provement in sanitary conditions, provision of maternal and child care with family health, improvement in the nutritional status of the people, and general guidance towards a healthier and better way of life. Institutes of public health cannot afford to be sterile of ideas. Current ideas must relate to the needs of society; they cannot and must not escape the scientific climate of the time nor exceed the bounds imposed by our present limitation in resources.

In conclusion I would end on this important note. Our medical education must change so that we produce health personnel who can function effectively in the specific environment in which they work. Our medical research must change

so that we primarily pose questions which arise out of the life and suffering of the majority of the people who inhabit the globe, with due relevance to the local situation. And, as doctors, our deeply ingrained guild outlook must change, and we must open the doors wide to all those who can augment the quality of health care in this environment. Given the right guidance, the right stimulus, ordinary people are capable of self-sacrificing voluntary effort which surpasses anything that one would expect. If the obstacles that all too often prevent ordinary people from giving effect to their innate initiative and genius are removed, one will find that they are capable of solving most problems—including health problems.

A New Look at Infectious Diseases

Hepatitis

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The two diseases infectious and serum hepatitis are often referred to as “viral hepatitis.” In both diseases, however, attempts to demonstrate a causative agent in the laboratory by tissue culture or other methods have failed and evidence for their viral aetiology rests on transmission experiments in human volunteers. The discovery of Australia antigen¹ was important because it is a marker for the presence of serum hepatitis virus.²

It is now clear that infectious and serum hepatitis are two diseases which are immunologically distinct and caused by different viruses, respectively A and B; they are, however, almost indistinguishable by clinical and biochemical criteria and their epidemiological characteristics overlap to some extent. An important point of difference is that the incubation period of serum hepatitis is much longer than that of infectious hepatitis.

Australia Antigen

A specific antigen is detectable in the blood late in the incubation period and in the acute phase of serum hepatitis. It is called variously Australia antigen, SH antigen, hepatitis-associated antigen (H.A.A.) and hepatitis B antigen; electron microscopy (figure) shows that it is constantly associated with the presence in the serum of spherical particles (a) about 20 nm in diameter and tubular forms (b) of similar width. Larger particles (c) have been described³; these are about 42 nm in diameter and consist of an inner component that resembles a rhinovirus⁴ and an outer shell that may be the source of the smaller particles. There is, however, as yet no general agreement on the nature of these particles or their relationship to serum hepatitis virus.

Australia antigen was first detected by a serological technique in which the source of antibody was serum from some haemophiliacs who had received many blood transfusions and presumably repeated exposures to antigen; the reaction between antibody and antigen could be shown by a simple double-diffusion precipitin technique. Since then, however, detector

Australia antigen particles in the serum (after ultracentrifugation) of an infected patient ($\times 90,000$).

antisera have been raised in guinea-pigs, rabbits, or other animals by immunization with purified antigen; and techniques of greater complexity and sensitivity have been introduced, including complement fixation, immunoelectro-osmophoresis, passive haemagglutination, haemagglutination inhibition, and radioimmunoassay. At present immunoelectro-osmophoresis is the most commonly used mainly because it is relatively simple and suitable for the rapid testing of large numbers; thus it is used for the screening of all blood donations, now an accepted part of blood transfusion practice.

Infectious Hepatitis

Formerly known as catarrhal or epidemic jaundice, infectious hepatitis has an incubation period of 15-40 days. Transmission experiments have shown that virus A is present in blood and faeces in the acute phase of the disease and in faeces during convalescence; it is transmitted readily by contact, evidently by the faecal-oral route. Well-defined outbreaks are observed in families and in residential institutions but there are also many isolated cases. The disease is common in children and often so mild that it is not recognized as hepatitis.

In this "short-incubation" hepatitis the result of tests for Australia antigen is negative. Another antigen detectable in the blood, the epidemic-hepatitis-associated antigen (E.H.A.A.) or Milan antigen, has been demonstrated in some outbreaks of infectious hepatitis but it is evidently a non-specific indicator of liver-cell damage and not related to a virus.⁵

Serum Hepatitis

Formerly known as homologous serum jaundice, serum hepatitis has an incubation period of 60-160 days. Virus B is present in the blood during the incubation period and acute phase of the disease, and in some healthy people who are long-term "silent" carriers. These carriers can be detected by the test for Australia antigen, which is positive in about 0.1% of normal people in North West Europe and North America but in from 1% to 5% of those in tropical and some Mediterranean countries. In patients with serum hepatitis the test for Australia antigen is positive in the acute phase but usually reverts to negative during convalescence.

