The Classic

On Loose Bodies in the Joint

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Abstract This Classic Article is a translation of the original work by Franz König, “Ueber freie Körper in den Gelenken” [On loose bodies in the joint]. Dtsch Z Chir. 1887;27: 90-109. available at DOI [10.1007/s11999-013-2824-y](https://doi.org/10.1007/s11999-013-2824-y) (Translated by Drs. Richard A. Brand and Christian-Dominik Peterlein). An accompanying biographical sketch of F. König is available at DOI [10.1007/s11999-013-2823-z](https://doi.org/10.1007/s11999-013-2823-z). A PDF of the original German is available as supplemental material. (ED Note: An attempt has been made to preserve some of the original wording while placing the material in a

contemporary context. In some cases the author’s original intent was obscure.)

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From the Surgery Clinic in Göttingen
On loose bodies in the joint
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1. The Loose Bodies in the Elbow Joint

The history of loose osteochondral bodies, the free bodies, in human joints, the joint mice, as they were called by our predecessors in a naive way due to their rapid movements is in some way reminiscent of a mouse scurrying about inside the joint sacs. Since antiseptic surgery we can not only remove the loose bodies but also view the joint itself and make observations on the in vivo factors for the formation of the bodies. Also in relation to the presence of these bodies in the different joints, our knowledge has expanded since that time, and if the surgeon earlier in the discussion of “joint mouse” almost invariably thought of the knee joint, we now know these bodies occur in other joints as well. One joint is especially among the larger body joints and likely has the

next highest incidence to the knee joint, the occurrence of loose bodies in which other surgeons from Germany especially Carl Hueter noted, but I refer to the elbow joint. I will now give here first contributions on foreign bodies in this joint, based on clinical and anatomical observations. I believe that to explain a series of obscure findings, mostly occurring in intermittent disease, one needs an accurate accumulation of knowledge of typical conditions in the relevant joint. I will communicate my reasoning regarding the formation of loose bodies, which demands somewhat different interpretations, and I will also describe more clinical cases after discussing the joint bodies in the elbow to seek an explanation of the emergence these bodies in general.

I have seen in one year three patients with severe dysfunction of the elbow complicated by at least with temporary inflammatory conditions but eliminated by removal of loose bodies.

The first case histories follow.

1. Carl Vogel -16 years - from Nordhausen. This well-developed healthy man noted in the last 6 weeks, without

remembering any trauma, that he could not extend his left arm at the elbow completely. He has noticed since that time in the joint sometimes pops loudly. He has had no significant pain.

The examination of the joint of the patient showed a lack of extension of about 20 degrees. Pro- and supination are executed with considerable crepitus from the radiohumeral joint. There is significant swelling on the posterior aspect of the joint. All other joints are completely intact, and there are no signs of arthritis deformans.

Operation 8th December. In a bloodless field the dorsal aspect of the radiohumeral is incised across its entire width. In the middle of the capitellum is a deep defect that is flattened at the edges. A very thin cartilage layer has overgrown this defect. After various movements at high flexion between the radius joint surface and capitellum is a flattened free body of bone and cartilage, on the cartilage side convex and on the abraded bone side concave, and the free body perfectly matches the shape of the defect of the capitellum, which is about the size of a twenty pfennig coin. However, the free body is slightly larger than the defect. There is no doubt this could be viewed only as a detached piece of capitellum, particularly since there is no obvious disease of the bone (arthritis deformans) or of the moderately thickened synovial lining.

After repeated examinations the patients still recalls no earlier trauma.

The wound healed without problem, and the patient is on 22 December dismissed with a normal functioning joint.

2. Theodor Rath, 22, carpenter, from Norderney. This otherwise healthy man fell on his elbow about 2 years ago and subsequently could not completely extend the joint. There were no other indications of a severe injury at that time. The functional limitations disappeared soon afterward and the patient continued to work as a carpenter for 1 1/2 years, when suddenly without previous injury he again had dysfunction which persisted. The dysfunction was accompanied by a significant weakness of the arm, so that he had to give up his work.

The examination of the patient showed all other joints were normal. There was no sign of any other disease in the elbow joint including arthritis deformans. Only on the dorsal side of the radiohumeral joint can one see and feel swelling, which develops first at this place in case of effusion. In contrast to the right arm, the musculature of the left arm is poorly, and it lacks both passive and active extension of about 20 degrees.

