

is an important part of the operation so that the weight-bearing area is pulled back underneath the raw ends of the metatarsals.

DR. M. WILKINSON (*Perth*) Is there any tendency in the cases with longer follow-up for the toes to slip sideways or backwards?

MR. FAITHFUL No, there were only two patients in whom the toes became irregular, and there was no apparent reason for this.

DR. A. G. MOWAT (*Oxford*) Could I confirm that the Fowler approach described by Dr. Ashford does work very well and can reduce the stay in hospital. In Oxford, also, we do not remove the callosities from the sole and there is only one incision. The callosities disappear within 3 to 4 weeks and the sole of the foot returns to normal.

MR. FAITHFUL Yes, I am sure that, when the irritation of weight-bearing goes, the callosities do heal. I think they are not on the normal weight-bearing areas, but on the area proximal to this. The fat-bearing pad moves forward when the toes become hyperextended at the metatarsal joints.

DR. A. ST. J. DIXON (*Bath*) I have seen very few of these Fowler-type arthroplasties done from the top, but I have the impression that the Kates-Kessel type of operation produces working toes, toes that actually do something in walking, whereas the others become mere flaps, that waggle around on the end of the foot when the patient is walking and take no weight at all.

PROF. J. J. R. DUTHIE (*Edinburgh*) This is a thing that struck me. We were doing this Fowler operation earlier on and found that if you take a bit off the proximal phalanx the toes remain as living prostheses. If you take the metatarsal head and neck and leave the base of the proximal phalanx you get perfectly good functional toes. This is something I don't understand, but perhaps Mr. Souter has some comment on this.

MR. W. A. SOUTER (*Edinburgh*) No, I have no personal experience of doing the operation from the dorsum. Having been trained by Mr. Savill I have followed his techniques of coming from the sole. I would agree with Professor Duthie that by this technique the patient regains remarkably good functional control of the toes.

Sulphated Acid Mucopolysaccharide Metabolism in the Rabbit Intervertebral Disc. An Autoradiographic Study. By **W. A. SOUTER** (*Princess Margaret Rose Orthopaedic Hospital, Edinburgh*)

Two groups of New Zealand white rabbits, one consisting of 3 to 4-week-old animals, the other of 2½ to 3½-year-old breeding stock, were injected intraperitoneally with $\text{Na}_2\text{S}^{35}\text{O}_4$ and thereafter killed at intervals varying from 15 minutes to 8 weeks. Microautoradiographs were prepared from sections of thoracic and lumbar intervertebral discs by a dipping technique using Kodak NTB₃ emulsion, and were stained mainly with Alcian blue in

view of its specificity for sulphated acid mucopolysaccharides.

The intervertebral disc complex of the young rabbits showed marked uptake of the radioactive label, the latter being demonstrable intracellularly within 15 minutes of injection and apparently reaching a peak about 8 hours later. The cells exhibiting by far the greatest avidity for the isotope were the peripheral groups of notochordal cells in the nucleus pulposus, the proliferative and hypertrophic cells of the growth columns of the vertebral epiphyseal plate, and the hypertrophic chondrocytes of the 'peripheral epiphyseal crescent'. Slightly less active were the fibrocartilaginous cells of the inner two-thirds of the annulus fibrosus, while the least activity was shown by the germinal cells of the epiphyseal plate, the centrally placed cells of the nucleus pulposus, and the outer fibrous layers of the annulus fibrosus.

By comparison, the findings in the discs of the mature rabbits suggested a striking rundown in the level of mucopolysaccharide metabolism. A moderate uptake could still be observed within the residual elements of the epiphyseal growth columns, but in the nucleus pulposus marked reduction had occurred, not only in the size and number of the metabolically active cellular aggregates but also in the actual intensity of uptake exhibited by those cells which did remain.

Discussion

DR. D. L. GARDNER (*London*) There are technical factors here which have to be considered. (1) Fixation in 10 per cent. formalin removes much of the sulphated mucopolysaccharide. (2) Sulphate labelling is not specific for sulphated mucopolysaccharide. (3) Your summary suggests that the early phase of labelling is intracellular but one of your photographs shows heavy labelling of a pericellular matrix with pale Alcian blue staining, by contrast with the more deeply staining intercellular matrix which was poorly labelled, suggesting that the correlation between Alcian blue positivity and sulphate labelling was not complete. (4) The specificity of Alcian blue itself for sulphated polysaccharides depends heavily on the control of pH and magnesium chloride concentration.

There are therefore at least four important technical points which have to be considered before drawing the conclusions you have reached.

