of linkage at the level of the periportal cholangioles. Good liver function remains and some adaptive mechanisms seem to have developed to deal with the serum bilirubin and cholesterol.

An explanation of the findings is attempted.

I wish to thank Dr. A. P. Norman for permission to publish and for his advice. I am grateful to the many members of the staff of The Hospital for Sick Children whose contributions have enabled me to write up the case.

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Preliminary Communication

DIARRHŒA CAUSED BY DEFICIENCY OF SUGAR-SPLITTING ENZYMES

DIARRHŒA of untraceable origin is often met in clinical practice and in such cases causal therapy is impossible.

Holzel et al.[1] recently proved that the diarrhœa in two children was caused by lactase deficiency; the lactose, which remained unsplit and could not be absorbed, gave rise to abnormal fermentation in the intestine with increased fluid excretion and stronger peristalsis, resulting in diarrhœa.

We have observed three children (patients X, Y, and Z) with analogous disturbances—not caused by lactase depletion but by invertase and/or maltase deficiencies. We are now looking for deficiencies in carbohydrate-splitting enzymes, and we have recently seen more cases of diarrhœa due to such deficiencies, including one with shortage of lactase. This form of diarrhœa disappears promptly when the sugar concerned is excluded from the diet, or if the lacking enzyme is added.

Diagnostically these enzyme deficiencies can be demonstrated by means of sugar-loading curves, and by examination of the fæces, in which excessive quantities of lactic acid and volatile fatty acids cause fermentation. Fig. 1 represents a typical example of a saccharose-loading curve in patient Z, with invertase deficiency. Fig. 2 shows that the quantity of lactic acid in the stools is a good criterion of diagnosis; in normal cases almost no lactic acid is excreted in the fæces, but in the absence of invertase, lactase, or maltase the lactic-acid excretion is increased at least tenfold by the saccharose (lactose or maltose) and starch. This increase in lactic-acid excretion is so great that determination of lactic acid in any sample of fæces is sufficient to demonstrate abnormal fermentation, although more information can naturally be obtained from determination of the lactic-acid excretion over 24 or 48 hours.

An obvious further step was to try direct quantitative typing of significant components of the fæcal microflora,

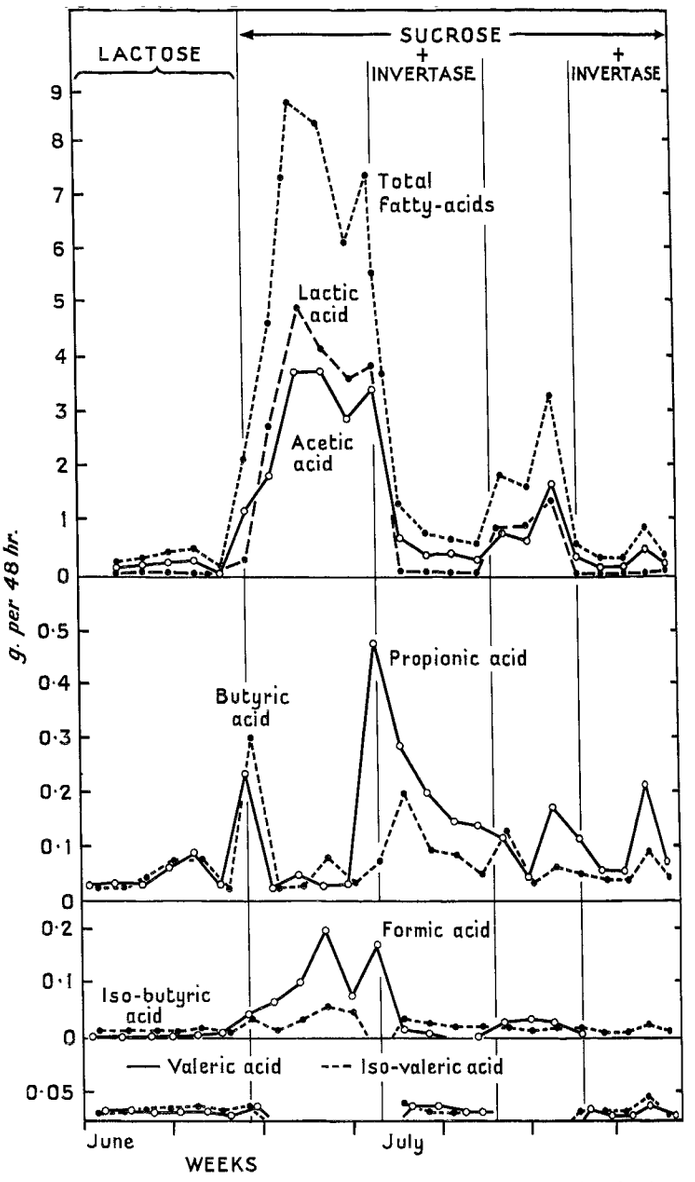

Fig. 2—Fatty-acid excretion in the fæces of patient X when having a diet containing lactose or sucrose.

