Obesity was found to have no influence on prognosis in the series, as 60 per cent. of the patients were less than 7 lb. over their ideal weight for height and age, and there was no correlation between deterioration and excess of weight.

It was shown that 68 per cent. of the patients left in the trial had deteriorated after 5 years; *i.e.* eighteen patients needed increased time for stairs and 39 required surgery. 32 per cent. of patients had shown no deterioration in any way which could be measured.

Finally, it was suggested that all patients with primary osteoarthritis of the hips did not inevitably deteriorate, although those with radiological cysts when first seen were more likely to do so and might be suitable for surgery at an early stage.

Discussion.—DR. G. HOLDEN (*Crawley, Sussex*) asked if there was any relationship between the rate of deterioration of the hips and the previous occupations of patients. Mr. Seifert replied that no such correlation had been found.

Following a discussion on the apparent recovery of joint space in a number of patients in Mr. SEIFERT's study, DR. A. ST. J. DIXON (*Bath*) made the point that it was essential to standardize radiographs by ensuring that the patient was weight-bearing and that the foot was rotated to the same extent on each occasion.

DR. L. J. BARFORD (*London*) was encouraged by the evidence that a number of cases of osteoarthritis of the hip improved clinically, but DR. SAVAGE stressed that in this series a more important finding was that one-third of the patients did not deteriorate.

Pressure Studies in the Moving Knee. By M. I. V. JAYSON and A. ST. J. DIXON (*Bath*): Intra-articular pressure recordings were made by passing catheters into knee joints and connecting these with transducers.

Pressures were recorded with varying amounts of simulated effusions during a variety of manoeuvres.

The results of these readings were presented with a discussion of their relevance to the effects of effusion in patients with arthritis.

Effects of External Environmental Changes on the Viscosity of Human Synovial Fluid. By J. F. BUCHAN and M. P. RIGBY (*Royal Northern Hospital, London*): Synovial fluid is usually regarded as a time independent non-newtonian fluid. Both prolonged agitation and prolonged cooling of sterile centrifuged human pathological fluid have no effect on the viscosity as estimated by the Frame and Wier Viscometers. However, prolonged gentle heat under controlled conditions initially raises the viscosity and later reduces it. The causation for these changes and their significance was discussed.

Behaviour of Synovial Fluid on Articular Cartilage. By P. S. WALKER, J. SIKORSKI, D. DOWSON, D. LONGFIELD, and V. WRIGHT (*Bio-engineering Group for the Study of Human Joints, Rheumatism Research Unit, and*

Department of Mechanical Engineering, University of Leeds): It had previously been shown that in load-bearing joints, such as the hip and knee, the cartilage surfaces were protected by a fluid film which was maintained by a squeeze-film action. Even under prolonged loading the fluid took a long time to squeeze out from between the surfaces and large areas of boundary contact were prevented from forming. This action depended upon a combination of the properties of synovial fluid and of the surface of articular cartilage. Some of these special properties as revealed by scanning electron microscopy and other techniques were described.

The outlines of small agglomerations of hyaluronic acid-protein complexes were visualised and evidence was presented to show their entanglement with each other to form a network.

The undulating nature of the surface of cartilage was shown by a stylus tracing method and by scanning electron microscopy.

When two such surfaces are loaded together a large array of "trapped pools" is enclosed. Evidence was presented to support this concept of boosted lubrication by fluid entrapment. A stylus measuring method had been used to assess the degree of surface flattening at different loadings and after different times under load.

Scanning electron micrographs of osteoarthrotic cartilage were shown to give information about the wear mechanism in these joints.

Discussion.—PROF. K. W. WALTON (*Birmingham*) referring to Mr. Longfield's paper, suggested that the electron-microscopic appearances on the surface of the cartilage might reflect the shape of the hyaluronic molecules or their polymers. He also pointed out that artefacts were liable to be produced during the preparation of specimens for the scanning electron microscope.

PROF. E. G. L. BYWATERS (*Taplow*) suggested that this criticism might be met by looking at impressions of the original specimens.

PROF. J. H. KELLGREN (*Manchester*) asked Mr. Longfield if he had studied other materials with the same sort of undulating surface and roughly the same elastic properties as cartilage, to establish whether it was the surface and elasticity of the material or some chemical property of the cartilage surface which caused entrapment.

MR. LONGFIELD replied that from the results of experiments using a rubber replica it was probable that entrapment was due to some chemical or other property of the surface of the cartilage.

DR. G. NUKI (*Glasgow*), in discussing the paper of Drs. Buchan and Rigby, suggested that there was a gradual decrease in viscosity of synovial fluid with rise in temperature. This was much accentuated when the fluid was incubated at body temperature for two days. He thought that the explanation of this phenomenon was degradation of hyaluronic acid by enzymes contained in the fluid.

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ADDENDUM

The Secretary of the Heberden Society regrets that the following contribution to the Discussion of Dr. P. S. Walker's paper on "Behaviour of Synovial Fluid on Articular Cartilage" given in November, 1968, was omitted from the report published in the May 1969 issue (*Annals*, 1969, **28**, 326).

DR. D. L. GARDNER (*Kennedy Institute, London*): I congratulate Dr. Walker on the excellence of his electron micrographs and on the interest of his argument.

The shallow pits which Dr. Walker describes on the surface of the human articular cartilage that he has studied under load may be of general biological significance

in mammalian species. Using specimens of guinea-pig femoral and tibial cartilage, we have shown first, a pattern of shallow undulations of about 400 μm . in diameter and second, superimposed on these, numerous hollows closely resembling those described by Dr. Walker and measuring approximately 20-30 μm . in diameter. The finer pits, which give the femoral head an appearance resembling that of a golf ball, were clearly seen and photographed on the freshly-opened joint surface by incident light microscopy; their presence was confirmed by scanning electron microscopy after fixation and drying. This procedure also revealed aggregates of synovial fluid, remnants of what were thought to be synovial cells, and the intact outlines of occasional normal red blood cells.