DR. D. RAJAPAKSE (London) In one set of experiments the harvesting was done on the 5th day and in the other on the 6th day. Might this not account for wide variation in the uptake of thymidine?

DR. DAVEY In the first group of experiments we did not find any marked difference in the results, whether cultures were harvested at day 5 or day 6, but this is clearly very late in lymphocyte culture time and there tended to be a fairly wide variation. It is late even for antigen stimulation, and I think that in some of the cultures the pH had dropped so much that we were getting rather slight effects.

Review of the Results of Excision of the Metatarsal Heads in Patients with Rheumatoid Arthritis. By D. K. FAITHFUL and D. L. SAVILL (*Princess Margaret Rose Hospital, Edinburgh*)

The results of excision of the metatarsal heads on account of pain in the forefoot in 77 patients with rheumatoid arthritis are reviewed. There were 62 females and fifteen males in the group. Ages ranged from 23 to 74 years. Follow-up ranged from 2 months to 5 years (average 2.2 years). Complications included the development of haematomata requiring release in three feet, wound infection in seven, and delayed wound closure in seven. The results of surgery were assessed in three grades:

- I. Unlimited, pain-free walking in normal shoes.
- II. Some residual pain on walking requiring the wearing of insoles in normal shoes.
- III. Persistent pain on walking not relieved by conservative measures and requiring further surgery.

Of 147 feet operated on, 118 were classed as Grade I, fourteen as Grade II, and fifteen as Grade III.

Of the fourteen in Grade II, eight had persistent pain as a result of pressure on a metatarsal remnant, four had discomfort attributed to wound infection, one had persistent hallux rigidus on one side, and in one the cause of pain was not obvious.

In the fifteen in Grade III, the poor results were attributed to irregular resection of the metatarsals in nine, inappropriate operation in three, and no obvious cause in three.

The fact that in 80 per cent. of feet operated on symptoms were abolished and the wearing of normal shoes made possible makes this procedure one of the most reliable in the treatment of rheumatoid arthritis.

Discussion

DR. A. G. S. HILL (Stoke Mandeville) What is the average length of stay in hospital for these patients?

MR. FAITHFUL It is usually about 4 weeks. After 3 weeks they start walking and by the end of the fourth week they are confident in their sandals and they go home.

DR. A. G. S. HILL (Stoke Mandeville) This always seems to be rather disappointing in the sense that this very productive operation involves a rather disproportionate length of stay in hospital, during which very little is happening because the patient isn't weight bearing.

DR. D. A. PITKEATHLY (Manchester) Have you any experience of treating psoriatic arthropathy with this same operation? In my experience it has been less successful.

MR. FAITHFUL There was one case in which the patient developed hallux rigidus on both sides. We feel that these patients should probably have a Keller's operation, with removal of the base of the first proximal phalanx as well. This patient in fact had this done and there was a good result with relief of pain.

DR. A. G. S. HILL (Stoke Mandeville) Could we ask Dr. Pitkeathly why the result was disappointing in his psoriatic patients?

DR. D. A. PITKEATHLY (Manchester) My feeling is that the metatarsal heads were so irregular, so jagged, to begin with that perhaps the surgeon had more difficulty in trimming them properly, but this was only my impression.

DR. A. G. S. HILL (Stoke Mandeville) Did you refuse any patients for operation because you thought the vascularity was poor?

MR. FAITHFUL Not that I am aware of, no.

PROF. E. G. L. BYWATERS (London) How did you test for this?

MR. FAITHFUL Mainly by testing the pulses and also by seeing the return of circulation in the toes preoperatively. I know Mr. Kessel likes to carry out an arteriogram on his patients before he operates on them, but we did not think this was necessary.

DR. J. A. D. ANDERSON (London) I am interested in this 4-week period in bed, because in my department we are studying progressive patient care, trying to get people out of expensive beds into less costly ones. Would you like to suggest how long these people have to be in the most expensive (Class I) type of bed?

MR. FAITHFUL It has been the policy of this unit to keep them in bed for 3 weeks. We have found that if we get them up on crutches before that, or try to get them home, their feet tend to swell. It is quite a big operation on the forefoot and any swelling might interfere with the blood supply to the foot. For this reason we like to have them in bed with their feet up in the air.

DR. MAUREEN ASHWORTH (Stoke Mandeville) We have found that if we use a dorsal incision the patient needs to spend only 3 weeks in hospital for both feet to be done. Without the plantar incision they are more rapidly mobile and the callosities heal spontaneously.

MR. FAITHFUL Yes, I believe this was the operation described by Mr. Fowler. He also removed a segment of skin from the sole as well, but you don't remove the skin? And you find that the weight-bearing area is not affected on the sole? One of the main reasons for using the plantar incision is to remove this segment of skin: we feel this

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