surface layer, loose fibrous tissue present between the surface layer and the underlying muscle, and faint metachromasia of the surface cell cytoplasm. The articular cartilage changes were followed by autoradiography employing sulphur³⁵ as an index of chondrocyte viability.

The regeneration of the synovium was complete after 85 to 110 days, but in the steroid-treated group the regeneration was incomplete and there was a preponderance of scar tissue at the end of the experiment. The articular cartilage surfaces were fibrillated in 20 per cent of the non-steroid group by the end of the experiment, but they were unaffected in the steroid-treated group. It is suggested that the administration of steroids or other drugs with a similar inhibitory effect on synovial regeneration could be beneficial after synovectomy in rheumatoid arthritis.

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Discussion

DR. A. G. S. HILL (*Stoke Mandeville*) Your steroid dose is roughly equivalent to cortisone 90 mg./day in an adult human.

MR. BENTLEY We are now conducting more controlled experiments including checks on serum cortisol levels. We may have produced excessive steroid effects.

DR. A. G. S. HILL (*Stoke Mandeville*) This would be a higher dose than one would want to use routinely.

PROF. E. G. L. BYWATERS (*London*) If steroids were given weekly it might be difficult to say that there was direct effect of the cortisone on cartilage. It may equally have affected the animals' behaviour; how they leaped about their cages, or whether they were very lethargic, etc.

MR. BENTLEY They appeared to be moving about and using their joints normally, after the immediate pain of the operation had passed.

PROF. D. L. GARDNER (*London*) Do not large doses of corticosteroids suppress regeneration in experimental conditions of repair? Articular cartilage for some days after death in man will take up sulphate and this is surely not a sensitive index of viability or health. You showed the blue of the toluidine blue but no metachromasia. Does hyaluronate react with toluidine blue to cause metachromasia?

MR. BENTLEY It is accepted that hyaluronic acid is linked to protein, together called hyaluronate, which is bound to the articular cartilage surface and is responsible for lubrication. There are other theories: e.g. the fat theory of Swanson and Freeman (1970) and various mechanisms

described by Walker, Dowson, Longfield, and Wright (1968).

We demonstrated cytoplasmic metachromasia in the synovial cells. Articular cartilage does remain alive after death and Curran and Gibson (1956) showed that pieces of cartilage kept in saline for 6 weeks could still be labelled by ³⁵ sulphate. Labelling indicates that the cells are taking up the radioactive sulphate and turning it out into the matrix which they cease to do when dead. The only other mechanism would be by diffusion of ³⁵ Sulphate into the cartilage and if this were so then one would have to explain why the ³⁵ Sulphate accumulates around the cells. I would accept labelling around the cells and in the adjacent matrix as an index of viability of the cells.

DR. W. W. BUCHANAN (*Glasgow*) Rabbit joints are very small and any operation might produce instability. What are the effects on the cartilage of a sham operation?

MR. BENTLEY We have done sham operations previously and provided the patella does not subluxate, there appears to be no effect on the articular cartilage.

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An Objective Clinical Study of Chest Expansion. By J. M. H. MOLL and V. WRIGHT (*Rheumatism Research Unit, University Department of Medicine, Leeds*). Published in full in *Ann. rheum. Dis.* (1972) **31**, 1.

Discussion

DR. J. T. SCOTT (*London*) Chest expansion is not of much value in the diagnosis of ankylosing spondylitis but it is useful in serial follow-up assessments. How reproducible is this observation?

DR. MOLL I have done an intra- and inter-observer study in chest expansion. The correlation between two observers gives an 'r' value of + 0.8 with significance at the 0.1 per cent. level. The intra-observer error, in terms of the coefficient of variation, is less than 10 per cent.

DR. A. J. PALFREY (*London*) Were these measurements all taken in the horizontal plane, and since there is a variation in the posture of ankylosing spondylitis in the elderly did you record this?

DR. MOLL All measurements were made in the horizontal plane. No objective account was taken of variation in posture, either in patients with ankylosing spondylitis or in the elderly. However, on subjective grounds, one feels that if the difference due to posture were to be expressed numerically the number would be small.

