is partly explicable by the desire to find very early cases of a disease in which the earliest symptoms and signs are not usually clearly defined.

(c) *Inter-observer Error in Reading Characteristic X-ray Changes of Rheumatoid Arthritis in the Hands and Feet.*—Two observers from the Manchester Rheumatism Research Centre kindly read the films of the hands and feet of the 20 cases with typical "rheumatoid" chest x-ray films. Their readings are plotted against each other in Table V. In read-

TABLE V.—*Inter-observer Error in X-ray Diagnosis of Rheumatoid Arthritis*

		Second Observer				
		Normal or Doubtful	Slight	Moderate	Marked	Total
First Observer	Normal or doubtful	<i>Hands</i>				
	Slight	8 (1)	4 (3)	—	—	12
	Moderate	1 (1)	3 (3)	1 (1)	—	5
	Marked	—	—	1 (1)	—	1
	Total	9	7	2	1	19
First Observer	Normal or doubtful	<i>Feet</i>				
	Slight	12 (4)	1 (1)	—	—	13
	Moderate	—	—	5 (5)	—	5
	Marked	—	—	—	1 (1)	1
	Total	12	1	5	1	19

The numbers in parentheses indicate proved cases of rheumatoid arthritis.

ing the films of the hands there was agreement in 13 of the 19 cases, but in 5 cases one observer noted changes (3 of which were osteoporotic changes only) which were not noted by the other observer; in the remaining case the difference was only one of degree. In reading the films of the feet, however, there was agreement in 18 of the 19 cases. Table V also indicates that the x-ray changes in the feet seemed less likely to be present than in the hands, but when present they were more severe. In this series, four cases of proved rheumatoid arthritis had no changes in the x-ray films of the feet, whereas only one case had no changes in the x-ray films of the hands; nevertheless, among these 11 cases of rheumatoid arthritis six had moderate or marked changes in the feet, whereas only two had moderate or marked changes in the hands. Typical x-ray changes of rheumatoid arthritis were never read by either observer in this series for any case which had no other clinical evidence of arthritis; there was one case of proved arthritis which both observers agreed had no x-ray changes in the hands or feet. This study would have been improved if a normal control bone had been used when each film was taken. Many films were read as "doubtful" because osteoporosis cannot be accurately assessed without such a control.

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BLOOD SUPPLY OF THE FEMORAL HEAD

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[WITH SPECIAL PLATE]

Towards the close of the eighteenth century William Hunter had raised London to the position of one of the best anatomy schools in Europe. He visited Albinus, the celebrated Dutch anatomist, in 1748, and admired his injected anatomical specimens. On returning to London, Hunter developed and elaborated this technique, and many of his original examples are preserved in the Hunterian Museum at the University of Glasgow. This collection contains a number of illustrations of the *circulus articuli vasculosus*, which Hunter had described originally in 1743.

Materials and Methods

The injected specimens used in this investigation were removed from recent post-mortem bodies or from the anatomical dissecting-rooms. They were dehydrated and cleared in oil of wintergreen (methyl salicylate). Red lead and starch were employed for the intra-arterial injections in Figs. 1 and 2 and indian ink was used for Figs. 6 and 7.

Circulus Articuli Vasculosus.—Since Hunter's original description, this vascular articular anastomosis has been given various anatomical situations. In his account Hunter states, "All round the neck of the bone there is a great number of Arteries and Veins, which ramify into smaller Branches and communicate with one another by frequent Anastomoses like those of the mesentery." These vessels he placed by the margins of the articular cartilages in the subsynovial tissues (Figs. 1 and 2). Some more recent accounts put the *circulus articuli vasculosus* at the attachment of the joint capsule to the bone. This attachment may coincide approximately with the margin of the articular cartilage in those diarthrodial joints which permit little movements, such as the joints between the intervertebral articular facets. In the adult femoral neck, however, the regions are separated by from 2 to 5 cm. The head of the femur derives its main blood supply from the subcapital anastomosis, as the contribution via the ligamentum teres is, at any age, limited to a small medial segment of the head of the femur. Davies (1946), when discussing the dynamics of haemarthrosis, emphasized the richness and superficial position of the capillary fringe in the synovial membrane.

Retinacula.—The arterial circle at the base of the femoral head is supplied by arteries situated on the neck of the femur between the synovial membrane and periosteum. The vessels are concentrated postero-inferiorly, superiorly, and occasionally anteriorly. The synovial membrane covering these vascular bundles is thrown into longitudinal ridges, to which the term "retinacula" was first applied by Weitbrecht, of St. Petersburg, in 1742. The postero-inferior retinaculum is a very definite structure in the human femur, and shows as a duplication of synovial membrane measuring 1 cm. or more in 76% of specimens examined (Figs. 2, 3, and 4). This pleat of synovial membrane always contains medium-sized arteries, situated at the attachment to the periosteum of the neck or anywhere along the pedunculated area (Figs. 2, 4, and 5).