It was only after repeated examination that one discovered on the anteromedial side of the joint, somewhat inward from the median nerve a hard apparently swollen capsule fold that was sensitive to pressure.

On 15 March with a tourniquet in place a 6-cm incision on the flexor surface was made medial to the artery. The

medial cutaneous nerve came into view, then the pronator was separated along its fibers and retracted by blunt retractors. Medialward the brachialis internus cover an apparently thickened capsule. The capsule was incised in the direction of the cut, following which there flowed an excessive amount of clear synovial fluid. The incised synovial lining was generally thickened, and it extended over the joint surface with numerous small villi. A foreign body was not initially observed at this point. However, when markedly flexed one could see deep into the joint between the ulna and the trochlea a large round, mulberry-shaped body about 1 cm in diameter. On this cartilaginous body, which had a boney core, a small lentiform piece was attached via a large fibrous stalk. Otherwise the body was free. Afterward a second body appeared similar to the first. After examining the joint movements, the joint is perfectly healthy apart from the above local synovial thickening. There were no defects or trace of change visible on the joint surfaces, and no side of any particular deforming arthritis.

Full healing occurred with full restitution of the joint movements. On 28 March the patient could be discharged.

3. Mr. von d L., 25 years. The patient, a cavalry officer was generally healthy except general nervousness, and particularly free of any objectively verifiable or subjective symptoms of joint disease, developed since age 12 years a problem in the right elbow without any known cause. The problem has recurred in recent years as he came into service and the symptoms are disruptive. Namely the joint swells, especially after strenuous use of the arm, suddenly, and it becomes painful with any motion. Often these symptoms occurred after certain movements. After some time the pain decreases and the swelling diminishes, but the as long as the symptoms persist complete extension was impossible. Free periods alternated with such attacks.

Patient presented directly after such an attack (September 2) with clear signs of a painful effusion (swelling on the dorsal side, especially at the joint radius, but also on the volar surface). Every movement was sensitive, yet he immediately noted a point on the anterolateral region as painful. When after a few days the signs of effusion had disappeared, one could feel a localized hard spot on the front of the radiohumeral joint that was painful to the touch and one had a feeling of a moving body upon applying pressure.

On 8 September bloodless surgery was performed over the described location of the capsule. The incision ran about 8 cm. laterally and parallel to the biceps tendon. After retraction of the skin, the muscle fibers of the Supinatus longus in its long direction were split and retracted by blunt retractors – one could then see a thickened capsule over the radiocapitellar joint. Even before the

opening one could feel a moving body. The same slid around immediately after the opening, with moderate amounts of clear synovial fluid exuding from the capsular incision. The body was round, the size of a large cherry stone and consists of thick cartilage layer with a small bone core. A second smaller body with a long connective tissue stalk is attached to the synovial insertion of the ulnar joint surface. Again, the capsule is slightly thickened and filled with small red villi. All other signs of joint disease, especially those of arthritis deformans were absent, also where the joint can be viewed at high flexion, there was no visible defect of a joint surface.

Healing with the restoration of function in 14 days.

Before I begin the discussion of some general issues in relation to the joint body on the basis of these observations and those of other joints, let me emphasize from the above 3 cases only those things about the free body in the elbow and their treatment seems to be clinically important.

In all 3 cases it was youthful individuals who had the disorder (16, 20 and 12 years at the first onset of symptoms). Initially, about the etiology in the individual cases we want to highlight that none of the patients had any general joint diseases, especially none was affected by arthritis deformans, and that the joint for all three individuals other than the locale capsule thickening as consequence of the stimulus of the foreign body and that the defect in the first patient, to which we shall return later, was associated with no signs of general disease such as arthritis deformans. In common all three patients had similar clinical symptoms. Sudden pain occurred in the affected joint frequently with swelling, and then with disappearance of the initially severe symptoms which was associated with painful restricted mobility, there were function restrictions for shorter or longer periods. This functional disturbance was regularly accompanied by limited extension of the joint. In two of the cases, one could, however, before the operation to demonstrate the joint body on the front side of the joint, and in one (Case 1) during the operation the body had been lying in the front of radiohumeral joint. We are of the opinion regarding the behavior of the free body, that when it appears in the front of the capsule the envisioned movement is inhibited by the capsule and that usually only with the passage of the body between the posterior surfaces of the joint does the lack of extension vanish. It is certainly conceivable that a body can remain anteriorly as long as possible until a pouch that does not prevent capsule stretching anymore, or a defect in the bone is polished. But as a rule the symptoms of foreign bodies in the elbow joint emerge when the body is moving from trauma to the joint, between the anterior wall of the capsule and the articular surfaces.