Serum hepatitis is transmitted by blood transfusions from silent carriers and by procedures in which the skin is penetrated by instruments contaminated with blood that is Australia-antigen positive. These include the repeated use of hypodermic needles without heat sterilization, tattooing, and the ritual scarification practised in some countries. Transmission may also occur by insect bites: Australia antigen has been demonstrated in mosquitoes.⁶

In some cases of Australia-antigen-positive hepatitis a history of exposure to blood-borne infection is lacking, and evidence for other routes of infection has been sought. Some workers have reported the demonstration of antigen in urine, faeces, and saliva; the amounts detected have, however, been small and consistent with the presence of traces of blood but not necessarily indicating a route by which serum hepatitis virus may be transmitted. Alternatively the explanation for "non-parenteral" transmission may be that exposure to a source of infection two or three months previously may have been concealed when it was associated with the illicit use of drugs, forgotten when it occurred in the course of dental treatment, or overlooked when an insect bite was responsible.

Aspects of Hepatitis

IMMUNOPATHOLOGY

The demonstration of a specific antigen in serum hepatitis has led to speculation about the nature of the immune response and its relationship to the pathology of this disease. Dudley *et al.*⁷ have suggested that initially hepatitis virus proliferates in liver cells without causing damage. Antigen is formed and released into the circulation, but some is incorporated in the surface membrane of infected cells. Circulating antigen is recognized as foreign by thymus-dependent (T) lymphocytes. As a result, sensitized lymphocytes react with antigen on the surface of infected cells to cause both inactivation of the infective agent and liver cell necrosis. If T-lymphocyte function is defective

there is little or no liver cell damage but production of antigen continues.

This concept is consistent with observations that in acute hepatitis severe liver damage is often associated with rapid loss of antigen; on the other hand, in some chronic diseases such as Down's syndrome, leprosy, and renal failure treated by maintenance haemodialysis hepatitis is mild or asymptomatic and followed by long-term carriage of antigen. There is an intermediate position in chronic hepatitis when some liver cell necrosis occurs associated with continued production of antigen.

In healthy persons found to be carriers of antigen a history of hepatitis is usually lacking: infection may have occurred in early childhood before T-lymphocyte function was fully developed. Indeed, cases have been reported⁸ in which antigen-positive mothers transmitted infection at parturition to their offspring, who became long-term carriers of antigen.

It is not known whether there is a parallel immunological basis for the pathology of infectious hepatitis but this may well be so because the hepatocellular lesion is similar to that of serum hepatitis.

CLINICAL AND BIOCHEMICAL FEATURES

Both infectious and serum hepatitis are characterized by acute inflammation of the liver that varies greatly in severity. Malaise, anorexia, and nausea are common early symptoms and liver tenderness is usually present. Jaundice is not a constant feature, and in relation to the epidemiology of hepatitis it is important to remember that anicteric cases may outnumber those with detectable jaundice, particularly in children.

Of many liver function tests available in hepatitis the most useful is the determination of serum alanine aminotransferase (formerly SGPT), the level of which is always appreciably raised and is a very sensitive indicator of the hepatocellular damage associated with hepatitis; it is raised whether the patient is jaundiced or not and hence is particularly valuable in recognizing anicteric hepatitis. The serum bilirubin level is raised in icteric patients and is a useful index of the severity and progress of the disease. Serum alkaline phosphatase is normal or only moderately raised in hepatitis; a very high value suggests obstructive jaundice. Serum immunoglobulin determinations give very variable results in hepatitis, as do tests which depend on the albumin: globulin ratio; they are not necessary for the routine investigation of the disease.

DIAGNOSIS

Apart from infectious or serum hepatitis other causes of acute liver damage that may be encountered include: other virus infections, of which glandular fever is the most common and in which anicteric hepatitis is common but jaundice rare; leptospiral infection (Weil's disease), acquired from rats; and hepatotoxic drugs including some oral contraceptives.

The investigation of a patient with suspected hepatitis should always include inquiries about the patient's occupation, contact with jaundiced patients, admission to hospital, transfusions or injections, dental treatment, travel abroad, and treatment with hepatotoxic drugs. It is important to look for tattoo marks and for evidence of illicit drug use by injection; this may not be admitted, but social contact with drug addicts is sometimes reported by patients with serum hepatitis. Inquiries about possible sources of infection should take into account the long incubation period of serum hepatitis.

Apart from liver function tests laboratory investigations that may be undertaken include a full blood count. In viral hepatitis there is a lymphocytosis but in leptospiral infection the findings include a polymorph leucocytosis and in glandular

fever atypical monocytes associated with a positive Paul-Bunnell test. Hepatitis sometimes occurs during other viral infections; for specific but retrospective diagnosis of these, appropriate serological tests are necessary.