The lactic acid was determined according to Long,[2] and the volatile fatty acids gaschromatographically according to van de Kamer et al.[3]

for which purpose the viable numbers of the following organisms were determined:

1. Three extensive general classes of bacteria.
2. Four typical groups of fæcal bacteria.
3. Yeasts.

2. Long, C. *Biochem. J.* 1946, **40**, 27.
3. van de Kamer, J. H., Gerritsma, K. W., Wansink, E. J. *ibid.* 1955, **61**, 174.

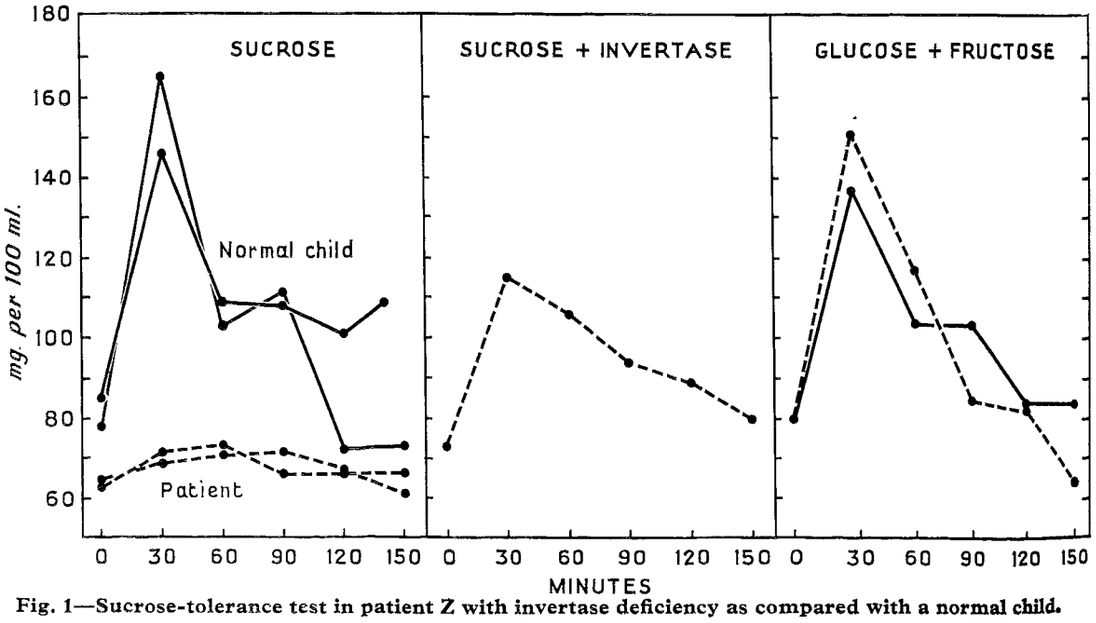

Fig. 1—Sucrose-tolerance test in patient Z with invertase deficiency as compared with a normal child.

1. Holzel, A., Schwarz, V., Sutcliffe, K. W. *Lancet*, 1959, i, 1126.

This was done in a patient with deficiency of maltase and invertase.[4 5] The results are shown in the table; in no case were salmonellæ observed, nor did the numbers of *Staphylococcus aureus* exceed 10^2 per gramme.

EFFECT OF DIET ON BACTERIOLOGICAL DIFFERENTIATION OF FÆCES IN A PATIENT WITH MALTASE AND INVERTASE DEFICIENCY

Bacterial counts per gramme fresh fæces	Diet with maltose or sucrose	Same diet + corresponding enzymes; or diet with glucose only
Total aerobic count	$0{\cdot}2\times10^{10}$—$0{\cdot}4\times10^{11}$	$0{\cdot}1\times10^{10}$—$0{\cdot}8\times10^{10}$
Total anaerobic count	$0{\cdot}7\times10^{9}$—$0{\cdot}4\times10^{11}$	$0{\cdot}1\times10^{10}$—$0{\cdot}2\times10^{10}$
Aerobic proteolytic count	$0{\cdot}1\times10^{5}$—$0{\cdot}2\times10^{8}$	$0{\cdot}9\times10^{5}$—$0{\cdot}5\times10^{9}$
Enterobacteriaceæ	$0{\cdot}3\times10^{8}$—$0{\cdot}8\times10^{9}$	$0{\cdot}8\times10^{9}$—$0{\cdot}3\times10^{10}$
Fæcal streptococci	$0{\cdot}4\times10^{9}$—$0{\cdot}4\times10^{10}$	$0{\cdot}2\times10^{7}$—$0{\cdot}7\times10^{8}$
Sulphite-reducing clostridia	$0{\cdot}4\times10^{5}$—$0{\cdot}6\times10^{7}$	$0{\cdot}1\times10^{5}$—$0{\cdot}6\times10^{9}$
Bifidibacterium bifidum	$0{\cdot}2\times10^{9}$—$0{\cdot}8\times10^{11}$	$0{\cdot}3\times10^{9}$—$0{\cdot}8\times10^{10}$
Yeasts	$0{\cdot}6\times10^{4}$—$0{\cdot}7\times10^{7}$	$0{\cdot}4\times10^{4}$—$0{\cdot}1\times10^{7}$
pH of fæces	4·7—5·8	6·4—7·2

