separation of the epiphysis from the shaft. This variety of frac­ture is termed a *diastasis.* When a bone is broken there is gener­ally distortion and preternatural mobility, inability to use the limb, and pain on pressure over the fractured part. In the majority of fractures there is also crepitus,—the feeling elicited when two osseous surfaces are rubbed together. When a bone is bent, or when a diastasis has occurred, there is no crepitus. It is also absent in impacted fractures, in which the broken extremities are driven into one another. In order to get firm osseous union in a case of fracture the great points to attend to are accurate ap­position of the fragments and complete rest of the broken bone. Accurate apposition is termed “ setting the fracture ” ; this is best done by the extension of the limb and coaptation of the broken surfaces. Complete rest is attained by the use of appropriate splints. As a rule it is of great importance to command the joint above and below the seat of fracture. In cases of fracture near a joint, in which very commonly a splintering of the bone into the joint has taken place, more especially in those cases in which numerous tendons in their tendinous sheaths have been stretched, if the surgeon forgets that there may be effusion into the joint and the tendinous sheaths, and that this effusion may form fibrous tissue leading to stiffness of the joint and stiffening of the tendons, the result, more especially in old people, will be a permanently stiff joint or permanently stiffened tendons. Care must be taken in such instances by gentle passive movement during the process of cure to keep the joint and tendons free from the fibrous formation. To take a common example,—in fracture of the radius close to the wrist joint, it is necessary to apply appropriate splints to keep the bone at rest, and to arrange them so that the patient can move his fingers and thumb to prevent stiffness, and the splints must be taken off occasionally in order to move the wrist joint gently. If, however, the splints extend to the points of the fingers and are kept on for some weeks without removal, the consequence is a normal radius and a useless hand. Instances occasionally occur in which non-union results, either from want of formative power on the part of the individual or in consequence of improper treat­ment by the surgeon. For the treatment of this condition the reader is referred to one of the systematic works mentioned above. For fractures of the cranium see below, p. 688.

There is no form of injury in which the truth of the principles first advocated by Lister has been more prominently brought forward than in compound fractures. When such an accident occurs from direct violence the soft parts are generally much crashed and the bone is frequently comminuted. When a. bone is broken from indirect violence the fracture is frequently oblique and the sharp point of the bone projects through the skin. In such a case the injury is, as a rule, not so severe. Formerly com­pound fractures were the dread of the surgeon : septic inflammation occurring in the wound reached the open medullary cavity of the bone, and the open blood-vessels of the bone gave easy access to the causes and products of the inflammation into the general blood­stream, giving rise to pyæmia. It is not asserted, however, that this accident always occurred. In a case of compound fracture the wound should be at once covered with a towel thoroughly soaked in a five per cent. solution of pure carbolic acid. And, if some time elapses before the arrival of a surgeon, more of the solution must be poured upon the towel, which should be kept thoroughly soaked. After the fracture is set it will probably be necessary to inject the solution into the interstices of the wound, over whieh an efficient antiseptic dressing must be applied. When the injury is so severe that it is impossible to preserve the limb, amputation is the only resource. It is often a difficult thing to say when the surgeon should amputate. The question will frequently be settled by a consideration of the general circumstances and surroundings of the patient, and no definite rules can be laid down. Speaking in general terms, an artificial substitute may take the place of the lower limb, but no artificial substitute can ever efficiently take the place of the upper limb ; and therefore surgeons will run some risk in attempt­ing to save an upper limb which they will not do in treating an injury of a lower limb.

There are three principal types of joint injury—(l)sprain or strain, in which the ligamentous and tendinous structures around the joint are stretched and even lacerated ; (2) contusion, in which the cartilaginous surfaces of the opposing bones in the joint are driven forcibly together ; (3) dislocation, in which the articular surfaces are separated from one another ; in this last injury the ligamentous capsule of the joint must be torn to allow the accident to occur. Joint strength may be classified anatomically under three heads—

(1) ligamentous, due to the ligaments binding the bones together ;

(2) osseous, due to the shape of the bones forming the joint ; (3) muscular, due to the muscles surrounding the joint. Ligamentous strength predisposes to sprains, osseous to contusions, and muscular to dislocations. A joint is frequently saved from injury in conse­quence of the relative weakness of a bone near it. The ankle joint is saved by the weakness of the fibula, the wrist joint by the weak­ness of the radius, the sterno-clavicular joint by the weakness of the clavicle ; the fracture of the bone preserves the joint from

injury. The tonicity of the muscular structures around a joint often prevents a dislocation, the patient being prepared for the violence to which his joint is subjected. The osseous strength of a joint will depend very much on the position of the limb at the time of the accident.

