scabies—a highly contagious and little-known disease—should be considered in the presence of a hyperkeratotic, desquamating, and possibly non-itchy rash occurring in a patient suffering from carcinomatosis and on corticosteroid therapy. A skin biopsy will provide sufficient evidence for the timely prophylactic treatment of contacts—a measure of great importance both in the hospital ward and the home.—I am, etc.,

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α -Thalassaemia in Britain

SIR,—The results of surveys for abnormal haemoglobins such as the one reported by Dr. J. Stuart and his colleagues from Birmingham (3 November, p. 284) illustrate the point that if one does not include in any series of screening tests a test for Hb H bodies, the diagnosis of α -thalassaemia trait will not be made. The tests used in the Birmingham survey included haemoglobin electrophoresis and Hb A₂ and Hb F estimations. Of the 6,835 children studied, 26 were found to have the β -thalassaemia trait and none to have the α -thalassaemia trait. This contrasts with the experience at this hospital, which serves an area containing many Negro and Asian immigrants and where in the past three months there have been 26 new cases of β -thalassaemia trait and 15 of α -thalassaemia trait. The α -thalassaemia patients included 1 Turk, 1 Chinese, 1 Greek, 1 Lebanese, 1 Pakistani, 1 African, 2 Indians, 5 West Indians, and 2 Europeans (1 Pole and 1 Briton with German ancestry). Two of the West Indians were from the same family. The patients with α -thalassaemia trait had similar blood films to those with β -thalassaemia trait and the same abnormal red cell indices (low mean corpuscular haemoglobin and mean cell volume). Their haemoglobin electrophoretic patterns were normal and their Hb A₂ levels were in the normal, usually the low normal, range. In each patient Hb H bodies were present in a small proportion of red cells and if the patients had not been tested for Hb H bodies the diagnosis of α -thalassaemia trait would not have been made.

The conventional search for Hb H bodies can be tedious and it has been found possible to make the Hb H body test more sensitive. Blood from just below the buffy coat of a column of blood centrifuged in a Wintrobe tube is mixed with brilliant cresyl blue stain and incubated at 37°C for three hours. It is usually then possible to find several Hb H-containing cells in each high-power microscope field. It is only to be expected that if one is searching for an unstable haemoglobin such as Hb H, the best yield would be in the fraction of blood rich in reticulocytes and young red cells.

It is not being suggested that every person being screened for abnormal haemoglobins should have an Hb H body test. However, if one studies those patients with thalassaemic blood films, abnormal red cell indices, and a normal Hb A₂ level, there should be a good yield of α -thalassaemia trait in this group. Experience at this hospital suggests that for every two cases of β -thalassaemia trait there will be one of α -thalassaemia trait in a community containing

Negro, Asian, and Mediterranean immigrants.—We are, etc.,

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Clinical Diagnostic Process: An Analysis

SIR,—May I comment on the interesting paper by Dr. D. J. Leaper and others (15 September, p. 569). These authors purport to show that the diagnostic process as a monolithic structure does not exist. They show quite clear patterns of diagnostic behaviour which differ between senior and junior medical personnel, suggesting that experience modifies approach to diagnosis. That there is no diagnostic pathway common to all doctors is recorded,¹ but then there are neither standardized doctors nor standardized patients. It does not follow that because behaviour differs between doctors the mental processes used by them should not show basic similarities. Certainly this has been shown by Elstein *et al.*,² though their findings were based on simulated consultations which, as Dr. Leaper and his colleagues point out, have to be interpreted with caution. The diagnostic processes of general practice do show common patterns of mental approach,^{3,4} which strongly suggest the possibility of adaptation to computer technique based on Bayesian probability.^{5,6} This not only may have application to future computer technique but, more importantly, helps to define general practice diagnostic pathways so that they may be taught more effectively, that they may be standardized,⁷ and that they may also allow general practitioners to discover areas of diagnosis which may be safely and profitably delegated to non-medical members of their team.—I am, etc.,

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Brachial Plexus Palsy after Parenteral Feeding

SIR,—Serious complications arising from the use of intravenous catheters are well known. Commonly infection and phlebitis occur, while less well-known complications include the shearing off of catheters by the needle,¹ catheter tips cutting out of veins,² and catheters knotting within the veins.³ Brachial plexus damage has been recognized as a complication of percutaneous subclavian vein puncture but does not seem to have been previously reported in connexion with the introduction of intravenous catheters via the basilic vein.

