will undoubtedly illuminate the mammalian genome and allow predictive genetic engineering and genome alterations. Eventually society will have to settle the moral and ethical issues.

In the simplest genetic systems, exemplified by viruses, the basic information is already at hand to undertake predictive genetic engineering. Such information includes knowledge of how to introduce precise changes into specific sites, the complete nucleotide sequences of genes and their regulatory elements, complete genome sequences, the regulation of expression of viral gene products, and in some cases the three dimensional structures of viruses. The molecular biology of viruses has been studied for decades, and a great body of information is at hand, particularly for certain plant, insect, and mammalian viruses—for example, poliovirus.¹ Much practical experience has been gathered with live virus vaccines—for example, vaccinia²—and since the turn of the century naturally occurring baculovirus insecticides have been used to control insect pests of crops, with environmentally acceptable results.³

The genetic engineering of viruses to cause a specific change in their phenotype is a commonplace technology. Alterations can be introduced to test theories of structure and function and determinants of virulence. Many such studies have been already conducted, and as experience grows so do the accuracy and predictability of the results. Consequently scientists are now turning to tackling practical problems by releasing genetically engineered viruses into the environment. These are new generations of live virus vaccines and of viral insecticides.

Because of their replication cycles some viruses are released from the person vaccinated to infect others—for example, poliovirus, which is spread by the faecal oral route.¹ The use of live poliovirus vaccines, which are engineered to be safer than the current vaccines, will raise questions of what, if any, will be the environmental consequences.⁴ Detailed risk-benefit analyses will be needed before such viruses will be licensed for use in medical practice, which should stimulate international discussions, agreements, and regulations.

Another virus that is the subject of intensive genetic engineering is vaccinia virus—to be used, for instance, as a vector of foreign genes to which an immunological response is required. Foreign genes can be engineered into vaccinia and expressed in the patient vaccinated.⁵ Vaccinia has many advantages as a vector, particularly with inducing both humoral and cell mediated immunities.⁵ There are also opportunities to reduce the potential pathogenicity of the parent virus.^{6,7} Currently under trial are vaccinia recombinants designed to induce protection in man to human immunodeficiency virus⁵ and to protect wild life from rabies.⁸ A deliberate release of live vaccinia virus containing the requisite rabies virus genes to infect (and protect) wild life from the disease was started in 1987.

Limited field trials using genetically altered baculoviruses as viral insecticides have been undertaken in Britain since 1986 with government approval and with publicity in the media.⁹ The studies are part of a cautious programme of research into the improvement of natural biological insecticides. The eventual objectives are to produce fast acting insecticides against which the pest species cannot acquire or develop resistance. An example of how this might be achieved would be to incorporate an insect hormone gene into the genetic make up of the virus so that early during a caterpillar infection the pest becomes physiologically

deregulated, causing it to stop eating. Baculoviruses are good subjects for genetic engineering as they are restricted in their host ranges to particular insect species and do not infect, or otherwise affect, other insects, let alone other invertebrates, plants, or vertebrates. These viral insecticides do not pose a threat to man and are environmentally and ecologically preferable to chemical insecticides. A programme of risk assessment into their use has already led to self destructive, pest specific, baculovirus insecticides that can infect a target caterpillar but which afterwards are swiftly degraded. Further studies with the release of genetically engineered virus insecticides with new phenotypes are planned for 1988 and subsequent years.

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“Dr Kildare let me down”

Soon women will make up half the medical workforce in Britain. Yet they are still rare at the top of the profession. None of the current college presidents are women (although Dr Eileen Adams is dean of the faculty of anaesthetists) and only 2% of consultant surgeons are women—and there is a widespread feeling that life is difficult for women in medicine. Some suggest that “women doctors will be the overseas doctors of the 1990s.” Now a large study of doctors’ careers funded by the Department of Health and Social Security and published last week has produced the chilling finding that not only are many women doctors deeply unhappy about their chosen profession but so also are many men doctors.¹ One told researcher Isobel Allen that “medicine is no longer a desirable profession to be in, and I wouldn’t recommend anyone to go into it.”

A questionnaire was completed by 314 men and 326 women randomly selected from graduates in 1966, 1976, and 1981. The doctors were asked why they had chosen a medical career, and most had done so because they were good at science subjects. Women were more likely than men to have wanted to help people, and they were also more likely to have succumbed to parental pressure—surprisingly from their mothers. Careers advice at school was non-existent or useless—one doctor had been told to take Latin at ‘O’ level and had studied this instead of biology only to discover later that biology ‘A’ level was essential. Schools painted a romantic picture of life as a doctor: “If I’d known more about the hours . . . I don’t think I’d have gone into it. . . . Dr Kildare let me down. . . .” Careers advice at medical school was little better. Of the 1966 cohort, 99% had received no advice, and by 1981, 80% were still getting no careers information from their medical schools. Most of the doctors

thought that even when they qualified they had little idea of what was ahead of them or what their options were. Many eventually made their career choices by exclusion.

