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1. Marshall, E. *Science* **284**, 883–886 (1999).

2. Goeddel, D. V. et al. *Nature* **281**, 544–548 (1979).

Statement from Peter Seeburg

Sir—I, as an inventor of a patent held by the University of California on cloned human growth hormone complementary DNA, was a witness in a trial involving a patent dispute between the university and Genentech (see page 289 of this issue and ref. 1).

My testimony concerned events that occurred 20 years ago, my work at the University of California, San Francisco (UCSF) and early work at Genentech, which collectively resulted in the expression of human growth hormone (hGH) in bacteria. This pioneering work with my colleagues at Genentech was the culmination of three years of previous efforts at UCSF by which I and my colleague John Shine had succeeded in cloning the main part of the coding sequence for human growth hormone. It had been a difficult personal time as this project had often involved working nights, owing to efforts by my lab head to stop my research on growth hormone, as documented in the 1987 book *Invisible Frontiers: The Race to Synthesize a Human Gene* by Stephen S. Hall (Tempus Books of Microsoft Press).

As I testified during the trial, the *Nature* paper² reporting the landmark study by Genentech regrettably contains a technical inaccuracy. This inaccuracy concerns a plasmid, pHGH31, which represents one of the intermediate steps in the construction of the expression vector for hGH. In this plasmid, the coding region for amino acids 24–191 plus 3' noncoding sequence, all contained on a 551-base-pair *Hae*III complementary DNA fragment, is inserted by 'GC tailing' into the *Pst*I site of pBR322. Not this plasmid, but an equivalent one carrying the same 551-base-pair *Hae*III fragment inserted by linkers in the *Hind*III site of pBR322 and previously constructed by me and Shine at UCSF, was used as source of the natural coding region for amino acids 24–191 in the construction of the final hGH expression vector.

The existence of pHGH31 is questioned

by the fact, acknowledged by Genentech, that there never was a sequence record showing hGH DNA sequence attached to a G or a C tail, even though such a record should have existed, according to the *Nature* paper. Several attempts at Genentech by a colleague and me to obtain pHGH31 were unsuccessful, primarily due to the poor quality of the RNA starting material available to us at the time. With increasing pressure to complete the expression work, my colleague and I agreed to use the University of California's cDNA clone for part of the work.

To be absolutely clear, I, like my coauthors, view it as mandatory that publications are correct in all aspects, including all technical and methodological details. Hence, I deeply regret that, contrary to my own principles and the principles of scientific endeavour, the *Nature* paper contains a technical inaccuracy.

As I emphasized during the trial, all scientific results and conclusions of the *Nature* paper are unambiguous and correct. The expression vector is exactly as described and the bacteria make the correct hormone at the levels described in the publication. The study reported in the paper forms the basis for the first human growth hormone preparation free of neurodegenerative agents³, and the first recombinant therapeutic to be marketed by Genentech, from which 100,000 children benefit worldwide.

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1. Marshall, E. *Science* **284**, 883–886 (1999).

2. Goeddel, D. V. et al. *Nature* **281**, 544–548 (1979).

3. Seeburg, P. H. "Human growth hormone: from clone to clinic"
Cold Spring Harbor Symposia on Quantitative Biology **51**,
669–679 (1986).

Innocents suffer as rogue regime rapped

Sir—Christian Seelos's Commentary, "Lessons from Iraq on bioweapons", discussed only active warfare, where the weapons themselves contain infectious materials or biological toxins (*Nature* **398**, 187–188; 1999). He failed to mention an equally nefarious kind of biological warfare, of the passive variety.

The bombing of Iraq during the Gulf War targeted infrastructure, with drastic effects on public health. One of the many results was a lack of water free of infectious particles, which led to a resurgence of bacterial infections, especially infantile diarrhoea, cholera and many other infectious diseases. The mortality rate for infants soared, with excess mortality of

close to a million children, exacerbated no doubt by the severe malnutrition that the United Nations embargo has imposed.

One factor that exacerbated this problem was the lack of chlorine, which the UN Special Commission (UNSCOM) has decreed to be, in Seelos's sanitized phrase, "dual use". Eventually another UN agency, the children's fund UNICEF, campaigned to allow chlorine back, but the amount recently allowed is probably enough for only two or three cities. This kind of biological warfare is similar to poisoning wells or rivers upstream of besieged cities, which has its own long and notorious history.

Yet these issues are not discussed, perhaps because the personal viewpoint of Seelos, or the official one of UNSCOM, is that only when you lob the carcass of an infected animal into a besieged city do you commit the horrible crime of biological warfare. Or else, they might simply state, in the words made famous 50 years ago, that they were only following orders.

How many more people have to die before we decide that the price of our policies towards the rogue regime of the day is unsupportable?

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Science powerhouse of Central America

Sir—Small is beautiful, but when you are small nobody sees you. Democratization of Latin America is our chance to progress as a region, as your supplement on *Science in Latin America* demonstrates (*Nature* **398** (Suppl. 1 April); 1999). The articles on recent developments in Mexico, Chile, Argentina, Brazil and Cuba are inspiring. But only the largest countries of the region were considered. There are also small countries that have scientists who are trying to make a difference.

Costa Rica has a population of 3.5 million and a research budget much smaller than the US\$108 million indicated in the figure on page A5 of the supplement. Yet it produces more scientific papers than much larger and richer countries. It has been an uphill challenge for us, however. The government is unsupportive of science, and we suffer all the maladies described in the supplement.

Even so, Costa Rica has managed to be the science powerhouse of Central America, and we will continue our fight to advance science in this minuscule country.

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