Loose bodies in the elbow joints are relatively common findings in the operations. Throughout the summer I

Fig. 1 Elbow joint opened from the front with three loose bodies, one in the radial portion and two in the ulnar portion of the joint.

have preserved most of these joints, which had these findings, because the question interested by me and they are so instructive that I want to describe at least some of the same types as the topographic behavior of these bodies here.

1. Two elbow joints of a cadaver

Right elbow: Signs severe arthritis deformans. (Edge overgrowth at the joint ends, especially at the radius, at the joint surface of the cartilage abraded with furrows and curves at the location of the radius of the head is merely abraded bone. The capsule is thickened significantly, see Figure 1).

On the back of the cut side of the first joint is the front of the radiohumeral joint with an enlarged capsular pouch cartilage covered with an uneven bone body of the shape and size of a broad bean. This is obviously a barrier to the humerus bone polished by movement, so that a ridge of bone from the cartilaginous rim of the anterior intercondylar fossa extends upwards and outwards. The body is retained between the capsular pouch and the bony ridge on the front side of the radiohumeral joint.

The body is located where the radius appears in the front section of the joint, a crescent-shaped free body that extends with a stalk from the synovial sac, rubbed by the tip of the enlarged roughened coronoid process of the ulna, and similarly retained in the humeroulnar portion of the joint pocket with two other bodies.

A third body found with broad stalk sits in the synovial sac in the intercondylar fossa post (not visible on the figure.)

The left elbow has only the cartilage sign of incipient arthritis deformans (fraying), but two roughly pea-sized

Fig. 2 Joint widely opened from the rear. A hazelnut-sized body in the posterior intercondylar fossa. A smaller one on the coronoid process of the ulna.

Fig. 3 Elbow joint opened from the lateral side. Two bodies in the anterior intercondylar fossa.

joint bodies with thin synovial stalks. One is seated in the posterior intercondylar fossa, the second on the front of the joint at the contact point between the radius and ulna.

2. Joint with marked signs of arthritis deformans.

There are two thin-stalked bodies covered with cartilage, one a hazelnut sized one in the posterior intercondylar

fossa, the other at the front of the joint is considerably smaller, in the pocket of the ulna located by the insertional point of the synovial lining to the coronoid process of the ulna (see Figure 2).

3. Right elbow with signs of arthritis deformans.

A pea-sized bone-cartilage body sits across the capsule of the posterior intercondylar fossa; and a slightly smaller one at the synovial insertion on the coronoid process in the front of the joint.

4. Right elbow.

Insignificant changes in the cartilage surface. No marginal growths of the articular ends. An approximately fava bean-sized body is exposed in the capsular pouch of the intercondylar fossa extending anteriorly and it has ground a shallow pit on the front surface of the humerus. Below it is a second large pea-sized body with a connected stalk of synovial membrane (see Figure 3).

Even if in the majority of the above-described joints of movable bodies occurred in arthritis deformans, which our above clinically observed cases could not confirm, yet it is certainly readily accepted that the mechanical behavior of the joints studied in relation to free bodies in them, and the more so as indeed the finding of the joints operated upon by us match these findings. Regarding the localization of the foreign body, we must accept what has been previously known that as a rule they will likely be in the free pouches of the back and front of the joint. Decidedly rarely the bodies may also be in the posterior intercondylar fossa pouch, and also the posterior part of the synovial pouch between the radius and the lateral border of the ulna but these are far more rare. Also, a change in location to the front of the joint is more common, and only the flat body in the first patient operated upon by us had to removed be from the depths of the joint only by various movements through a posterior incision. Most often, the bodies are found in the front pouches of the joint, sometimes more toward the ulnar and sometimes more toward the radial sides of the pouches.

