

(US\$900 million) to £720 million in 1993 to try to maintain its success in developing such popular drugs as its anti-ulcer medicine Zantac. And while most of Japanese industry has held down R&D spending, Japan's drug industry increased its spending on R&D in 1992 by 6 per cent, a rate well above inflation. Similarly, in the United States and Switzerland drug companies are maintaining heavy investment in drug development, exceeding 10 per cent of sales.

Another glimmer of hope is offered by the election of Bill Clinton as US president. Many observers expect Clinton to strengthen government support of industrial research, much as the Ministry of International Trade and Industry does in Japan. But any such policies are unlikely to have much effect on spending during 1993.

David Swinbanks

## Agricultural biotech moves into spotlight

The year is likely to be the most critical yet for the agricultural biotechnology industry. This summer, all eyes will be on Calgene, Inc. of Davis, California, as it introduces its rot-resistant Flavr Savr tomato into the \$3.5-billion annual US market. A successful launch will also pave the way for the next wave of genetically engineered foods and make it easier for agricultural biotechnology companies to raise capital.

Roger Salquist, Calgene's chairman and chief executive officer, has become the industry's standard bearer in building consumer confidence in genetically engineered foods and doing battle with critics. A frequent foe is Jeremy Rifkin of the Washington-based Foundation on Economic Trends, who agrees that this year will also be critical for the foundation. He has promised to step up his 'Pure Food Campaign', and to lead a boycott of each new genetically engineered food until regulators implement pre-market testing and labelling of the foods.

All Calgene has actually done with its Flavr Savr tomato is to isolate the gene that codes for the polygalacturonase enzyme and reintroduce it into selected tomato varieties in the reverse or 'antisense' orientation. That change blocks the action of the enzyme, which causes softening of the fruit, by as much as 99 per cent, producing a better-tasting, longer-lasting tomato that can be harvested from the vine when ripe instead of ripening artificially. If Calgene's tomato is rejected by consumers, predicts Louis Da Gama, executive director of the UK BioIndustry Association (BIA), the idea of introducing novel genes into crop plants "will be dead in the water".

The Flavr Savr tomato is expected to be followed within a year by crops able to tolerate herbicide treatments, and within two to three years by crops resistant to insect attack. Eventually, companies hope to

develop families of genetically modified oils and fatty acids for use as foodstuffs and in industrial applications as biodegradable lubricants and hydraulic fluids.

At the same time, there is little reason for optimism among those working on novel animal technologies. Genetically engineered bovine somatotropin (BST), when injected into lactating dairy cows, can boost milk yields by 10 per cent or more but offers no benefit to consumers. Despite a clean bill of



health from several review panels, the drug has become a prime target for consumer lobbyists who have raised questions about its safety and who say that it will put small farmers out of business.

Some expect a smoother regulatory ride in the United States for genetically engineered porcine somatotropin, which when given to pigs produces leaner meat. Philip Paxman, chairman of the European Trade Association for Advanced Animal Breeding, points out that a more efficient, more profitable animal is not enough. "There also has to be a social benefit", he says, such as the use of animals to produce human therapeutics or as model systems to study human disease.

Early this year, the European Commission (EC) is expected to start a significant research initiative in agricultural biotechnology involving more than 50 research laboratories. Managed jointly by the John Innes Centre in Norwich, England, and the Max Planck Institute for Breeding Research in Cologne, Germany, and funded initially for three years, the programme is intended to strengthen the European science base and make it a stronger international competitor. Richard Flavell, director of the John Innes Centre, says that the programme will try "to create a platform of research right across Europe that is seamless and that will give

rise to discoveries, trained people and information that will be particularly useful to European industry". It is expected to cover research into plant development, with emphasis on hormones and related growth substances, in addition to environmentally friendly agricultural research, research to improve the quality of harvested products and the use of beneficial microorganisms.

Despite positive news last year for the agricultural biotechnology industry in the United States, a patchwork of regulations still exists in Europe. The Council of Ministers' directive on the deliberate release into the environment of genetically modified organisms, due to be adopted by member states in October 1991, has yet to be implemented by six of the 12 countries of the European Communities.

There is some progress expected on the 'novel foods' regulation, under discussion in the Council and in the European Parliament. The regulation sets out a means of assessing the safety of all novel foods and food ingredients, including those produced from or containing genetically modified organisms. The BIA opposes the current proposal, believing that it would place European industry at a disadvantage by going beyond international standards on safety, efficacy and quality.

Legislation is also under discussion in the EC for the labelling of foods produced by genetic modification. Last May, the US Food and Drug Administration gave preliminary approval to eliminating pre-market review and labelling of foods derived from biotechnology except in circumstances where levels of a naturally occurring toxicant have been increased, when an allergen not usually found in a plant has been introduced and where levels of important nutrients have been changed (see *Nature* 357, 352; 1992).

Diane Gershon

## Magnetic fusion proceeds with no end in sight

The inauguration of the Tokamak Fusion Test Reactor (TFTR) at Princeton University on Christmas Eve 1982 was described by the world media as the dawn of the era of fusion energy. Almost exactly a decade later — and 35 years after Sir John Cockcroft said (mistakenly) that he was "99 per cent certain" fusion had been demonstrated at Britain's Harwell laboratory — clean, commercially available energy remains a long-term dream.

This year, for reasons both scientific and political, fusion is again likely to make headlines. On the experimental front, two events stand out: the Joint European Torus (JET) at Culham, England, is expected to reopen in October after being closed for