To distinguish between serum and infectious hepatitis it is essential to test for Australia antigen. None of the biochemical tests enables this distinction to be made; the fact that in serum hepatitis the transaminase levels tend to remain abnormal for longer clearly does not help in the diagnosis of the individual case.

TREATMENT

There is no specific treatment for viral hepatitis. For the ill patient bed rest is necessary but in convalescence, which may be prolonged, the patient's own sense of wellbeing is probably the best guide to the amount of activity that should be permitted. Special diets are unnecessary.⁹

Corticosteroid treatment should not be used routinely in hepatitis. By a mechanism not fully understood it may cause a sharp fall in serum bilirubin and thus "whitewash" a severely-jaundiced patient. This is of benefit in the acute stage of the disease, but there is no evidence that the course of the illness is shortened. Moreover Guistino *et al.*¹⁰ have suggested that corticosteroid therapy in antigen-positive hepatitis may suppress T-lymphocyte function and lead to the persistence of both antigen and the associated infective agent.

Patients recovering from hepatitis are often advised to abstain from alcohol and there may be support for this recommendation in the findings of Pettigrew *et al.*¹¹ In Glasgow they found that all of 11 patients with chronic alcoholic liver disease had evidence of cell-mediated immunity to hepatitis virus B, indicating previous infection. They suggested that the course and outcome of virus B infection are modified in the alcoholic, with the development of chronic hepatitis and cirrhosis instead of the usual recovery of normal liver structure.

PREVENTION

Though there is no specific treatment for infectious and serum hepatitis certain preventive measures are available for the control of these diseases.

Infectious Hepatitis

Spread of infectious hepatitis in the community cannot be prevented but when special protection is required normal human immunoglobulin (gammaglobulin) is of proved value.¹² This suppresses the overt features of infectious hepatitis, including jaundice, though infection may still occur with presumably the development of active immunity. Those for whom protection of this kind may be required include children in institutions and patients in mental hospitals where there is persistent infection difficult to control by other methods; pregnant women in contact (as mothers, nurses, or teachers) with infectious hepatitis among children; and travellers to areas where hepatitis among newcomers is known to be common.

Serum Hepatitis

Normal gammaglobulin is not effective in the prevention of serum hepatitis. It has been suggested, however, that protection may be given by gammaglobulin prepared from plasma of donors found to have antibody to Australia antigen and this is at present under investigation. The prevention of serum hepatitis depends primarily on the identification of infected persons, including

long-term carriers, by means of the test for Australia antigen; they are excluded from the panel of blood donors and from haemodialysis units.

Hepatitis in Haemodialysis Units

Patients with chronic renal failure are being kept alive and well in increasing numbers by haemodialysis at home after training in a hospital unit. In some units outbreaks of hepatitis have occurred: the outbreaks in Britain studied prospectively by Polakoff *et al.*¹³ were all associated with Australia antigen. In some of these outbreaks patients on dialysis have been infected by transfused blood or by cross-infection from other patients and have become long-term carriers with strongly positive tests for Australia antigen. Numerous cases of hepatitis have occurred among staff caring for them and engaged in procedures such as attending to arteriovenous shunts, cleaning dialysis apparatus, and carrying out biochemical tests on their blood in the laboratory.

To prevent spread of hepatitis among staff and patients in haemodialysis units it is essential that antigen-positive patients should be maintained by haemodialysis at home with the help of relatives. These patients require treatment by an extracorporeal circulation technique two or three times a week; inevitably their relatives are exposed to risk of blood-borne infection and there may be cases of serum hepatitis among them. This must be regarded as the lesser of two evils when the alternative is the closure of the haemodialysis unit itself.

Blood-borne Hepatitis as an Occupational Hazard

The occurrence of hepatitis in haemodialysis units showed in a dramatic way that blood-borne disease may be a hazard to medical and paramedical personnel. Allowance must be made for the exceptional risks inherently associated with haemodialysis and evidence that the patients may be exceptionally heavy carriers of serum hepatitis virus. Nevertheless, care must always be exercised in handling blood known to be Australia-antigen positive or from a patient with jaundice or suspected hepatitis. Staff exposed to risk include not only those involved in the initial venepuncture but also clerical and technical staff who handle or carry out examinations on the specimen.

In these "high-risk" cases rubber gloves should be worn when performing the venepuncture, and subsequently placed together with used cotton-wool swabs in a plastic bag for disposal. Syringe and needle should be heat sterilized if necessary but it is better to use disposables. Safe disposal is essential; the doctor who cannot burn his own disposable material should enlist the help of his local hospital or health department for incineration facilities.