When a joint is sprained or contused there is effusion into it and into the structures around it. In such cases accurately applied pressure will prevent effusion, and along with gentle passive exer­cise and nibbing will prevent subsequent stiffness. When a joint is dislocated it is of importance to restore the bones to their normal position as soon as possible after the accident. Within the last few years, in several dislocations, the treatment by extension of the limb and forcible pressure of the bones back into their normal position has been given up, and a method of treatment at one time in use in the French schools has been revived by Dr Bigelow of Boston, Mass., who has pointed out that with less force and there­fore less injury a dislocated joint may be reduced by manipulation. The great principle at the root of this treatment is to manipulate the limb so as to cause the dislocated bone to pass back into its normal position by the same path by which it left it. In com­pound dislocations the same precautions must be attended to as in compound fractures.

II. Process of Repair.

After an injury certain changes take place, which, if kept within bounds, terminate in repair, in other words, in a restoration of the injured part to a condition as nearly as possible normal. When the injury is severe the restoration may fall far short of the normal. The recovery may take place with very little pain or discomfort even in severe injuries. Frequently, however, as the result either of improper treatment on the part of the surgeon or of feebleness on the part of the person injured, local uneasiness and a general feverish condition arise, which interfere with the healing. When these evil results follow, a local death of tissue in a greater or less degree is observed. Three forms of local death have been described —(1) suppuration or the formation of pus ; (2) ulceration, or the formation of an ulcer ; (3) mortification, or the formation of a slough. These three processes ran imperceptibly into one another. They are not distinctly separable from one another, and they very frequently occur together. It is to be noted that the process of repair and the local death which interferes with a painless repair differ only in degree. As a general rule, in the truly subcutaneous wound of tissue, be it the soft parts or bone, the changes that take place ending in its repair are simple and uncomplicated ; it is in the open wounds of the soft parts and in compound fractures of bone that complications arise.

In order to understand this process, it will be best to take a simple injury, such as a clean cut. As the result of the passage of even the sharpest knife through the tissues a microscopic laceration along the line of the incision must occur. The skin, subcutaneous fat, fascia, and muscle are divided. These parts being vascular, bleeding takes place from the cut vessels. Let us suppose that the bleeding has ceased, and that the surfaces and edges of the wound are not brought into contact. The retractile power of the tissues, when they are divided, necessarily produces a trench-shaped gap. If the sides of this gap are watched a weeping of a straw-coloured fluid will be observed, which, when examined under the microscope, is seen to have corpuscles floating in it. The fluid is the liquor sanguinis of the blood, and the corpuscles are the blood corpuscles. In the blood as it circulates throughout the vessels in the body, the yellow or red blood corpuscles are greatly in excess of the white. In this fluid the white blood corpuscles are very numerous. Careful observation, with the aid of a sufficiently powerful micro­scope, will show the formation of fine fibrils of a solid substance, which gradually extend over the field ; this fibrillation takes its start from the white blood corpuscles. The effusion has coagulated. A soft solid—fibrin—is formed, which gradually contracts, and a clear fluid escapes ; this is the blood serum. To return to the wound,—in consequence of the injury the smaller blood-vessels dilate, their walls are thinned, and a stasis or Stoppage of the flow of blood within these vessels takes place. The stasis is caused by the injury to the vessel walls, rendering the blood corpuscles more ad­hesive. The circulation is going on in the vessels beyond the area of stasis. The blood in a state of stasis acts as an obstruction, and con­sequently there is an increased pressure on the inner surface of the thin walls. As a result the fluid part of the blood or liquor sanguinis and the corpuscular elements of the blood escape into the tissues and on to the surface of the wound. On this surface and in the tissue next the surface a clotting takes place, and fibrin is formed. The surface of the wound becomes glazed, and as the fibrin contracts the blood serum oozes out upon the wound surface and escapes. The glazed surface then becomes vascular ; new blood-vessels are formed in it ; and through these a circulation is set up continuous with the circulation in the blood-vessels around. If the surfaces of the gap are now brought into gentle contact, the blood-vessels on the two surfaces will unite. At first the uniting tissue is very succu­lent and vascular, and further changes must occur before the uniting