When the patients had diarrhœa increases in total counts and in the count of fæcal streptococci and *Bifidibacterium bifidum*, and decreases in the counts of aerobic proteolytic bacteria, enterobacteriaceæ, and sulphite-reducing clostridia were usually noticed. But, with the exception of the increase in fæcal streptococci during diarrhœa, these bacteriological changes never reached the same order of magnitude, and were not therefore as reliable diagnostically as the decrease in pH or increase in lactic-acid content observed at the same time. Because accurate determination of streptococci in fæces is doubtless the most laborious procedure of the three mentioned, it seems preferable to rely on an indirect biochemical change rather than on a direct bacteriological one.

Practically, this means that when investigating the cause of diarrhœa the lactic acid in the stools should always be determined. If the content exceeds 1 g. per 48 hours, the possibility of carbohydrate intolerance should be considered. Then, with the help of saccharose, lactose, maltose (and if need be starch) tolerance curves, one can discover whether such an intolerance really exists, and whether it is due to an invertase, lactase or maltase, or amylase deficiency.

The diarrhœa should be treated either by giving supplements of the deficient enzyme, or by eliminating the sugar concerned from the diet.

A detailed report of this investigation will appear in the *Acta pædiatrica*.

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Reviews of Books

The Development of the Infant and Young Child

Normal and Abnormal. R. S. ILLINGWORTH, M.D., F.R.C.P., D.P.H., D.C.H., professor of child health, University of Sheffield. Edinburgh: E. & S. Livingstone. 1960. Pp. 326. 27*s*. 6*d*.

THIS book, much of which is based on the pioneer work of Arnold Gesell of Yale, is concerned with the normal and abnormal development of the infant and pre-school child. It describes in simple language how to assess mental development in the early years, and the significance of the results obtained. Professor Illingworth emphasises the importance of a detailed history of physical and environmental factors, which may influence development, and of an individual developmental history. The chapters on history-taking and examination are clearly written in non-technical language and that on the significance of different fields of development and their relative importance goes to the heart of the matter. It is essential to realise, for instance, that whereas gross motor development—the easiest field of development to assess—is the least useful for predictive purposes, manipulative development and the age at which chewing begins are useful predictive signs, and that speech and pre-verbal vocalisation is the most valuable of all. The conclusion is that developmental tests in infancy are of great value, for they can detect mental retardation and neurological conditions with a considerable degree of certainty, though there is little to suggest that mental superiority can be detected so early.

Much emphasis has rightly been placed on the wide variations of development regarding both general pattern and individual functions such as speech, and there is a useful chapter indicating the level of intelligence in a wide variety of conditions, though some of the rare conditions mentioned might have been omitted in a book of this scope.

The concluding chapter on common mistakes and difficulties in developmental diagnosis gives valuable guidance by one who has had much experience in this important and long-neglected area of pædiatric practice.

Principles of Bone X-ray Diagnosis

GEORGE SIMON, M.D., M.R.C.P., F.F.R., assistant director, X-ray department, Brompton Hospital; radiologist, St. Bartholomew's Hospital, London. London: Butterworth. 1960. Pp. 178. 57*s*. 6*d*.

IN his latest book Dr. Simon has again adopted the unusual approach of arranging his material according to the abnormal appearances seen on the X-ray film. This is the technique which he used so successfully in his earlier *Principles of Chest X-ray Diagnosis*. In each chapter one broad type of abnormality is discussed and the additional features are described which assist in the eventual diagnosis. Dr. Simon has covered a wide variety of bony disease, including congenital abnormalities, deficiency diseases, and disorders of growth, as well as inflammatory and neoplastic conditions. All the commoner lesions are recorded, as well as many conditions less often seen. His style is concise and the text is easy to follow. The radiographs have mostly reproduced well, and generally appear on an appropriate page so that the reader is not distracted by having to search for them. There are useful notes on pathology, blood chemistry, and radiographic technique.

With such a strong accent on interpretation and differential diagnosis this book will be a highly prized addition to the shelves of radiologists and students of radiology. Although there is no doubt that the author's primary aim has been successfully achieved, in a work of this character detailed pathological descriptions have no place, and the reader who seeks them must refer to a standard textbook. To keep the book to a reasonable size the author has deliberately excluded such specialised X-ray investigations as arteriography and arthrography, and the appearances of the radiograph after orthopædic operations. There is a first-class index and a useful list of the 244 illustrations.

Encyclopædia of Medical Syndromes

Editor: ROBERT H. DURHAM, M.D., F.A.C.P., physician in charge, division of general medicine, Henry Ford Hospital, Detroit. New York: Paul B. Hoeber. 1960. Pp. 628. 110*s*.

A READER who picks up this book may wish to ascertain, in the first place, exactly what is meant by a " syndrome ". The introductory pages admit the difficulty of an exact definition,