sanguinis and migration of the white blood corpuscles take place, and a severe gnawing pain is felt at the seat of the bruise. The pain is severe because the effusion cannot escape. It collects under the periosteum aud in the Haversian canals. The cell elements in these situations are irritated, and cell proliferation takes place. The periosteum becomes thickened, and if the tension continues suppuration may occur between the periosteum and the bone. The periosteum is raised from the bone ; the blood-vessels passing into the Haversian canals are obliterated or torn across ; and the outer layers of the hard dense bone, their sources of nutriment being cut off, die. The extent of the necrosed tissue will depend upon the extent of the suppurating area ; if the suppurating area includes the nutrient artery within its range, nutriment being then cut off' from the medullary tissue from which in part the deeper layers of the shaft of the bone are supplied with blood, death of the whole thickness of the shaft of the bone may occur. As already stated, the most acute forms of suppurative periostitis and suppurative osteomyelitis are infective diseases, the suppuration in them being due to the presence of a micrococcus. If after an injury the primary inflammation is relieved by fomentations, leeching, or incisions, suppuration may be prevented ; or even if, after suppuration has occurred, free incisions are made to allow the pus to escape, the periosteum may assume its normal position, and the area of necrosis be limited or necrosis be prevented altogether. After a portion of the shaft of the bone dies, the necrosed area is gradually absorbed; but, if the area is of considerable size, and more particularly if sepsis occurs, the dead part is gradually separated from the living, and after a time it becomes loose, and as a rιιle has to be removed by operation. If the inflammation, acute in the first in­stance, becomes sub-acute, or if it is sub-acute from the first, then, instead of suppuration, the effusion under the periosteum coagu­lates, whereupon lymph is formed, the proliferating osteoblastic cells in the lymph take up their normal function, and new bone is made. This mass of new bone is termed a *node.* In the Haversian canals the osteoblasts there forming bone will render the bone tissue more dense and ivory-like in consistence, to w’hich the term *sclerosis* is applied. In some cases the osteoblastic cells in the Haversian canals, instead of forming bone, feed upon the original bony tissue which constitutes the walls of the canals. The Haversian canals becoming enlarged, the result is a lessening of the amount of inorganic matter in the area affected, and a cancellation of the hard bone takes place. This condition is called *rarefying ostitis.* The rarefaction of the dense bone may persist, or the process may stop, the osteoblasts again forming bone and the rarefied area be­coming sclerosed. In the cancellated tissue in the extremities of the long bones, and in that which forms the mass of the short bones, such as the vertebræ, the tarsal and the carpal bones, the inorganic matter compared with the hard bone is relatively in smaller amount than the organic matter filling the cancellæ. Here as a result of injury the thin lamellæ of bone may be cut off from their blood-supply, and death take place. If the process is acute, an area of cancellated tissue will die, and be separated from the surrounding living tissue as in the hard bone. In consequence, however, of the quantity of organic matter, death may take place in a molecular form, more nearly allied to the process of ulceration in the soft parts. This condition is known as *caries.* If the inflammatory process in cancellated tissue is sub-acute, instead of a molecular death, sclerosis of the cancellated tissue occurs. When the cancellated tissue is the seat of inflammation, in con­sequence of its close connexion and intimate anatomical relations with the articular cartilages, they in their turn become implicated, and we have then to deal with disease of the joint. In all cases in which incisions are made to relieve tension under the periosteum, or in w’hich portions of bone are removed to relieve tension in the shaft or in the medullary cavity of a bone, or in w’hich incisions are made to check the progress of inflammatory action in the can­cellated tissue, strict antiseptic precautions must be taken to pre­vent sepsis occurring in the wound.

3. *Diseases of Joints.*

A joint is a complicated organ, and its integrity depends upon a healthy condition of the bones which form it, of the articular carti­lages w’hich cover the ends of the bones, and of the synovial mem­brane which supplies the synovial fluid that lubricates the joint. These different structures are closely associated anatomically and physiologically, and disease beginning in any one of them will assuredly, unless checked, gradually extend to the others. The cartilage covering the ends of the bones receives its blood-supply mainly from the bone, and is also to a certain extent supplied at its edges by the synovial membrane. The cartilage being in itself non-vascular, disease does not commence in it ; the majority of joint diseases commence either in the synovial membrane or in the bone ; as a general rule they begin with some slight injury of the joint. These injuries consist of strains or twists (of the joint) on the one hand and jarring or contusion on the other. In the latter case the elastic cartilage lessens the force of the contusion.