Safe transmission of blood specimens to the laboratory is important, and for details of local arrangements the pathologist should be consulted. For high-risk specimens, screw-capped containers securely closed should be used—each sent in a separate transparent plastic bag. Leakage from the container can then be seen before the bag is opened; contamination of the handler and of other specimens is thus avoided.

Advice may be sought by patients who as blood donors have been found to be Australia-antigen positive. Clinical examination and liver function tests should be undertaken to exclude liver disease; it is possible, for example, that the patient may be incubating serum hepatitis. The healthy carrier should be told that he must not on any account act as a blood donor, but that at present there is no epidemiological evidence to justify other restrictions. He should, however, report the existence of a positive test to his dentist, who may then take appropriate precautions when giving treatment including the use of gown, face-mask, eye protection, and rubber gloves.¹⁴

I am indebted to Dr. Anne M. Field for the electronmicrograph and to the Editor of *Archives of Disease in Childhood* for permission to publish the figure.

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Any Questions?

We publish below a selection of questions and answers of general interest

Mumps in Pregnancy

Are there any dangers of the fetus developing congenital defects if the mother contracts mumps at any time during pregnancy?

Several reports have suggested that various congenital defects occur after mumps in pregnancy. These include endocardial fibroelastosis¹ and chorioretinitis,² but unfortunately the evidence remains inconclusive. The answer to this question can be provided only by prospective clinical and virological studies of infants born to mothers with mumps in pregnancy. There is a possibility of stenosis of the aqueduct of Sylvius being a sequela of intrauterine mumps infection in view of the experimental work of Johnson and Johnson,³ who have produced aqueduct stenosis in suckling hamsters infected with mumps virus.

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Treatment for Scapula Winging

Is there any treatment, surgical or otherwise, for winging of the scapula?

Winging of the scapula is occasionally troublesome because the patient gets an ache in the shoulder and the shoulder girdle muscles from the unsupported weight of the arm. Fascia lata slings from the upper part of the scapula and vertebral border to the spinous processes can be an effective treatment. This is frequently not necessary.

Notes and Comments

Antibiotic Cover for Dentistry.—Mr. J. D. LANGDON (Department of Oral Surgery, The London Hospital Medical College, London E1) writes: In the answer to this question ("Any Questions?" 2 December, p. 544) your expert rightly stated that patients with a cardiac defect predisposing to bacterial endocarditis should be so covered. Unfortunately he gave the im-

pression that only congenital cardiac defects and those following on rheumatic fever require cover and then only for dental extractions.

Bacterial endocarditis can become established when bacteria circulating in the blood are able to settle upon and colonize the endocardial lining of the heart and great vessels. For this to occur there must usually be a pre-existing organic defect of the endocardium providing a suitable site at which the organisms can establish themselves. Such pre-existing lesions are: congenital cardiac defects (including the "innocent" murmur); a history of rheumatic fever or of Sydenham's chorea; all patients who have undergone any form of cardiac surgery, including that for patent ductus arteriosus; and all patients with an internal pacemaker electrode. It has even been suggested that any patient with a history of cardiac infarction is at risk because many of them will have scarring which involves the endocardium.

Patients in the above categories are continuously at risk if they have more than the mildest periodontal disease, periapical or pericoronal infection, or have denture ulcers. These patients will be having repeated bacteraemias with each meal. Furthermore, it is not only when extracting teeth that the dental surgeon produces bacteraemia but also during scaling and periodontal surgery, root canal therapy, and also when preparing teeth for fillings and crowns.

The current antibiotic schedules recommended for prophylaxis against bacterial endocarditis are: as a first choice, one mega unit benzylpenicillin intramuscularly 20 minutes before the operation and then phenoxymethyl penicillin 250 mg orally q.d.s. for three days. Alternatively, for those patients allergic to penicillin or who are on long-term penicillin prophylaxis, erythromycin estolate 500 mg orally two hours before operation and erythromycin estolate 250 mg orally q.d.s. for three days postoperatively.

OUR EXPERT replies: Reasonably brief answers are preferred in this column. The question specified "a healthy individual," and the questioner almost certainly had in mind only the merits of antibiotic treatment for its local effect. Hence, though the prevention of endocarditis had to be referred to, I saw no need to list the more uncommon conditions predisposing to this disease, or to enter into details about choice of antibiotic and dosage. The question refers only to extraction; thus the possible effects of other dental operations do not arise from it. I agree in general with what Mr. Langdon writes—and I trust that he can do something else about his several categories of patient who have "repeated bacteraemias with each meal." I hope that on his part he agrees with my reply on the purely dental aspect of the question—namely, that the extraction itself is usually the only treatment required.