

stantiated by the Canadian study." The Canadian findings were qualitatively similar to those from the European trial, their combined results suggesting an excess fetal loss rate of 3.2% (95% confidence interval 0.3% to 6.2%) in those investigated by chorionic villus sampling compared with amniocentesis.<sup>1</sup> It is for individual women and those responsible for their care to decide whether this risk is acceptable in order to achieve earlier diagnosis (or exclusion) of fetal abnormalities and the advantages of earlier termination if this is then indicated.

Some disappointment that chorionic villus sampling may not be quite as safe as amniocentesis is understandable, but if this is the case—and the evidence suggests that it is—those concerned need to know and attempts to try to explain the excess away are not in their interests.

T W MEADE

MRC Epidemiology and Medical Care Unit,  
Northwick Park Hospital,  
Harrow HA1 3UJ

A M GRANT

National Perinatal Epidemiology Unit,  
Radcliffe Infirmary,  
Oxford OX2 6HE

1 MRC Working Party of the Evaluation of Chorionic Villus Sampling. MRC European trial of chorionic villus sampling. *Lancet* 1991;337:1491-9.

2 Liu DTY. Chorionic villus sampling. *BMJ* 1991;303:1402. (30 November.)

3 Canadian Collaborative CVS-Amniocentesis Clinical Trial Group. Multicentre randomised clinical trial of chorionic villus sampling and amniocentesis. *Lancet* 1989;i:1-6.

## Could an outbreak of poliomyelitis occur in the UK?

SIR,—S O Cameron and colleagues ask whether an outbreak of poliomyelitis could occur in the United Kingdom.<sup>1</sup> A patient with fatal acute poliomyelitis was treated recently in this hospital, but despite extensive microbiological investigation the causative organism is not known.<sup>2</sup>

Acute poliomyelitis was diagnosed only after postmortem examination and investigations performed during life had been inconclusive: the spinal cord was removed and examined four weeks later, after fixation in formalin. The spinal cord is not routinely examined at postmortem examination and, indeed, is probably examined very rarely in postmortem examinations performed for a coroner. It is therefore feasible that this case, although not proved to be due to poliovirus, could be one of several and that other fatal cases of poliomyelitis have escaped diagnosis.

A V SPEDDING  
E GRADWELL

Department of Histopathology,  
Whiston Hospital,  
Prescot,  
Merseyside L35 5DR

1 Cameron SO, Carrington D, Patterson W. Could an outbreak of poliomyelitis occur in the UK? *BMJ* 1992;304:52. (4 January.)

2 A case of poliomyelitis. *Communicable Disease Report* 1991;1:209.

## Resuscitation and hypothermia

SIR,—Minerva<sup>1</sup> mentions a study in which none of 185 patients who had suffered a cardiac arrest outside hospital were discharged; all had received unsuccessful resuscitation outside hospital, which had been continued in the hospital emergency room.<sup>2</sup> What Minerva fails to mention is that hypothermic patients were excluded from this study; this is a vital point, as we recently found.

A patient was brought to Westminster Hospital, having been found unrousable while in police custody. A police surgeon had diagnosed a cardiac arrest, and an ambulance crew with paramedical training had started resuscitation. The time from

the cardiac arrest to the start of resuscitation was over five minutes. On arrival at the hospital the patient had no pulse, was not breathing spontaneously, felt cold, and had fixed dilated pupils. Further resuscitation was continued in line with guidelines of the Resuscitation Council. The patient's core temperature was 29°C on a low reading thermometer.

As hypothermia is a contraindication to stopping resuscitation we decided to rewarm the patient by using extracorporeal bypass. For technical reasons this had to be instigated at a neighbouring hospital, and cardiopulmonary resuscitation was continued in the ambulance and into the operating theatre, where bypass was established via the femoral route. Within 10 minutes the patient developed a cardiac output. Cardiopulmonary resuscitation had been performed for over 60 minutes. The patient subsequently recovered completely.

Defibrillation is not likely to be effective if a patient's core temperature is less than 30°C, and resuscitation should not be abandoned until determined efforts to rewarm the patient have been made. Pupillary reactions may be misleading during resuscitation, especially after drugs have been given. The saying that you are not dead until you are "warm and dead" should be borne in mind by the person responsible for stopping resuscitation, especially at this time of year.

DAVID POTTS  
JEREMY BOOTH

Accident and Emergency Department,  
Westminster Hospital,  
London SW1P 2AP

JOHN BLACK

Cardiothoracic Surgery Department,  
St Thomas's Hospital,  
London SE1 7EH

1 Minerva. *BMJ* 1991;303:1410. (30 November.)

2 Gray WA, Capone RJ, Most AS. Unsuccessful emergency medical resuscitation—are continued efforts in the emergency department justified? *N Engl J Med* 1991;325:1393-8.

