

Technical university

Fears of an engineering gap

THE Danish Technical University (DTH) dates back to 1829, when it was established by the illustrious Hans Christian Ørsted, who first demonstrated the connection between electricity and magnetism. Shunted from venue to venue over the years, DTH finally found a permanent home during the fat years of the 1960s, when it was established on the grounds of a former airfield in Lyngby, 15 kilometres from the centre of Copenhagen. The move was completed in 1973, and the end result was a tripling in size.

DTH admits 1,000 students a year, granting both *Civilingeniør* (Master of Science in Engineering) and *Licentiat* (Doctor of Engineering) degrees. About 80 per cent of the students are in the former programme.

Research is carried out on an internationally recognized level in areas such as microelectronics, computer-aided design and applied physics. A permanent research staff of about 500 is augmented by 300 short-term staff and 150 international visitors a year. Special priority areas have been set up to try to keep Denmark's research in step with the inter-

national competition. Notable among these is MIDIT, a programme in modelling, non-linear dynamics and irreversible thermodynamics.

DTH faces considerable difficulties in the years to come. Heading the list is the expected shortfall of engineering students highlighted in a recent Organization for Economic Co-operation and Development (OECD) report on Denmark's national science policy. The OECD warned that despite an absolute increase in the number of engineering students (the number of civil engineering graduates nearly doubled from 1977 to 1986), universities will be hard pressed to train as many young engineers as Denmark needs.

In addition, DTH is plagued with that ailment familiar to most engineering schools of not being able to attract enough young faculty members. Salaries in Danish universities "can't compete with those in private industry", says DTH rector Hans Peter Jensen. The company is far from being a ghost town, but the implication is that the 1990s will bring not enough students, and not enough teachers to teach them. □

Carlsberg Laboratory

Not crying in their beer

SOME of Denmark's happiest scientists work for a brewery. But the basic researchers at the Carlsberg Laboratory are not there just for the beer. With a budget (DKr 60 million) as large as that of the Natural Sciences Research Council, the Carlsberg Laboratory is one of the most highly respected institutions in Denmark.

Founded in 1875, it was established to develop "as fully scientific a basis as possible for the operations of malting, brewing and fermentation". The laboratory, which carries out basic and applied research, was augmented in 1976 by the Carlsberg Research Center, which does only applied research. Both are owned by United Breweries, which produces the Carlsberg and Tuborg brands of beer. The breweries' majority stockholder is the Carlsberg Foundation, which also gives grants to university researchers and supports artistic endeavour in Denmark.

The laboratory's two departments, chemistry and physiology, have been directed by a series of world-class researchers, starting with E.C. Hansen, head of physiology from 1887-1909, who developed the first pure culture of yeast, a boon to brewers and biologists alike. S.P.L. Sørensen, head of chemistry from 1901 until 1938, was famous for the buffer system that served for years as the standard for the definition of pH.

The current head of physiology, Diter von Wettstein, continues the tradition of excellence. Von Wettstein, a fourth generation biologist, has interests in plant breeding as well as molecular biology. The group of researchers he has assembled includes Morten Kielland-Brandt, whose group works on changing the efficiency of certain enzymes in brewer's yeast using the techniques of molecular biology. Should the effort succeed, the average



Diter von Wettstein, head of physiology at the Carlsberg is a "fourth-generation biologist".

brewing time of beer might be reduced from several days to several hours.

The chemistry department is using site-directed mutagenesis to change the specificity of the yeast enzyme carboxypeptidase Y, which is useful for peptide synthesis. If the goal of producing a variety of specificities and having the enzyme secreted from the cells instead of being stored in a vacuole is achieved it

Århus Science Park

Look for industry on the windswept Jutland peninsula, and all you are likely to find is a Lego factory pressing toys out of plastic. Although the chemical and electronics industries are making inroads on Jutland's pastoral setting, much of its economy is still agricultural. But now a small group of people in Århus are sowing the seeds for the kind of high-tech industry that makes government ministers salivate. With enthusiastic backing from Århus University, they have started Århus Science Park, which is still not much bigger than the tiny saplings planted neatly in its courtyard.

The philosophy of the park is conservative. Instead of trying to be a publicly financed 'motor' for technology development in the area, it is simply providing space for technology development "with the objective of creating research-based production". The aims fit in with the desires of the Danish government to link basic research with industry in such a way as to increase productivity.

Local industry showed enthusiasm for the project from the start. Banks, companies, and the Århus University research foundation contributed to an initial investment of DKr 9 million, which was used to lease the land and erect the first buildings. The number of local 'member firms' has risen from 21 in 1985 to 125 in mid-1987. Tenants include a branch of the Danish water quality institute, a cancer virology laboratory supported by the Danish Cancer Society, and an engineering firm trying to find ways to recycle the waste products from fish processing.

Science Park academic administrator Jørgen Anderson (one of a total of four employees) explains that the general pattern of support within the EEC for innovation parks may catch on in time. But in Denmark, it is necessary to start smaller, because "most firms don't have a tradition of having scientific people in their labour force". Jutland, he explains, is even more conservative than the rest of Denmark in this respect. The thought of spinning off projects from Århus University, a few blocks away, is "still a dream". □

could be of major significance for the biotechnology industry.

But it all comes back to beer. As von Wettstein puts it, "Of course we want to help improve the quality of the beer — the more beer that's sold, the more money we get to do research". In general the brewers do not pay too much attention. At one point, however, the Carlsberg Research Laboratory discovered that the taste difference between Carlsberg and Tuborg is accounted for by their 3-methylbutylacetate content. That was, says von Wettstein, "the first time we made an impression on the brewers". □