A patient was admitted to the wards in an emaciated state and it was decided that parenteral

feeding was necessary preoperatively. The technique used on our unit was to introduce a long polyethylene catheter via the basilic vein until its tip was estimated to be lying in the subclavian vein. The higher blood flow rates in these larger veins prevent the phlebitis so often associated with parenteral feeding solutions. The catheter tip was shown to be in the vein by allowing blood to run back down the catheter. Twelve hours after the infusion was started the patient complained that he could not move his arm. He did not complain of any discomfort. On examination a diffuse infraclavicular swelling was observed and the affected arm showed a flaccid paralysis and a dense sensory loss from C6 to T1. Eight weeks later the neurological signs were unchanged and electromyography confirmed severe axonal degeneration.

The brachial plexus palsy in this patient was probably due to extravasation of infusate following perforation of the vein by the catheter tip. Such perforation has previously been reported.^{2,4} In one of Adar's cases the right atrium was perforated. Once extravasation of the highly irritant infusate has occurred, irreparable damage would be caused to nerves in that region.

In conclusion, one wonders if splinting the arm to prevent flexion might not reduce excessive movement of the catheter tip and hence the risk of perforation.—I am, etc.,

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Health as a Quantifiable Property

SIR,—In spite of efforts to prevent disease, medicine has tended to become a huge industry, gravely neglecting the potentialities of the individual to cause or cure disease and the social milieu that affects that potentiality. More attention to the quality of the individual¹ would, I suggest, enormously reduce the expensive problems of medicine. Efforts to measure one's quality and health generally aim at measuring absence of disease.^{2,3} They risk overcomplexity even though practical measures have been proposed⁴ for estimating rates of cure. These efforts will fail so long as we lack a positive and usable definition of health.

I have elsewhere defined health ecologically as "a continuing property that can potentially be measured in terms of one's ability to rally from challenges to adapt ('insults')."⁵ Rallying is measured by both speed and success (the level of health reached afterwards). Established tolerance, function, and other rallying tests measure parts of health in absolute units. Present health may reflect ample reserves; or it may be lowered to some threshold as with a child malnourished and therefore vulnerable to a relatively small deficiency; or health may be due to compensation, or accompany some genetic or ontogenetic predisposition.

If a property is chartable, it is potentially measurable. Even speculative charting can be realistic (fig. 1a, U). General health will rise with maturation and sink with senescence. Superimposed on the curve will be circadian and other physiological rhythms, and frequent fluctuations during coping episodes, some of which will be labelled as

FIG. 1—Levels of health. (a) Physiological health charted without absolute units, relative to two cocoons, the uterus (U) and the immediate outside world (A-F). P is a hypothetical loss of health at post-maturity relative to the uterus. B-F are episodes of lowered health relative to the outside world, followed by coping with challenges, the most prompt (B) being that of birth. The dotted lines Am are projected health curves in the absence of challenge, and slope upwards because of normal gains with maturity. Episode D terminates in a permanent decrement in health, g3, and the series D-F represents increases in vulnerability due to successive challenges, ending in death. (b) Pre- and postnatal immunological health can be absolutely measured as shown in antibody levels,⁷ but physiological and mental health also influence coping with and outcome of infections. Although each type of health may be charted separately, all types are of course linked in the individual. For example, consider the series: social health (work stress through personal relationships)—psychological health (feelings of failure)—physiological health and physical signs (structural organ changes: ulcer, degenerative changes, emphysema).

