operation between industry and academia has always been an essential

part of the Japanese economy and politics. In the field of biotechnology, it had started half a century earlier with the establishment of the Japanese Organization of Industrial Fermentation in 1942. Its successor, the Japanese Biotechnology Association now comprises a group of 300 companies, 100 public organizations and 1300 academic institutions. Often under the auspices of MITI, these groups focus and drive research and development further, and have a considerable influence on Japanese economic politics.

It is Japan's perception that it has to catch up with other countries in genomics research and bioinformatics

Another impetus for the establishment of JBIC is Japan's perception that it needs

The father of JBIC, Kazuo Katao

to catch up with other countries in the new sciences—particularly in the areas of genomics research and bioinformatics. Japan is hampered by its small academic infrastructure relative to those of the USA and Europe. For instance, Japanese universities offer fewer courses in bioinformatics. Japan also has fewer students and teachers, particularly in the interdisciplinary fields that have become increasingly important for genomics research. To overcome the limited resources, MITI is applying the same strategy that has made Japan a major player in electronics and computer technology, pooling available resources in academia and industry and concentrating them on economically important fields of research. In this way, Japan hopes to reap economic benefits from these emerging technologies. Toru Yao, a consultant to the Genomic Sciences Center of RIKEN, the Institute of Physical and Chemical Research, expects the new JBIC to become 'central to bioinformatics in Japan' by linking the efforts of industry, government and academia. According to its founder Katao, JBIC ultimately aims at connecting all genomics research efforts in Japan.

By pooling available resource and concentrating them on economically important fields, Japan hopes to reap economic benefits from the emerging technologies

When established in November 1998, JBIC was a consortium of 12 companies together with academic and government institutions. Since then, JBIC has grown to 63 companies with the ultimate target of 70, according to Katao. The industries involved include pharmaceutical companies, computer and bioinformatics companies, and companies from the food processing and food additive industry. Among the members are global companies such as Takeda Chemical Industries, Chugai Pharmaceuticals, Sankyo, Hitachi, the Mitsubishi Chemical Corporation, Compaq Computer, Fujitsu and

NEC. 'JBIC is very unique in the world because of the collaboration among biological companies, information technology companies, and measurement device companies,' Yao, who was a consultant to JBIC for its first 6 months after its creation in 1998, points out the advantages. Non-industrial members include RIKEN, the Biomolecular Engineering Research Institute and the Helix Research Institute and several other national institutes. Now JBIC will be led by the former president of Mitsubishi Chemicals, Masahiko Furukawa, who was unequivocally elected as JBIC's first chairman. He will be supported by five vice-chairmen.

The initial funding for JBIC prior to its incorporation as an independent organization was provided exclusively by MITI, despite the involvement of the Japanese industry. The budget increased from 4.3 billion yen (42 million Euro) in 1998 to 18.1 billion (177 million Euro) within 3 years of its creation. As an independent organization, JBIC will now be able to rely increasingly on income from contractual work. 'If you want to jump, first you have to run,' Katao explains why the Japanese government decided to finance JBIC by MITI alone for the first 3 years. However, MITI will continue to support JBIC's work with an amount yet to be decided. The ministries of Agriculture, Forestry and Fisheries, Health and Welfare, Education and Culture as well as Science and Technology, will provide additional funding now that JBIC formally has become independent.

The projects started this year fall into several categories such as monitoring technology, informatics analysis and utilization, and protein analysis, and will continue to be funded by MITI. JBIC's projects include gene network analysis system, generation of high quality BAC libraries, database and analysis tools for single nucleotide polymorphisms, and computer modelling software. A fourth category of molecular interaction projects includes gene expression analysis. Indeed, as Katao points out, JBIC will focus its efforts mainly on protein structure and functional genomics. And although JBIC will concentrate on the field of genomics information, Katao expects the consortium to expand into related fields as well, due to the increasing importance of this technology. 'We

understand proteomics as one of the important areas deriving from genome research,' he says.

Representing an influential part of the Japanese industry and academia, JBA and JBIC are also playing an increasingly important role as representative organizations in global disputes involving the biotechnology industry. For instance, although not officially connected to the Japanese government, JBA is playing a supporting role in the government's challenge to the USA on the patenting of expressed sequence fragments. JBA and the Japanese government have confronted the US Patent Office about the recent patenting of human kinase homologues by Incyte Pharmaceuticals in Palo Alto, CA. As JBA expressed its stance in a public statement last year, 'We are worried that if patenting of this type of invention becomes common practice, it will seriously affect the entire global bioindustry.' As JBIC agrees with JBA on the patenting challenge, it is expected that the two organizations will unite in this debate.

JBIC also plans to join JBA in public education and opinion campaigns to promote public acceptance of the new bioscience technologies in Japan. Both organizations are particularly focusing their efforts on addressing public concerns about genetically modified food. JBA has already engaged in issuing the consortium's opinion about the labelling of GM food. It is clear that JBIC will become a major influence on biotechnology in Japan.

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