

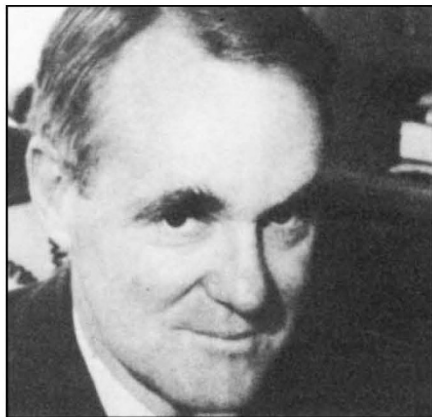
**J** W. CORNFORTH, who shares this year's Nobel Prize in Chemistry with V. Prelog, is now taking up, at the age of 58, a new full-time appointment as Royal Society Research Professor in the Department of Applied Science in the University of Sussex. He began his distinguished career in organic chemical research in Australia: he graduated at the University of Sydney and was awarded the University Medal in Organic Chemistry. This was followed by an 1851 Exhibition Overseas Scholarship to the UK, which he held from 1939 to 1942 in the Dyson Perrins Laboratory at Oxford with Robert Robinson, and he has remained in the UK since.

His early work was on Australian plant materials (with J. C. Earl) and he moved in Robinson's laboratory naturally. Inevitably in that environment he was attracted to the problem of the laboratory synthesis of cholesterol, and when the Second World War extended his stay in the UK, he was drawn into the maelstrom of the penicillin problem. In 1946 he joined the staff of the Medical Research Council at the National Institute for Medical Research and a career of individual work began to take shape; a summary is almost impossible to make: it would be a task of selecting highlights in a dazzling array of subjects. Enquiry into natural products, laboratory synthetic methods, fundamental reactions of biosynthesis, isotope techniques, reactions applicable to manufacture of medicinal products—all were grist to his mill; one has only to start discussion of a structural or synthetic problem with him to provoke a flow of 'graphite and cellulose' solutions. The only drawback to consultation is his complete deafness, which makes the problem of getting a word in edgeways and saying "yes, but" or

"I thought of that" a difficult one. The handicap of deafness he has overcome magnificently, particularly with the aid of his wife, Rita, who is herself an organic chemist of great skill.

Cornforth's relation with Robert Robinson is best put in his own words.

## Cornforth's prize



Opening the Robert Robinson Lecture he gave to the Chemical Society in 1972 he said: "Our friendship . . . for more than 30 years has been a continuous sequence of differences of opinion". Reorientation of Cornforth's work, after the publication of some papers on miscellaneous subjects from the National Institute for Medical Research, came about in two ways in 1950. First, as a consequence of the Medical Research Council taking the lead in this country in the search for a source from which cortisone could be manufactured, and its involvement with the National Research Development Corporation, the workers at the National Institute were mobilised. Hecogenin, the steroid sapogenin from

(*Agave sisalana*) was found to be such a raw material, which, on the basis of fundamental chemical work at Mill Hill and development in collaboration with the staff of Glaxo Laboratories became of considerable commercial importance.

The second direction of development of Cornforth's work came in the early 1950s in association with George Popják, then in the Biochemistry Division at Mill Hill and later at the Medical Research Council's Radiopathology Research Unit. This work, which led, finally, to the results of fundamental theoretical significance for enzymology that have earned the Nobel Award, began with the examination of the problem of the route of biosynthesis of squalene from mevalonic acid. Development of new techniques for using isotopically labelled compounds, with such incidental ingenuities as the characterisation and orientation of the three hydrogen atoms of a methyl group by labelling with protium, tritium and deuterium followed, along with the extension to the study of enzyme stereochemistry on a wider basis.

In 1962, Cornforth and Popják became joint directors of the Shell Research Milstead Laboratory of Chemical Enzymology at Sittingbourne, an establishment that in the best tradition of schoolboy humour was dubbed at its inauguration the "Pop-Corn Laboratory". Unhappily Popják broke the link when he migrated to the USA. No doubt Cornforth's new laboratory in the University of Sussex will acquire some title of affection appropriate to the unique individuality of its presiding genius and certainly occupy an important place among the world's centres of scientific research.

**R. K. Callow**

## Kennedy's good deed

**THOMAS H. JUKES**



**O**N September 8, the US Senate passed, by 61 votes to 29, a bill (S-963) introduced by Senator Kennedy to ban the use of diethylstilboestrol (DES) in growing beef cattle. The same bill would authorise the use of DES as a contraceptive after sexual intercourse only in rape, incest or "a comparable medical emergency" (the 'morning-after pill').

The bill carefully provides that the ban for beef must first be approved by the National Cancer Institute. This will be easy. Scientists of the National Cancer Institute have already testified before congressional hearings that one molecule of DES may cause cancer. Quite a lot of cancer cases were thus implied in a world population of  $3 \times 10^9$  which is presumably exposed to molecular levels of DES in the air and water. One morning-after pill contains

$7 \times 10^8$  molecules.

Diethylstilboestrol is a known human carcinogen. Even worse, it is synthetic and man-made; a self-inflicted wound. Herbst, who discovered its carcinogenicity in human subjects, has calculated its cancer-causing potency: less than 4 cases per 1,000 in the female progeny of pregnant women receiving 1.5 mg ( $3 \times 10^{18}$  molecules) of DES per day. He also notes that "there has been no documented correlation of maternal DES therapy with the development of cancer in males". Incidentally, DES is widely used as an anti-cancer drug in prostatic cases.