From these findings we can also causally explain the phenomena: the pain, the not uncommon swelling, sometimes the feeling of sliding of a body or of crepitation, and in most cases a particular functional limitation: the lack of ability to extend the joint. The exacerbations that occur from time to time one may explain by the fact that a loose body during certain normal movements becomes trapped between the articular ends, thus causing the sudden severe pain and often causing a traumatic synovitis.

After these contradictions we can soon put together the symptoms to suggest the probability or for reliably diagnosing moving bodies in the elbow joint: when repeated attacks of sudden pain in the relevant joint occur with symptoms of synovitis, when moving the joint is remarkably painful and if after the disappearance of the worst

symptoms there is a restriction on the extension of the joint for a longer period, it is very likely that it is a joint mouse. If one considers the sensitivity at the front of the elbow joint with each bout, then the probability is greater, and if there is a hard tumor moving back and forth and one has the feeling of crepitus on moving it, the diagnosis is certain. If the body is in the back of the joint in the intercondylar fossa relation of the body is much less likely and probably only when symptoms are great; this is in line perhaps with the observation that the body is relatively firmly seated, and during movement the stalk was easily detached. In contrast, radioulnar joint bodies are frequently found in the rear side of the pouch. However, they are probably only exceptionally located here and they change if they are not too big, frequently slide forward and in this case cause the described symptom complex.

The surgical removal of the body from the elbow joint is extremely rewarding. It therefore sometimes makes an impact at least temporarily when an arm previously useless for hard work is again perfectly effective. The operation will achieve its purpose only if the incision is made based on the lessons learned from our clinical and pathological experiences for locating the body at specific points of the joint. From those lessons it is now clear that we experience only exceptional things about the bodies on the back of the joint, the rarest and perhaps only customary size on the dorsal aspect of the humerus and the corresponding intercondylar fossa, and probably more frequently according to the forearm area belonging to pouch between the radius and ulna. At this point one can more often detect the body by feel and remove by it dorsally. Far more often, however, the incision must be at the front of the joint of the elbow, and here you must determine the position of the incision by demonstrating whether the body lies in relation to the ulna and radius. In both cases, longitudinal cuts are made, sometimes on the outer and sometimes on the inner side of the biceps tendon 8–10 cm length. On the inner side, one makes the incision medial to the artery and the median nerve. One first encounters the nerve branches of the medial cutaneous nerve, which you can easily preserve. The one separates the pronator teres along its fibers and can separate the fibers by blunt retractors. Now the brachialis internus can be seen and when its medial border is retracted laterally, one sees the capsule which is also divided on the direction of the longitudinal section.

If, however, one intends to incise the pouches in area of the radius, an incision of the same length is used lateral to the biceps tendon. Then one splits the fascia in the upper area of the cutaneous external nerve, located by the brachialis muscle. One can now either go to the medial border of the brachioradialis in depth or, as I usually do, split the muscle along its grain in the direction of the incision, and can distinguish the gap. Under the muscle one

encounters the radial nerve, which can easily be retracted to the side, then the capsule is exposed and incised lengthwise. It is best either way to make the capsule incision large, so that if the bodies are not immediately visible or if they can be seen and removed, one can more freely view the joint during movements joint and identify any other body or pathological changes in the joint.

After surgery one can leave a drain tube in the capsular incision and bring it out through the muscle gap and the skin incision. The wound is close by deep sutures.

2. Contributions to the Cause of Free Bodies. Same Origin as Osteochondritis Dissecans

The doctrine of the origin of the free body is definitely still not completely closed and especially the questions, can a free body in a joint form by an injury and how often are joint bodies of traumatic origin, are certainly not answered by either the pathological anatomist or surgeon. If we now want to deny on the one hand that there are traumatic loose bodies, for example, that the radial head can break off in whole or in part, and immediately in the joint cause the symptoms of a free body, we believe on the other hand that the majority of cases of in which the joint mice have been described following trauma, cannot be considered in the strict sense resulting from a broken-off body.