Many doctors thought that it was important to do pre-registration jobs in teaching hospitals: "If you pursue a hospital specialty in your own teaching hospital you cultivate friends in high places and that matters if you want to get on." Such personal patronage was thought to carry more weight than written references. A woman consultant from the 1966 cohort said: "The phone call is tremendously important. Written references are absolutely useless and always standard . . .," and a man from the 1981 group summarised the views of many: "It's hardly surprising that the chap who's got an influential friend gets the job when there are dozens of applicants with very similar qualifications and experiences. . . ." It was widely agreed that the "old boy" network did not exist for women and that any woman who was not able to cultivate an influential patron was unlikely to advance far up the ladder.

There were surprisingly few differences between men and women in the study. Although the women graduating in 1966 had taken longer than the men to reach the grades of registrar, senior registrar, and consultant the average time to do so for graduates in 1976 was more similar, and so far the 1981 men and women have progressed through the training grades at fairly equal rates. There was no evidence that women doctors were taking much time off work to have families. The biggest difference between the sexes was in the amount of part time work they did. Women from the 1966 group had spent about half as long as men in full time jobs, although both sexes emphasised that part time work in medicine was often as much of a commitment as a full time job in any other career.

Marriage and children were seen as obstacles to career plans by doctors of both sexes. Many mentioned the difficulties of moving from job to job if a spouse also had to find work. This was especially so when doctors were married to other doctors. Although 81% of women with children saw them as restraining their careers compared with only 30% of men with children, men too resented the way that a medical career may diminish family life. The statement: "I preferred to be at home playing with the baby than looking after somebody else's" was made by a man.

There was little evidence of obvious discrimination against women but a general feeling that so much of the appointments procedure was secret that it would be hard to prove anything. Nearly a quarter of the women graduating in 1976 thought that they had been discriminated against on sexual grounds compared with 7% of those graduating in 1981. Both sexes were asked questions about family life at interviews, but women reported more detailed questioning and often found it offensive: "I was asked who wore the pants in our family." One woman consultant had even been asked if all her children were by the same father.

The most disconcerting finding of this study is the tremendous amount of disillusionment and regret among doctors of both sexes and all ages. Commonly expressed frustrations included lack of resources, fewer suitable career posts, long hours for comparatively poor pay, conflicts with personal interests, absence of job security, and the paucity of opportunities to deviate from the "straight and narrow" career path. Sixteen per cent of the 1966 group, 28% of the 1976 group, and 46% of the 1981 group had felt regret about their career at some stage. Many unhappy doctors wished they had not entered medicine.

This study should be the basis for introducing changes in the medical career structure, and it ends with some recommendations. Realistic career advice must be given at school so that pupils have some idea of what a career in medicine will mean. Personal assessment and career advice should be offered throughout medical school and beyond. The formal training requirements are too rigid and must be relaxed with no discrimination against doctors who have taken longer than average to reach a given stage or have arrived at it by an unconventional route. Whether personal patronage is compatible with equal opportunities should be examined. Questions asked at interviews should conform to the guidelines of the Equal Opportunities Commission, and no question should be asked of women that would not be asked of men. Part time training should be encouraged, and part time career posts should be extended. Job sharing should be reviewed. Women doctors who have had a break in their careers should have retraining, and an assessment should be made of those specialties in which women are underrepresented. Mr Tony Newton, Minister of Health, has welcomed the study, and the DHSS is sponsoring two conferences on it later this year.

Some people are irritated by suggestions that women should have special provisions made for them. Many of the women doctors graduating in 1966 were resentful of women who wanted to "have their cake and eat it." The great achievement of this study is that it has shown that the problems that restrict women in medicine affect men too. We can now campaign to have things improved for the good of the whole workforce. "Men doctors should also be able to be more involved with their families. . . . Whatever would help women would equally help men."

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Surgery for cardiac arrhythmias

"Direct operations for cardiac arrhythmias represent the last frontier in surgical cardiology," said Sealy in 1980, and now surgeons are streaming across the frontier.¹ It is 20 years since the first report of successful surgical intervention in a patient with the Wolff-Parkinson-White syndrome,² and now operations for patients with cardiac arrhythmias are routine.

The first indication for such an operation is that patients have arrhythmias that persist despite drug treatment. An operation is also indicated if the patient is young and will require drug treatment for many years. An operation may be necessary if the arrhythmia is life threatening—for example, when it is accompanied by ventricular fibrillation or a low output state. Finally, surgery may be the best treatment when the patient has an arrhythmia associated with a cardiac lesion that itself needs an operation.

Re-entrant arrhythmias that are normally amenable to operation are usually caused by congenital accessory electrical pathways connecting the atrium and the ventricle and bypassing the rate limiting behaviour of the tissue in the atrioventricular node. Conduction through the accessory path may be anterograde (resulting in the classic short PR interval and Δ wave of Wolff-Parkinson-White syndrome) or