The intake of DES per capita from beef may be calculated from data for the residues found in implanted cattle, and the consumption of beef liver, 0.7 kg a year (0.12 parts per  $10^9$ ), plus beef muscle meats, 52 kg a year (0.012

parts per  $10^9$ ), in the USA. The intake corresponds to a daily dose of 1.9 ng, which is about  $1.3 \times 10^{-6}$  of the 1.5 mg used in Herbst's calculations. On a linear basis, the cancer risk to female offspring is, therefore, less than 5 cases per  $10^9$ , corresponding to less than one case per 133 years in the 1.5 million females born annually in the USA. How much less than one case?

Probably quite a bit, but actually unmeasurable in view of the fact that other oestrogens predominate over this level the efficiency of conversion of feed into DES. Nubile women secrete oestrogenic potency equivalent to 300,000 ng

of DES daily, and wheat germ contains oestrogens, measured by ingestion, equivalent to about 400 ng of DES per gram. Also, DES in beef liver is said to be present as glucuronide, which is inactive. The organic food crowd will applaud Senator Kennedy. More important, they will vote for him. Consumers will pick up the tab for the extra cost of beef production occasioned by the ban, which will decrease the efficiency of conversion of feed into lean meat by about 10%. Food prices are increasing so rapidly that this extra cost of up to \$900 million will be lost in the spiral.

Of course the money might have been used for cancer prevention and treatment . . . But who wants to take a chance on getting cancer, even one case in 133 years in 200 million people of a form of cancer that responds to treatment?

Banning DES will call for about 7 million tons of corn to maintain the US beef production at its present level. Senator Kennedy has professed sympathy for the plight of starving people in Bangladesh. Seven million tons is a lot of corn. But sympathy has to make sense. These people don't vote in Massachusetts!

# international news

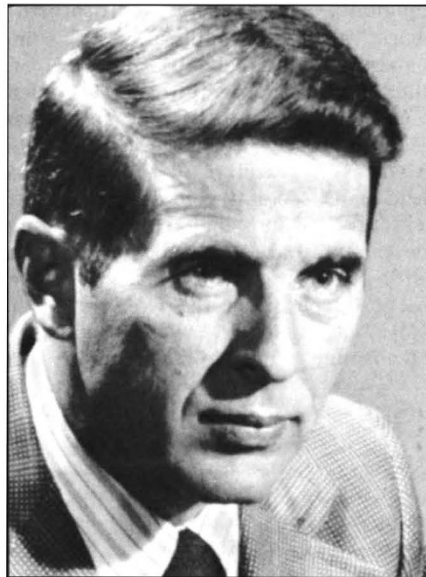
FOR years, spokesmen for the nuclear industry and the federal government have been assuring the American public that the risks associated with nuclear power plants are vanishingly small. The nuclear industry has a safety record unblemished by any accident which has released radioactivity into the environment, the argument goes, and nuclear power plants are bristling with so many safety devices that the chance of something going calamitously wrong is close to negligible.

But, as five years of raging debate have amply demonstrated, those bland assurances have not convinced everybody. So, in August 1972, the Atomic Energy Commission decided—though with some doubts about the feasibility of the project—to launch a mammoth computer analysis of the probability that a nuclear reactor could go haywire and endanger the lives of people nearby. The final results of the analysis, which were made public last week, support the official assurances. Nevertheless, they are unlikely to still the nuclear debate.

In general terms, the analysis suggests that there is a finite chance of a catastrophic nuclear accident, but the risk is minuscule when compared with other hazards such as fires, explosions, earthquakes, tornadoes or hurricanes. As William A. Anders, Chairman of the Nuclear Regulatory Commission (NRC)—which assumed responsibility for the project when the Atomic Energy Commission was dismantled earlier this year—suggested last week, the analysis "reinforces the commission's belief that a nuclear power plant designed, constructed and operated in accordance with NRC's comprehensive regulatory requirements provides protection to public

## Computing the chances of a nuclear accident

by Colin Norman, Washington



William Anders: reassuring

health and safety and the environment".

Carried out under the direction of Professor Norman Rasmussen, a nuclear engineer at MIT, the study involved a technique, widely used in the defence and aerospace industries, known as "event tree analysis". In short, the technique attempts to predict the chances of failure of various components in a reactor and to assess the effects in terms of release of radioactivity, loss of lives and damage to property. The Rasmussen study explored thousands of potential sequ-

ences of failures in reaching its conclusions.

The final results, contained in a massive 12-volume report, conform closely to preliminary estimates published by Rasmussen in a draft report last year. Although the draft report attracted more than 1,800 pages of comment from various individuals and groups—much of it highly critical—the most significant change required in the analysis, according to Rasmussen, was a large increase in the estimate of the number of cases of cancer resulting from a massive release of radioactivity.

The study concentrated on the possibility of occurrence of a string of mishaps which would cause the core of a reactor to melt. Surprisingly, the analysis suggests that the chances of a core melt are about 1 in 20,000 per reactor year, which is rather higher than many previously quoted estimates (which have generally been put at about 1 in  $10^6$ ). But it suggests that the consequences of such an accident may not be catastrophic. "Contrary to commonly held belief that . . . core melting would surely result in severe accidents with large consequences", the report states, "the magnitude of the potential consequences of a core melt accident were found to have a wide range of values. The probability is high that the consequences would be modest".

The analysis suggests, in brief, that if a core melts, the pressure vessel which encloses it would not necessarily rupture and release large quantities of radioactivity into the atmosphere. The core would, however, eventually melt its way into the ground, but the study suggests that most of the radioactivity would be trapped in the soil. The most likely consequence of a core melt, the study predicts, would be less than one