terms of a frequency spectrum containing a number of strong spikes on top of a broad distribution of frequencies. As one moves across the chaotic region, away from the critical parameter value that ends the period-doubling sequence, these spikes merge in pairs, simplifying the spectrum. Eventually only the broad band remains, the solution giving way to a simple periodic solution. The authors mention that Lorenz, in unpublished work, has established a similar structure of the solutions of model (1).

The strikingly simple qualitative result now obtained by Crutchfield and Hubermann is that, both in model (2) and in the noisily forced oscillator, the effect of the noise term is to remove the later stages of the bifurcation sequence of chaotic solutions. As the amplitude of the noise term is increased, this bifurcation gap widens.

The authors believe that this result should be capable of experimental test in situations in which the noise level can be controlled. Their anharmonic oscillator model was originally devised for application to solid state systems where anharmonic degrees of freedom can couple to a periodic field. Superionic conductors are an example of such a system. They are (Boyce & Hubermann *Phys. Rep.* **51**, 189; 1979) solids which display ionic conductivities many orders of magnitude greater than those of normal salts. They can be characterised by the presence of a rigid lattice of one type of ion in which another type of ion can move freely. The diffusion coefficients are very dependent on temperature, and for this reason Crutchfield and Hubermann suggest that superionic conductors may be particularly suitable for controlled variation of the noise term to test for the bifurcation gap. □

Cystic fibrosis

from Leighton Dann

UNTIL a few years ago, the genetic disease cystic fibrosis (CF) was considered to be a childhood disease as most patients succumbed at an early age. With the use of modern drugs the prognosis has been much improved and patients commonly reach adulthood. Thus CF has graduated from the paediatric clinic and entered general medicine.

This changing pattern provided the focus for much of the 8th International Congress on the disease held recently in Toronto*, with sessions on progression with age, and on genetics, diagnosis and screening.

The basic defect, as yet unidentified, primarily affects exocrine glands and so various bodily functions are impaired. Bronchopulmonary disease remains the greatest problem, and successful treatment and control of infection is a major goal of research. Several delegates discussed alternatives to antibiotic therapy, and H.V. Reynolds (Yale University New Haven) reported the use of immunoprophylaxis. Much of the work has concentrated on the bacterium *Pseudomonas aeroginosa* as it is so prevalent and so highly pathogenic in CF lung infection, particularly in the later stages of the disease. Although he showed that immunization with a multivalent lipopolysaccharide vaccine boosted existing titres of antibodies against the organism in the blood, no effect was noted in the lungs of patients. As with antibiotic therapies, serum values of drugs or antibodies bear little relation to local concentrations in the lungs. Reynolds felt that although this method of treatment was of no value to the patient who is already infected, early immunization, before infection with *P. aeroginosa,* might prove beneficial. He also suggested that other antigens should be studied, for example exotoxin A and several high molecular-weight cell wall polysaccharides.

A most promising therapeutic application of the chelating agent EDTA was proposed by R.E. Wood (Case Western Reserve University, Cleveland). He and his colleagues found that incorporation of EDTA into the culture medium retarded the growth of *P. aeroginosa* due to sequestration of divalent metal ions, particularly magnesium. There was also marked synergism shown between EDTA and many commonly used antibiotics. Preliminary experiments on animals show that EDTA does not affect mucociliary transport at the concentrations needed to arrest growth of bacteria and may therefore prove safe for use in the human lung.

Another major problem of CF is pancreatic insufficiency. Although it may be controlled by administration of pancreatic extracts, large and often increasing amounts must be given as the disease progresses. A new form of enzyme supplement, Pancrease, (manufactured by Johnson & Johnson, Slough, UK) was discussed by R. Dinwiddie (Hospital for Sick Children, London) A. M. Weber (Hospital Ste-Justine, Montreal) and D. J. Holsclaw and H. Keith (Hahnemann Hospital, Philadelphia).

Pancrease consists of enteric coated microspheres of pancreatic enzymes in a gelatin capsule, and passes intact through the stomach to the intestine. With this mode of administration fat absorption is greatly improved and patients have access to a more normal diet as well as being able to take fewer tablets each day (about 6 instead of about 30). Similarly, better food absorption was reported by D.J. Cameron (Hospital for Sick Children, London) and E. Rossi (Childrens Hospital, University of Berne) if cimetidine is used as an adjunct to pancreatic supplements. This drug lowers gastric acid output and so higher concentrations of enzymes reach the intestine intact.

Early diagnosis is of paramount importance for good prognosis, and much effort was focussed on newer methods of detection, especially those potentially amenable to mass screening or to antenatal diagnosis. R.B. Ellio (University of Auckland) described his test for immunoreactive trypsin in newborns. Because the pancreatic ducts are blocked, trypsin leaks into the blood and is present in high concentrations in affected babies. Great interest was shown in this test, as it is done on dried blood spots and could therefore be incorporated into existing screening programmes for phenylketonuria.

J. Lieberman (Veterans Administrations Medical Centre, Sepulveda, California) described an assay which detects a specific IgM-binding fructose-specific lectin in CF serum. He suggested that this test could prove useful in detecting heterozygote carriers of the CF gene, as the lectin is present in the blood of parents of affected children. The connection between this lectin and the CF factor (a highly basic small protein found in many body fluids) remains to be elucidated.

J.C. Manson (Western General Hospital, Edinburgh) reported the production of antiserum in mice using CF factor isolated from serum by isoelectric focusing. Preliminary results with the antiserum are highly succesful but its availability is limited. This method has potential as a screening test for homozygotes not only in newborns but also antenatally, for amniotic fluid from an affected fetus contains CF factor. In another approach to antenatal diagnosis, reported by L.G. Dann (Queen Charlotte's Hospital, London), an arginine esterase assay is used on cultured amniotic fluid cells. However lack of suitable samples is hampering validation of the method.

While delegates were optimistic that the outlook for patients with CF would continue to improve, it was clear that a better understanding of the disease and in particular, the basic defect, was needed before CF became truly a treatable disease. The work in progress presented at the congress encourage the hope that by the time of the next congress, in Britain in 1984, much of this will have been achieved. □

Leighton Dann is in Queen Charlotte's Maternity Hospital, London.

*The Conference was held on 26th-30th May 1980 in the Royal York Hotel, Toronto and was organized by the Canadian Cystic Fibrosis Foundation.

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