The Pericapsular Anastomosis.—The afferent arteries to the retinacular vessels are derived from another anastomosis on the capsular attachment towards the base of the neck. This pericapsular corona, which is part of the trochanteric anastomosis, gets its blood supply from the ascending branches of the medial femoral circumflex, the superior gluteal, the obturator, and profunda femoris arteries, as well as from small communications from the acetabular marginal

vessels. Arteries leaving this pericapsular anastomosis enter numerous bony foramina at the base of the femoral neck and pierce small openings in the attachment of the joint capsule. All these arteries are accompanied by a rich plexus of veins, which play an important part in the intravascular thrombosis associated with avascular necrosis of the femoral head.

Ontogeny

During the growth period the circulus articuli vasculosus is situated on the periphery of the epiphysal plate of cartilage and sends branches deeply to the bony epiphysis as well as recurrent vessels to the actively growing metaphysal region (Fig. 6). The marked vascularity of this juxta-epiphysal area, compared with the adjacent diaphysal bone, is obvious in injected specimens (Fig. 7). Harris (1933) pointed out that these metaphysal vessels terminate in large tortuous loops as end-arteries—in contrast to the epiphysal vessels, which anastomose freely. The retinacula in the growing child are well developed, but they are shorter and more firmly attached to the periosteum of the neck than in the adult hip-joint.

Freshly injected specimens demonstrate that the greatest concentration of intra-osseous blood vessels is in the region of Babcock's triangle. This triangle appears in antero-posterior skiagrams as an area sparse in trabecular bone situated inferiorly to the femoral head. An equally obvious triangle, often obscured by the acetabular rim, is seen superiorly at the junction of head and neck (Fig. 8). In fact, the whole base of the head is surrounded by this triangular tunnel, which is utilized by blood vessels to supply and drain the head of the femur. The afferent arteries to this vascular circle can be seen entering the subcapital bony foramina (Fig. 2).

Conclusions

The head and neck of the femur derive their significant blood supply from the pericapsular anastomosis at the base of the neck. The vessels which pierce the capsular attachment are subject to severe trauma and compression in dislocations of the hip-joint and in basal fractures of the femoral neck. These factors, together with pressure from local haemorrhage, jeopardize the vascular channels of the head of the bone.

Basal fractures of the neck of the femur in childhood are frequently complicated by avascular necrosis of the head. The more firm attachment of the synovial membrane to the periosteum of the neck is suggested as an aetiological component for this complication. While the epiphysal plate of cartilage is present the head of the femur depends on the retinacular vessels for its nutrition, as the consensus of reliable opinion is that the vessels in the ligamentum teres are immaterial for the vitality of the head.

Babcock's triangle is a common site for the early manifestations of bony tuberculosis of the hip-joint in children. This very vascular growing region, which is subject to repeated minor traumata and has a slow rate of blood flow, offers a well-protected culture bed for any circulating tubercle bacilli.

In transvesical adduction fractures of the femoral neck the superior and anterior retinacular vessels are always torn, whereas the vessels in the pedunculated postero-inferior retinaculum often escape actual rupture in their continuity but are badly distorted. This alteration of alignment and lumen, which slows or obstructs the local circulation and may lead to eventual thrombosis and avascular necrosis, is a strong argument in favour of early and gentle reduction of this fracture as advocated by recent writers.

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HYPOTHERMIA WITH AUTONOMIC BLOCK IN MAN

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The reduction of oxygen consumption that accompanies a fall in body temperature and the possibilities that induced hypothermia opens up in the field of cardiac surgery and for the poor-risk patient have been the topics of numerous recent publications (Bigelow, Callaghan, and Hopps, 1950; Bigelow, Lindsay, Harrison, Gordon, and Greenwood, 1950; Churchill-Davidson *et al.*, 1953; Annotation, *Brit. J. Anaesth.*, 1953; *Lancet*, 1953). So obvious are the advantages of a state of affairs wherein the cellular oxygen requirements are markedly reduced that they need not be further discussed.

In the past local hypothermia had been produced for a variety of purposes—for example, the relief of pain (Bell, 1812) and the treatment of carcinoma (Arnott, 1851)—but it was not until 1936 that Smith and Fay first induced generalized hypothermia as a treatment for neoplasms (Smith and Fay, 1939). These workers appreciated the necessity of abolishing the body's normal reactions to cold—namely, shivering and vasoconstriction—to facilitate the cooling, and for this purpose they used deep narcosis. The increase in oxygen consumption produced by shivering had already been noted by Voit in 1878, and it was not until 1916, when Krogh eliminated this reaction by curarization, that a fall in oxygen consumption could be demonstrated at lowered body temperatures (Martin, 1930).

In 1948 McQuiston pointed out the possibility of applying the principle to cardiac surgery in hypoxaemic children, and published details of 25 cases (McQuiston, 1949).

The term "artificial hibernation" was originally used by Simpson (Simpson and Herring, 1905) and later by Smith and Fay (1939) to describe the state of induced generalized hypothermia. The recent reintroduction of the term is due in the main to the French workers Laborit and Huguenard (1951). They first studied the potentiation of anaesthesia by promethazine ("phenergan") and diethazine ("diparcol") (Laborit, 1950), and postulated that these drugs produced a partial block of the autonomic nervous system, thus diminishing the body's unfavourable reactions