MR. SOUTER Because of the limited time at my disposal I did not elaborate on the technical details of our processing of the disc tissues. For fixation we did, in fact, use 10 per cent. formalin with cetyl pyridinium chloride as additive, which, according to Conklin (1963), enhances the retention of mucopolysaccharides.

With a few of the discs, we used barium hydroxide as additive in the formalin solution with a view to obtaining control material, as suggested by Campo and Dziewiatkowski (1961), on the rationale that the barium salts of chondroitin sulphate and keratosulphate are highly soluble and are thus liable to leach away from the tissue during the fixation period. The alteration produced in the staining reaction of the tissues fixed by this latter method was quite striking in that there was almost complete loss of Alcianophilia and radioactivity. In the case of the mature animal tissues, however, the effect of using barium

hydroxide as an additive appeared to be minimal. Hyalase too has less effect on abolishing the Alcianophilia and radioactivity from older animal tissues, but this may well be due to the relative increase in keratosulphate.

With regard to your doubts as to the accuracy of the assumption that sulphate uptake can be regarded as an index of mucopolysaccharide production, I am aware that at least some of the radioactivity has not been incorporated into the mucopolysaccharide but, as shown by Katsura and Davidson (1966), is merely loosely associated with the mucopolysaccharide molecule, probably being chelated with calcium. In view of this it may well be that quantitative studies of mucopolysaccharide production using sulphate uptake as an index may have to be regarded with some caution, but from a qualitative point of view, since there is no dispute that the label is, in fact, associated with the mucopolysaccharide molecule, whatever the nature of the bond, the observation of intracellular uptake followed by extracellular transfer would still seem to be a valid index of mucopolysaccharide metabolism.

Finally with regard to your comment that, even at the

early phases of the experiment, some of the label was present in the extracellular tissues, I would concede immediately that this is indeed so. All the early sections tend to have a very high background of radioactivity and it may be that the intracellular pattern of labelling, so characteristic of this period, is superimposed on a tide of inorganic sulphate diffusing into the avascular disc.

References

- CAMPO, R. D., and DZIEWIATKOWSKI, D. D. (1961) *J. biophys. biochem. Cytol.*, 9, 401 (A consideration of the permeability of cartilage to inorganic sulfate).
 CONKLIN, J. (1963) *Stain Technol.*, 38, 56 (Staining reactions of mucopolysaccharides after formalin-containing fixatives).
 KATSURA, N., and DAVIDSON, E. A. (1966) *Biochim. biophys. Acta*, 121, 135 (Metabolism of connective tissue polysaccharides *in vivo*. The sulphate group).

The Heberden Round was due to be given by Dr. Rowland Alexander, but his sudden and unexpected death shortly before the meeting prevented this. In place of the Round, Professor Ian Duthie demonstrated a series of rheumatological cases.

Book Review

Diseases of the Joints. Edited and published by the *British Medical Journal*. 1970. Pp. 107. B.M.A., London. (75p)

The *British Medical Journal* published a series of articles in 1969 giving practical advice on common disorders of the joints. These excellent articles have now been revised by their authors and collected together to form a booklet which is worth buying; they will succeed in their advertised attempt to bring doctors up-to-date where important therapeutic advances have taken place in the field of arthritis and rheumatism.

However, the metamorphosis of articles into a volume called 'Diseases of the Joints', proclaimed by the editor to be a handbook on the management of arthritis, entitles the reviewer to question whether this claim is justified. 'Not quite' is the answer. There must be a limit,

but ankylosing spondylitis, psoriatic arthropathy, disorders of the lumbar vertebrae (although the cervical spine is dealt with), and the surgery of joints should not have been omitted. Perhaps this was because the compilation of the booklet was an afterthought, so that no plan was formulated at the start to make it fully comprehensive.

Nevertheless, it is packed with practical information, and well written and illustrated. The stimulating introductory article, 'Arthropathies and Allied Disorders' by Dr. Dudley Hart, demonstrates why rheumatology can be such an interesting speciality, as troubles in bones and joints embrace the whole of medicine and the entire world of patients. That the differential diagnosis is wide, is shown by the list of about 180 possible conditions. Perhaps rheumatology will be the last refuge of the general physician.

CLIFFORD HAWKINS

Correction

In the November, 1970, issue of the *Annals*, in the paper by W. Carson Dick, M. F. Grayson, A. Woodburn, G. Nuki, and W. Watson Buchanan, vol. 29, on p. 645 (footnote), please insert plus sign to read:
 Placebo : corrected mean = overall mean + 2b.