## Cost effectiveness of rehabilitation

SIR,—Daphne Gloag reported a conference on rehabilitation organised by the British Society of Rehabilitation Medicine.<sup>1</sup> Several papers have recently been published in American journals, dealing with the effectiveness of rehabilitation for head injury when it is delivered as a coordinated system—that is to say, as the patient's needs change the patient's management changes and he or she moves from an acute high dependency unit to more conventional inpatient neurorehabilitation, to a community based transitional unit, to job coaching, to return to employment or sheltered or supported living or whatever is appropriate.

Given this organisation of services, two groups of workers have clearly shown that the system is effective in terms of increasing the patient's productivity of life.<sup>2,6</sup> Productivity is carefully defined, and the costs and benefits of different gains in productivity are defined. These workers show that an investment in appropriate rehabilitation can save many millions of dollars by reducing a patient's dependency, reducing the need for support, care, and attendance and (in the British context) the need for social security benefits.

In conclusion, there is now clear evidence of the effectiveness and cost effectiveness of skilled and appropriately delivered neurorehabilitation. I emphasise that the rehabilitation has to be skilled and appropriate.

D N BROOKS

Department of Psychological Medicine,  
University of Glasgow,  
Glasgow G12 0AA

1 Gloag D. Cost effectiveness of rehabilitation. *BMJ* 1991;303:1496. (14 December.)

- Brooks N. The effectiveness of post-acute rehabilitation. *Brain Injury* 1991;5:103-10.
- Cope DN, Cole JR, Hall KM, Barkan H. Brain injury: analysis of outcome in a post-acute rehabilitation system. Part 1: General analysis. *Brain Injury* 1991;5:111-26.
- Cope DN, Cole JR, Hall KM, Barkan H. Brain injury: analysis of outcome in a post-acute rehabilitation system. Part 2: Subanalysis. *Brain Injury* 1991;5:127-40.
- Johnston MV, Lewis FD. Outcomes of community re-entry programmes for brain injury survivors. Part 1: Independent living and productive activities. *Brain Injury* 1991;5:141-54.
- Johnston MV. Outcomes of community re-entry programmes for brain injury survivors. Part 2: Further investigations. *Brain Injury* 1992;5:155-68.

## Chaos theory

SIR,—W J Firth's article on chaos theory was a good general introduction to the subject for clinicians.<sup>1</sup> There are, however, many other aspects of medicine in which chaos is relevant. For example, Rapp *et al* have developed a method of electroencephalographic monitoring that may predict impending epileptic fits as well as monitor the effects of drugs on the central nervous system.<sup>2</sup> The variations of dopamine concentrations in patients with Parkinson's disease have been shown to be chaotic and therefore amenable to mathematical manipulation.<sup>3</sup> The mathematics of chaos theory has described the seasonal variations of measles epidemics; this calls for further research into the behaviour of other epidemics.

Some rhythmic processes in the body (insulin release and circadian and reproductive cycles) have already been re-evaluated by using the theory of chaos. In fact, almost any cyclic process is amenable to detailed mathematical analysis, which can help explain the underlying mechanisms and suggest ways for therapeutic intervention. This has been shown in the case of aging mechanisms. By using advanced mathematical formulas derived from the theory of chaos I have offered theoretical ways of altering some of the steps in protein modification that occurs with normal aging.<sup>4</sup>

Obviously, more research is needed into this fascinating new theory. The relevance of chaos in medicine needs to be more widely studied.

M KYRIAZIS

Northampton NN1 5HE

- Firth WJ. Chaos—predicting the unpredictable. *BMJ* 1991;303:1565-8. (21-28 December.)
- Rapp P, Bashore T, Zimmerman I. Dynamical characterisation of brain electrical activity. In: Krasner S, ed. *Ubiquity of chaos*. Washington, DC: American Association for the Advancement of Science, 1990.
- King R, Barkas J, Huberman D. Chaotic behavior in dopamine neurodynamics. *Proc Nat Acad Science USA* 1984;81:1244-7.
- Kyriazis M. Applications of chaos theory to the molecular biology of aging. *Exp Gerontol* 1991;26:6.

## Caring for larger lists

SIR,—G N Marsh writes about the possibility of increasing list sizes for general practitioners in the United Kingdom.<sup>1</sup> He should be aware, however, that experience in the United States shows that the general list size of between 2500 and 4000 patients cared for by community family physicians results, in the best of settings, in much preventive and long term care remaining undone. Even in the computer age, with efficiency of computerised practices (the rare situation), the number of elderly people and children who receive appropriate immunisations and the number of well managed diabetic and hypertensive patients falls far short of what have been set as goals for such care in general practice.

In the United States, particularly in times of economic hardship, patients visit physicians far less often than do patients in the United Kingdom; this results in fewer opportunities for practitioners to intervene prospectively in their care. Even in health maintenance organisations, where in theory there are no financial obstacles to obtaining