

# History of 'biotechnology'

SIR—Although old uses of the word 'biotechnology' have been noticed<sup>1</sup>, no satisfactory lineage has been traced. I should like to draw attention to a source that fulfills three strict criteria: a self-conscious claim to novelty, recognition from others of that novelty and noticeable use of the word.

In 1919, Kark Ereky, the Hungarian agricultural economist and, briefly, minister of food in the counter-revolutionary government, published an 84-page manifesto entitled: *Biotechnologie der Fleisch-, Fett- und Milcherzeugung im landwirtschaftlichen Großbetrieb*. Following the precedents of chemical technology and mechanical technology, Ereky coined his new word to cover the interaction of biology with technology, connoting all production by means of biological transformation:

*Auf Grund des gleichen Gedankenganges weist der Verfasser alle die Arbeitsvorgänge, bei denen aus den Rohstoffen mit Unterstützung lebender Organismen Konsumartikel erzeugt werden, dem Gebiete der Biotechnologie zu. [original emphasis]<sup>2</sup>,*

which may be translated as: "On the same grounds the author classifies as biotechnology all the lines of work by which products are produced from raw materials with the aid of living organisms".

Ereky's book was well received and its originality recognized. *Die Naturwissenschaften* described the author's goal as a new branch of knowledge that he calls *Biotechnologie*<sup>3</sup>.

Thereafter, the word biotechnology appeared in various contexts in the 1920s and early 1930s. Some applications clearly follow from Ereky's formulation. It appears immediately as a heading in *Zeitschrift für Technische Biologie*<sup>4</sup>.

Other uses should not, however, be attributed to Ereky. The similar word *Biotechnik* had come into use at about the same time, and although there is a difference in nuance, even in German the two words could be interchanged<sup>5</sup>. In English translation, the distinction is almost entirely lost. *Biotechnik* therefore spawned the alternative meaning of the English biotechnology. In one of the first English uses, *Nature* entitled a 1933 editorial "Biotechnology"<sup>6</sup>. Dealing with technology and the problem of maintaining the quality of the human species, its title seems to refer to the concept of *Biotechnik* presented by Goldscheid in his social biology of 1911<sup>7</sup>.

Since then the word biotechnology has been reformulated many times: in 1947 to describe ergonomics<sup>8</sup>, in 1962 as the title for a new journal dealing with biochemical and microbiological engineering<sup>9</sup> and in 1979 to describe the potential of genetic manipulation<sup>10</sup>. The distinction between

different usages has often been overlooked because they do share an important connotation: a new biological approach to a great range of industries. This breadth was foreshadowed in the aftermath of the First World War by Ereky's formulation of the concept of biotechnology.

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1. Dixon, B. *New Scient.* **105**, 38 (1985).
2. Ereky, K. *Biotechnologie der Fleisch-, Fett- und Milcherzeugung im landwirtschaftlichen Großbetrieb* (Paul Parey, Berlin, 1919).
3. Pringsheim H. *Naturwissenschaften* **7**, 112 (1919).
4. Lindner P. Z. *Technische Biol.* **8**, 54–56 (1920).
5. Hase A. Z. *Technische Biol.* **8**, 23–45 (1920).
6. *Nature* **131**, 597–599 (1933).
7. Goldscheid R. *Höherentwicklung und Menschenökonomie: Grundlegen der Sozialbiologie* (Werner Klinkhardt, Leipzig, 1911).
8. Taylor, Craig L. & Boelter, L.M.K. *Science* **105**, 217–19 (1947).
9. Bud, Robert. *Chem. Brit.* **24**, 441–444, 466 (1988).
10. US Trademark, 1180658 filed 3 December 1979, expired 1 July 1988.

## Primer availability

SIR—The possible applications of the polymerase chain reaction (PCR) (see ref. 1), which amplifies specific DNA sequences during successive cycles of DNA denaturation and extension of specific oligonucleotides (primers) by DNA polymerase, are enormous, both for basic research and for molecular diagnosis of inherited disease. In most laboratories involved in molecular diagnosis of genetic diseases, PCR will gradually replace routine DNA techniques of Southern blotting and hybridization with radioactive probes. A prerequisite to perform PCR, however, is the availability of the specific primers.

Recently, I requested primers for prenatal diagnosis of two common genetic diseases. On both occasions the answer was negative, although the papers describing the primer sequences and their possible applications had already been published. Costs of synthesis and distribution of the primers were probably the main factors hampering their release. If this becomes a general policy, laboratories will each have to face the problem of synthesizing the respective primers for all the different diseases they are studying.

Most companies charge \$1,000–\$2,000 to synthesize 10 micromoles of a 20–30 base pair oligonucleotide, which is enough to provide 100 laboratories with primer for 1,000 PCRs. With small fees (\$15–\$20) from each of the laboratories requesting the primers, costs for synthesis and distribution could easily be covered. It might be opportune, for logistic reasons, to centralize primer synthesis and distribution in an organization such as the American Type Culture Collection (ATCC), which has become a central depository and distributing organization

for DNA sequences.

The free release of DNA probes to laboratories throughout the world has contributed largely to the exponential increase in our understanding of genetic diseases. For the future, it is essential to guarantee the availability of the necessary PCR primers.

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1. Saiki, R.K. *et al. Science* **239**, 487–491 (1988).

## Soviet refusniks

SIR—We appreciate the increase in the number of exit visas from the Soviet Union granted to Jews, including some long-term refusniks who want to emigrate.

But despite the sizeable increase in the number of visas, a substantial number of long-term refusniks have no foreseeable hope of leaving. Several of them have been waiting for more than 15 years, and some have been told that they will not be allowed to leave until 1992 or 1996.

In most cases, the reason given is that of having access to secrecy. For instance, the Uspensky family has been refused because Igor Uspensky's mother, who is in her late seventies, worked in the Ministry of Agriculture until she retired 12 years ago. She has been told that the reclassification of her secrecy will take place after 1996 (when she will be 84 years old). This not only prevents her from leaving but also her son, daughter-in-law and grandsons. If they were not so tragic, one could put such classifications in the realms of the 'Theatre of the absurd'.

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## Biblical criticism

SIR—The recent note (*Nature* **335**, 203; 1988) on the history of the survival of the Aleppo Codex describes the codex as the Hebrew Pentateuch, the first five books of the Old Testament. But the portion reproduced is of a passage from the Book of Judges (9:57 to 11:2). It includes the first part of the story of Jephthah — his exclusion from his paternal inheritance by his step-brethren because he was "born of another woman".

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● The Aleppo Codex originally contained all the books which now constitute the Old Testament; about one-third of the text has been damaged or destroyed. Editor, *Nature*