When a joint is strained, the ligaments binding the bones to­

gether are stretched and the synovial membrane becomes inflamed. Consequently effusion takes place into the joint, which becomes swollen and painful on pressure. Any movement of it is painful, and all the muscles around it are rigid. In a healthy person appro­priate treatment—rest, hot fomentations, and gentle elastic pres­sure will cause the fluid within the joint to be gradually absorbed, alter which the joint can be restored to its normal condition. When the inflammation becomes sub-acute the pain disappears, and unless the joint is kept quiet by appropriate splints the condition is very apt to become chronic ; that is, the joint becomes swollen and the movements are restricted. This condition is most persistent, and prolonged rest, along w’ith counter-irritation by blistering or by the application of tincture of iodine, is necessary before the effusion subsides. The joint may remain weak for the rest of the patient’s life. Fibrous adhesions may form and prevent free move­ment. A joint in such a condition is always liable on the slightest injury to have a return of the effusion in an acute or sub-acute form. These are the chief consequences of a strain in a healthy person. In a weakly person the primary strain may entail a very different result. The synovial membrane may undergo gelatinous or pulpy degeneration, and, although it is improbable that this condition is associated with the tubercular diathesis in all cases, there can be no doubt that in very many the degeneration of the synovial membrane is tubercular in character. The tubercle bacil­lus has been found in the thickened membrane. A joint in this condition swells ; the enlargement, although it may be due in part to effusion into the cavity of the joint, is mainly caused by the thicken­ing of the synovial membrane, which has a peculiar doughy semi- elastic feeling. The movements of the joint are restricted, though little pain is complained of. If it is an upper limb the patient will not use it, if a lower limb he will walk w’ith a distinct limp. The disease is a chronic one, and the joint may remain in this con­dition for months. Rest, elastic pressure, and blistering may cheek the progress of the disease, but as a rule, sooner or later, and very often as the result of some slight injury, a change takes place. On the one hand, the effusion within the joint, instead of being serous, becomes sero-purulent and even purulent, owing to the formation of pus within it. If the joint is an important one, inflammatory fever is set up ; the joint becomes intensely painful on the slightest movement, and unless incisions are made to allow the pus to escape it passes gradually into a state of complete dis­organization. The cartilage softens and breaks down, so that gradually the cancellated bone underneath is exposed. A similar change takes place in the opposing cartilage. It is destroyed in its turn and the ligaments binding the bones together are softened and lose their elasticity, so that the joint can be moved in abnormal directions. A grating sensation can be felt when the cancellated bony surfaces are rubbed together. Along w’ith these changes within the joint, foci of inflammation form in the soft tissues around it. These inflammatory areas suppurate ; the abscesses burst into the joint ; the skin over them gives way ; and com­munication is established between the external air and the cavity of the joint. Through this channel the causes of putrefaction reach the cavity, and complete disorganization of the part accom­panied by sepsis occurs. Should the joint be an important one, a condition termed *hectic* is set up. If the discharge is allowed to continue, a gradual wasting takes place, which sooner or later ends in the death of the individual, unless the surgeon either re­lieves the tension by free incisions, or excises the joint, or amputates the limb. After disorganization has occurred, if the inflammatory process ceases, anchylosis of the joint may result. But, if the joint is freely drained and kept at rest, the inflammation will subside, and the granulation tissue on the two opposing surfaces will unite and a fibrous formation take place. The process may stop there, or the fibrous tissue n∣ay be gradually transformed into bone. Osseous union has taken place between the bones forming the joint. In many cases this is what the surgeon aims at, and it is of great importance to keep it constantly in view and to place the joint in such a position that, if anchylosis does occur, the limb may be as useful as possible. This result is only attained after prolonged treatment, and, if the patient’s strength is unequal to it, it will be necessary to excise the affected joint or to amputate the limb. Suppuration sometimes occurs within a joint without any previous pulpy degeneration of the synovial membrane, either as the result of a wound or from septic inflammation secondary to pyæmia, or in consequence of a very acute simple synovitis resulting from excessive tension within the joint. When the synovial membrane is affected with pulpy degeneration the vitality of the cartilage at its edges, where it joins the synovial membrane, may be interfered with : the thickened synovial membrane, by encroaching on the articular cartilage, gradually by pressure alters the nutrition of the cartilage so that it disintegrates and breaks down, and when it is destroyed disorganization of the joint ensues, as already described. Should the disease assume this form, if care is taken, and if the joint is kept quiet, suppuration within it need not necessarily take place. The inflammation may assume a sub-acute type and fibrous anchy­losis occur.