PROF. E. G. L. BYWATERS (*London*) Nature's purpose in chest expansion is air intake. Which of these various measurements would correlate best with air intake?

DR. MOLL We have not correlated these measurements with vital capacity. However circumferential and transverse, circumferential and antero-posterior, and antero-posterior and transverse measurements all correlate well, so that it is likely that correlations between individual measurements and vital capacity would be similar.

DR. P. H. N. WOOD (*Manchester*) Leeds have settled down and tested the New York criteria, for which they must be complimented. Unfortunately in doing so they have attached much importance to an equally bogus concept, that of the normal range (Murphy, 1966).

Reference

Murphy E. A. (1966) *Perspect. Biol. Med.*, 9, 333 (A scientific viewpoint on normalcy)

System of Job Analysis for Use in Studying Rheumatic Complaints in Industrial Workers. By J. A. D. ANDERSON (*Department of Community Medicine, Guy's Hospital Medical School, London Bridge, London, S.E.1*).

2,684 male manual workers employed in seven different industries were studied and the prevalence of rheumatic complaints assessed by structured questionnaires and clinical examinations. Subsequently their jobs were observed and separate assessments made of the effort needed by the arms, the legs, and the back of each worker in performing his normal task. In addition, the posture adopted at work was recorded and the climatic conditions noted. The classification used a five-point scale under each of six headings (Back, Arms, Hips, Legs, Posture, and Site—BAHLPS).

Rheumatic complaints as a whole were found to be more prevalent among workers engaged on jobs requiring heavy effort of the back, arms, and legs. Back pain (including disc disease) was related to effort at work and also to some extent to the posture adopted at the place of work. When the results of those who had been in the same job for 15 years or more were studied, however, no statistically significant correlation could be demonstrated between maximum effort by the back and back pain. One explanation of this could be that workers with back pains who are engaged in strenuous occupations (particularly if they are associated with awkward posture) may be forced to change their jobs. This is supported by a finding of the present study among workers employed on the same jobs for at least 15 years. Men engaged in heavy manual work requiring maximum effort by the back had a prevalence rate of disc disease (in some circumstances a more advanced manifestation of back pain from undetermined causes) rising to a maximum of 18 per cent in the age group 45 to 50 years; thereafter the rate fell to 14 per cent in those aged 60 to 65 years. By contrast the prevalence rate for disc disease among those engaged in less arduous

work continued to rise for longer reaching its peak of 19 per cent in those aged 50 to 55 years, while the rate for those aged 60 to 65 years was 17 per cent. It would appear therefore that point prevalence studies among those who have been in the same employment for 15 years will be more likely to include an unduly high proportion of healthy men. One way of overcoming this difficulty would be to carry out a cohort study over a period of years using the combined skills of a physician and an ergonomist.

Discussion

DR. J. WEBB (*Glasgow*) You have shown an increasing incidence of disc disease up to the age of 40 to 45 years, and then a falling off, especially in heavy workers, which often parallels the natural history of disc disease.

DR. ANDERSON In the lighter workers the incidence continues to increase for a longer time, while in the heavy workers it falls away more rapidly. There is as you say a natural history of apparent regression among those with disc disease; signs can often be found but the effects of the disease may not be so great. Surveys have been made among people who have left their employment and among those who are currently in work, but we have not yet done the combined operation which is needed to bridge the gap. It would be helpful if some test of measuring accurately the presence of disc disease could be developed.

DR. W. W. BUCHANAN (*Glasgow*) In the cohort study you are proposing, should you not be considering time off work due to disc disease rather than the presence of back pain or disc disease? What are the differences between various occupational groups in time off work due to disc disease?

DR. ANDERSON There is more time lost from work in heavier than in lighter occupations. I agree that back-pain which produces time off work is just as important as disc disease, but in the former it may be more difficult to differentiate between psychological and physical illness. Definitive disc disease is more likely than undetermined back-pain to lead to sickness absence among those engaged in heavy work. If one is trying to relate loss of work from back-pain to effort at work, I think one has to concentrate on the physical rather than the psychogenic causes, though the importance of the latter should not be underrated.