

The progress report states that "consultant posts would continue to be filled by open competition, and there is no reason why the lowering of the usual age of promotion resulting from the new training arrangements should adversely affect the standards required for appointment to the consultant grade . . . The nature of the work of the consultant grade would not however be affected." No argument is put forward to justify these assumptions. Competition will, indeed, still be open, but it will not be so fierce, except for the better jobs. There is a risk that quality will give place to quantity in such a marked rise in numbers. Already, however, some consultant vacancies in undesirable areas remain unfilled, while others have been filled only by appointing candidates from the registrar grade. If standards really are to be maintained, then the report's proposals will not solve the problem of attracting applicants to the areas which are already grossly understaffed. The danger is that registered specialists might be directed there to wait out their time until they achieve the consultant vacancy of their choice.

There is evidence of a growing movement of discontent among regional consultants. Many of them believe that first general practitioners and then hospital junior staff improved their lot only after effective protest campaigns, and that unless they do the same they will be ignored. It is depressing that so many consultants see the future as offering them less prospect of professionally satisfying work. The most important issue is that of changes in hospital staffing. Consultants in non-teaching hospitals form the large majority in the N.H.S., and they are responsible for more than their share of the work done in it. Quite possibly present junior staff would be prepared to accept a modification of consultant work in exchange for an eight-year training period with a near guarantee of a consultant post at the end of it. Consultants appointed after perhaps 16 years of ill-paid uncertainty will see any change in this direction as retrograde and unjust.

At present the chief fear of regional consultants is that the quality and nature of their work will change for the worse. At p. 612 of this week's *B.M.J.* Mr. M. A. R. Freeman, one of the authors of the Godber report,³ examines as a surgeon the implications of expanding the consultant grade and draws attention to three objections consultants will have to it. Firstly, they will see fewer cases of interest and will have to do more routine work; secondly, they will have to share physical facilities—beds, operating time, outpatient sessions—with more consultants; and, thirdly, their earnings from private practice may be expected to fall. Indeed, Mr. Freeman goes on to comment that the Health Departments have found that when consultants ask for more junior staff they will not accept the alternative of an additional consultant post instead.

One solution put forward by Mr. Freeman is an expansion of private practice. This is not the place to discuss the case for private beds and private treatment in N.H.S. hospitals, except to emphasize that private medical attention is a right of the patient; that a growing number of people want it; and that their needs cannot properly be met without the assistance of N.H.S. doctors and N.H.S. facilities. It should not be forgotten that before 1948 a fine British hospital service was largely subsidized by private practice to the benefit of both. Many doctors enjoy part-time work in the freer conditions of private practice, in which the only contract

is between them and their patient, and the provision of more private beds in N.H.S. hospitals would bring dividends in job-satisfaction among N.H.S. consultants which, on present showing, the N.H.S. can ill afford to lose.

But it is to the N.H.S. itself that consultants must look for most of their work, and on their conditions of service in it will depend their contentment. Closer examination of the future shows perhaps a less gloomy picture than currently seen by regional consultants. Too much can be read into generalities. Emergency work and the proportion of routine to truly consultant work varies from specialty to specialty. The pattern for, say, anaesthetics, diagnostic radiology, and thoracic surgery needs to be seen separately from that for general medicine and surgery. Also to be taken into account is the part the large district hospitals will play, and the introduction of the divisional system of medical staffing. It is probable that in the divisional system will be found the best solution to the problem of marrying the service needs of a hospital with its teaching requirements, since it offers the necessary flexibility. Another possibility is a hierarchical system for consultants, which might provide an answer to the distribution of the routine work between senior and junior consultants. In such a system differential payments could displace the existing secret merit awards. Surely a hospital service of this nature could provide better opportunities and the incentives for satisfying work in all provincial hospitals.

Meanwhile, however, the progress report acknowledges the anxieties of established consultants but does little to reassure them. Much more detailed proposals will need to emerge in the forthcoming discussions before they can see what sort of a bargain they are being asked to accept. Also, the hospital service must be given more money if spending on hospital building and equipment is not to be cut in order to pay for the staff increases, and the Government should be pressed for further details on this point.

Isolation of a Gene

Developments in molecular biology follow in rapid succession. The most recent is the isolation by a team in the laboratory of Jon Beckwith at Harvard¹ of a single gene—or, more accurately, a complex of three genes controlling a single function. These genes comprise part of the lactose operon of the bacterium *Escherichia coli*, which is the workhorse of molecular biology. In the presence of this gene complex the enzyme β -galactosidase is synthesized and the sugar lactose can be metabolized. The isolation represented a technical tour de force using a combination of techniques. Firstly, relative concentration of the lactose genes was achieved in bacteriophages that can carry small amounts of genetic material from one host to another—the process known as transduction. Then, by a method of hybridization of isolated strands of DNA and enzymic digestion, the gene complex representing the lactose operon was freed from other DNA. Electron micrographs showed it to be a double strand of DNA about 1.3 to 1.5 μ in length. Genetic controls were set up to ensure that the phages used contained only the lactose genetic material from the host.

¹ *British Medical Journal Supplement*, 1967, 2, 93.

² *British Medical Journal Supplement*, 1969, 1, 75.

³ *The Responsibilities of the Consultant Grade*, 1969. London, H.M.S.O.

¹ Shapiro, J., Machattie, L., Eron, L., Ihler, G., Ippen, K., and Beckwith, J., *Nature*, 1969, 224, 768.