It is hard to believe, that the trauma generally described, or in the patients examined, should cause such breaking away of a joint surface, and as Hueter once suggested, it would be through an experiment that could easily produce such broken away pieces, so I must deny this on the basis of experience. However it is possible at one or another time in cadaver experiments to break off a piece of bone the corresponding ligament and it is possible the head of the radius, or pieces of the femoral head break off, or cause an impression of the joint surface with destruction of individual superficial parts, but these lead me to believe that pieces of the articular surfaces could not break off with such planar pieces as I will soon describe, although they have been repeatedly described as having been formed by violence. So if those cases in which one finds a detached piece of bone and a corresponding defect in the articular surface following a trauma, the formation of these pieces generally require a further explanation apart from trauma. However, there are also a number of cases in which there is undoubtedly a defect on the surface of the joint with the missing piece is in the joint without any kind of significant trauma having occurred. We illustrate this fact with our first described case. Mr. Vogel (case history 1 of the previous section) had for 6 weeks symptoms of disease of the left elbow joint without previous trauma to the joint. During the operation a deep defect was found in the middle

of the articular surface of the otherwise healthy capitellum, flattened at the edges and covered with a thin layer of cartilage. The free body found in the joint fit almost exactly into this defect. It consisted of a cartilage layer with an underlying thin layer of bone. A skeptic would say: it has nevertheless been from a trauma the person does not remember. I would counter with several similar observations I found that positively confirm there is a detachment of larger or smaller areas of the articular surface, which could be caused neither by trauma nor by the usual form of infectious osteomyelitis. I describe next a case of with a loose body in the knee joint that looks very similar to that just reported from the elbow joint.

1. Johannes Dierlos, aged 28, from Warburg, admitted July 2, 1885 released on 28 July.

The patient has had no acute disease before he felt his knee problems nor did he have any kind of trauma before the same symptoms began (7 weeks). His other joints are perfectly healthy. The left knee pain began 7 weeks earlier and the patient had already made the diagnosis of a foreign body.

Above the external epicondyle on the outer area of the upper joint sac one finds a large flat body that moves about with regular joint motions.

When performed in a bloodless operation from the aforesaid external region, with a persistent fold that has become nearly closed off in the region of the joint of the described free body, which by its convex smooth surface on one side and its uneven concave surface on the other immediately is identified as a detached piece of the surface of a condyle and removed. Through the capsular incision a finger sliding across the articular surface of the femur, at various positions of the joint, can detect a defect the same a higher defect detected on the internal condyle. For the purpose of a precise autopsy an incision was made on the inside of the joint. The same was also made for a drain hole.

Only from the front portion of the articular surface of the medial condyle could one see a single defect which completely fits to the size and shape of the joint body. The defect has a very thin cartilage layer, but with a small piece of bone without cartilage on the anterior portion. The bone has been ground smooth and has the appearance of necrotic bone.

The detailed analysis of the relevant loose body I made after alcohol preparation, showed that the larger body was 2 1/2 cm. in greatest dimension, 2 cm. in the widest and 4 mm. at its point of greatest depth. Apparently one side is from the originally smooth surface, but now through the alcohol an unequal thickness of articular cartilage and thinner bone layer as it would be the nature is in the normal joint directly under the cartilage is apparent. Beyond the

margins, the body gradually flattens from the lower (bone side) to the upper (cartilage side). On the lower side is located the bone edge a flat, smoothly ground recess exactly like that in the defect located on the medial condyle and the size of a beans, an abraded sequestrum completely resembling and fitting the loose body.

2. The farmer Karl Borschel, 20 years old, from Rockensüss was on 18 January 1881 was admitted to the hospital. He has been complaining for about 1/2 year of increased discomfort in the right ankle, which while attempting vigorous walking is so painful that he is unable to work at times. Except for a slight swelling in the anterior part of the ankle and exquisite tenderness on pressure along the margin of the tibiofibular joint region there were no other joint findings. Having made an exploratory incision over the painful point, without finding the expected "tuberculous focus," and the patient was initially discharged apparently painless; he comes back in March, with renewed and increased symptoms. Now that the absence of objective symptoms made the diagnosis of "joint neuralgia" very doubtful, I made an extended double longitudinal section in the manner I would for a resection. Afterwards we found located approximately in the middle on the front side of the tibia at the margin of the cartilaginous articular surface, a round body, about the size of small bean, fully detached, lying in a smooth cup-shaped lined whitish bone pit. The body consisted of coarse bone tissue and was for the most part covered with soft tissue consisting of connective tissue with blood vessels and numerous scattered blood pigment cells. In each of the lacunae of the bone surface are giant cells. Signs of tuberculosis absent.