FIG. 2—Types of health in relation to types of challenge. FIG. 3—Operation of challenges in multiple causation of diseases. The health of the individual from ovum on is decided by challenges or insults (whether damaging or training) interacting with his genetic base. The self may thus be described in Dubos's⁸ term as "experience incarnate." Superimposition of an immediate or precipitating insult may "cause" disease; but all diseases are to some degree multicausal. Although these insults may be essential (only the tubercle bacillus can cause tuberculosis), they may not be obligatory or inevitably causative (exposure to the tubercle bacillus usually does not result in tuberculosis). These insults may be received directly or may be delivered by vehicles: water, an infected individual, an insect vector, or an intermediate host may deliver an infectious organism and cigarettes may deliver carcinogens. The dotted line indicates precipitating insults arising from within an otherwise protective cocoon.

disease (fig. 1a, C-F). During coping, vulnerability to other insults is increased and there may be sequences that progressively lower health (fig. 1a, E-F). But the body and the person learn something and the level of health usually rises after coping (fig. 1a, g₁, g₂). These rises account for most of a person's health and stamina. Mechanisms of coping reflect several types of health (fig. 2; see also fig. 1b).

Obversely, health may also be measured by the amount of protection from insults required to maintain a person's normal curve of health. Protective cocoons (fig. 3) range from the uterus to family, housing, and social institutions. There is constant feedback between individual and cocoons, and challenges may arise from within what is supposed to be a protective cocoon.

This definition of health in terms of a system can also be applied to groups such as family, community, and society: we can

conceive that such a group, taken as an entity, enjoys *societal health* analogous to the *social health* of an individual.⁶ Because all efforts at creating societies have required a frustrating limitation of potentialities and fettering of minds, many who feel entrapped by this process swell the number of "deviates," some of whom could, through their perceptiveness, help to remedy societal defects. The relations between the health of the individual and the societal health of his milieu demand further study.

This view of health provides a conceptual basis for attempts to measure health, indicates that there are distinct types of health, encourages an attitude that facilitates planning for health, emphasizes that coping trains but may render vulnerable, draws attention to sets of cocoons in the milieu, and, by application to the societal health of cocoons, enhances the study of social structures by sociologists and cultural

anthropologists as well as by health professionals.

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Formylation of Folate

SIR,—We note with interest the reply of Drs. Janet Perry and I. Chanarin (29 September, p. 698) to our suggestions (15 September, p. 591) regarding their paper (9 June, p. 588).

In an experiment in this department six jejunal sacs from three animals were incubated, as described elsewhere,¹ for an hour in phosphate-Ringer solutions containing added glucose. The resulting concentrations of folate in the serosal and mucosal solutions, as indicated by microbiological assay, are given below (in ng/ml $\pm$ S.E.M.).

Solution	Total Folate	<i>Pedococcus cerevisiae</i>	<i>Streptococcus faecalis</i>
Serosal	24.3 $\pm$ 2.0	5.1 $\pm$ 0.6	8.3 $\pm$ 1.2
Mucosal	3.7 $\pm$ 0.3	0.6 $\pm$ 0.05	1.4 $\pm$ 0.05

Though these serosal concentrations are several times higher than those applied by Drs. Perry and Chanarin in their experiments, they are consistent with the intrinsic folate levels (2.16 μ g/g) reported for rat intestinal tissue by Sotobayashi *et al.*²

Other recent publications confirm the importance of intrinsic folates in these investigations³ and indicate that folate transport in rat intestine proceeds independently of metabolism.^{3,4} We suggest, therefore, that despite their failure to record more than trace amounts of folate in their control solutions, Drs. Perry and Chanarin might usefully reconsider their conclusions in the light of our results.—We are, etc.,

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Loud Knocking on the Back Door

SIR,—Your correspondent Mr. John Squire (20 October, p. 172) objects to space being given to a consultant surgeon who advertised