Though there is little new conceptually and the result is expected, this work is a considerable achievement. It should be applicable to other bacterial genes, and the availability of pure genes should help in the solution of some important remaining problems in the control of gene expression. More generally, the work has again raised fears that biologists may come to abuse all this knowledge—for instance, by producing highly virulent infections for which there is no cure or by tampering with man's genetic endowment. In fact, the Harvard work adds little to already existing worries. The phenomenon of linked resistance against several antibiotics in pathogenic bacteria, now quite common in many countries, causes more trouble in practice than is likely to be achieved using purified genes even in the most diabolical hands. The Harvard team used the most favourable system now known. Much developmental work is required before isolation of a mammalian gene becomes possible, and more again before the isolated gene can be successfully introduced into the genome of a host cell. If this could be achieved, especially in germ cells, genetic deficiencies could be made up, so curing the corresponding hereditary disease. This is a long-term aim which we should all regard as laudable. As far as danger is concerned, the risks of producing genetic damage by radiation or radiomimetic chemicals seem at present far greater than those likely to be caused by abuse of genetic engineering, as the manipulation of genetic material has come to be termed. This discovery is a scientific achievement that need not carry with it any pangs of doubt or regret.

The Experience of Time

How is it that we experience the passage of time? We are aware of sound, touch, and colours through sense organs. Could it be that we perceive the flow and duration of time through some time-sense organ within the brain? We nowadays read of "biological clocks," and the pulse, the breathing, the electroencephalographic alpha rhythm, or one of our many diurnal rhythms could perhaps provide a time-base which our time-organ could calibrate against our wrist-watches.

In seeking answers to these questions psychologists have studied the perception of time. Among them was H. Hoagland,¹ whose febrile wife helped in his experiments. When she attempted to count at the rate of one number per second she went faster when her temperature was higher. He related the log of the counting speed to her absolute temperature and proposed a chemical clock which could make more time seem to pass during pyrexia. Later experiments conducted on divers, whose body temperature varied with immersion in cold or warm sea water, confirmed that the rate of counting was correlated with temperature.²

The psychedelic drugs lysergic acid diethylamide (L.S.D.)^{3, 4} and psilocybin⁵ also alter perception of time, so that a short period of clock time seems of much longer duration both subjectively and on testing. Dexamphetamine too has been found⁶ to cause a decrease in the clock-measured value of the apparent second: that is to say, like fever, L.S.D., and psilocybin, it makes the passing time seem long. On the other hand quinalbarbitone 200 mg. had the opposite effect and made time appear to pass quickly.⁸

Recently R. E. Ornstein⁷ has argued against any time-sense organ, and he points out that chemical theories cannot

cope with those purely psychological manipulations which alter perception of time duration. An interval filled with interesting and complex psychological stimulation is perceived as longer. Ornstein, with many ingenious supporting experiments, proposes that, since perception of duration must be linked with memory, we should use the metaphor of memory storage size to account for perceived duration. Fever, amphetamine, and complexity of stimulus could all be thought to increase the rate at which information is processed in the brain. Consequently the memory units therefrom would occupy more "space" in the memory store, and hence the period from which they arose would be judged as longer.

An important feature of this theory is that the space occupied in the memory store depends also on the coding or "chunking" into storage units. Inefficient chunking would increase storage requirements. Familiar procedures we perform automatically would be chunked as large units, so that when we have driven along a familiar route we may suddenly find we have got to our destination in an apparently short time. When there is very little input to the brain the duration of time will be judged to have been brief. For instance, it has been found that volunteers isolated under conditions of sensory deprivation underestimate the time they have spent and "lose" as much as one day in four.^{8, 9}

The doctor frequently hears his patients making judgements about time duration, including duration of the delay in falling asleep and duration of total sleep. Since sleep is relatively devoid of information-processing, little storage space should be required for memories arising from it, and in retrospect sleep would tend to be misjudged as short, or even absent, whereas delay in getting to sleep, or intervals of wakefulness while thinking was going on, would use up more storage and so appear to have occupied more of the night. In a recent study of such judgements S. A. Lewis¹⁰ did indeed find wakefulness overestimated and duration of sleep underestimated, a tendency strikingly enhanced when sleeping-pills were withdrawn.

Poorer capacity to code or chunk incoming information should mean that people of lower intelligence would judge an interval of time to have lasted longer than would people of higher intelligence. And in a recent comparison of Baltimore hospital staff from upper and lower socio-economic groups (and higher and lower intelligence respectively) the lower socio-economic group was found consistently to judge elapsed time as longer.¹¹ The authors see the difference as a factor contributing to social conflict and failure of patients in the lower social classes to do well with psychotherapy. At the least it may show that doctors have their priorities wrong if they are more apologetic to middle-class patients kept hanging around in the waiting-room.

¹ Hoagland, H., *Journal of General Psychology*, 1933, **9**, 267.

² Baddeley, A. D., *American Journal of Psychology*, 1966, **79**, 475.

³ Aronson, H., Silverstein, A. B., and Klee, G. D., *Archives of General Psychiatry*, 1959, **1**, 469.

⁴ Fischer, R., Griffin, F., and Liss, L., *Annals of the New York Academy of Sciences*, 1962, **96**, 44.

⁵ Fischer, R., *Annals of the New York Academy of Sciences*, 1967, **138**, 440.

⁶ Goldstone, S., Boardman, W. K., and Lhamon, W. T., *British Journal of Psychology*, 1958, **49**, 324.

⁷ Ornstein, R. E., *On the Experience of Time*, 1969. Harmondsworth, Penguin Books.

⁸ Vernon, J. A., and McGill, T. E., *Journal of General Psychology*, 1963, **69**, 11.

⁹ Banks, R., and Cappon, D., *Perceptual and Motor Skills*, 1962, **14**, 74.

¹⁰ Lewis, S. A., *British Journal of Psychology*, 1969, **60**, 203.

¹¹ Pollock, I. W., Uchberg, F. M., and Meyer, E., *Archives of General Psychiatry* 1969, **21**, 1.