The rest of the joint is normal.

In the following case the circumstances speak for themselves, that this is a pure case of avulsion of a piece of the healthy articular surface, although examination of the loose body and the joint could not confirm this hypothesis.

3. The 24-year-old bricklayer from Bielefeld August Ernst claims to have had for some time pain in the right knee joint, as if sitting on the bone he said, but before he suffered the accident to be described. One quarter year before he missed a few rungs climbing a ladder and fell while landing on both feet. He immediately felt a sharp pain in his right knee, which swelled up and since that time has been intermittent, especially during certain movements suddenly caused discomfort. For some time he himself felt a foreign body in the moving knee.

On admission on 1 January 1884 we found a moderate effusion and an articulated a movable foreign body in the lateral half of the upper recess. On the medial side on the edge of the outer joint surface of the medial condyle there was a hard, non-movable rounded prominence.

During the operation, an incision was first made over the loose body on the lateral side. Immediately the loose body slid out, and proved to be cartilaginous, about 4 cm. long, 2 cm. wide but not very thick. The synovial membrane was thickened and covered with extensive coarse villi. A second incision over the hard body overlying the medial condyle revealed extensive villi and thickening of the synovial lining. The body itself appears as a round, mobile formation on the lateral side but not quite the same size as a cartilage formation on the medial edge of articular surface. It gave the impression of a local formation, similar to that in arthritis deformans occurring in more general terms, and also as a change in the synovial lining with localized arthritis deformans.

The detailed examination of the removed joint body in alcohol showed the same as a 3 cm long, 1 1/2 cm wide, and 6 mm thick body entirely composed of hyaline cartilage. Both surfaces of the body were slightly convex, two borders were round, the third looked as if it were a fractured surface with slightly tapered edges. Within the hyaline cartilage, one could macroscopically see yellowing islands of various sizes, within which there were significant calcification. Bone was not detected in the body.

I will now describe two cases, which while perhaps not quite relevant here, do suggest a complete explanation in the femoral head where only by adopting a dissecting process can the findings be explained.

4. A 28-year-old shoemaker John Hacke from Zimmersrode was first seen in July 1880 and then returned to the hospital in March 1881. For about 2 years, he complained of discomfort in the left hip joint. This allegedly started about the same of the end of his military service in the cavalry when he found both the ascent and descent from the horse difficult and with increasing pain in the hip joint. Soon he had a limp, and then suddenly, at some time the patient cannot remember, the involved limb was shorter than the healthy. The shortening had the effect of causing severe pain when walking with peculiar cracking and crunching noises and daily and increasingly tormented the patient.

On examination there was a shortening of the diseased limb of about 2 1/2 cm decrease despite a reduction of the pelvis of 1 1/2 cm. Accordingly, the trochanter was 4 cm. above the os ilium line. The movements of the extremities are almost entirely free – in a supine position flexion to an acute angle, and full rotation, ab- and adduction actively and passively.

Any trauma was denied.

The whole hip region is swollen and shows indistinct fluctuation posteriorly.

The diagnosis included arthritis deformans with complete dissolution of the head and syphilis. The latter assumption appeared likely.

Patient had already been in treatment with a number of physicians. His main complaints of severe pain during walking were initially largely mitigated with a Taylor brace, but he demanded the ability to walk without the brace to be able to work again. So he agreed with a proposal for opening the joint possibly resection after the incision.

On 1 February 1882 with a large Langenbeck incision the joint was opened, the muscle attachments being were detached according to my method with a Trochanter fragment removed with a chisel. After the thickened synovial lining had been incised, fairly abundant synovial fluid came out and one immediately saw that the epiphyseal region of head was detached from the neck and lying in the socket. The socket was covered evenly with cartilage, the cartilaginous limbus greatly thickened, so that a piece of the rear edge had to be removed in order to dislocate the large head. The end of the femoral neck looked like a thicker round head, and on the surface smooth, whitish connective tissue, maybe coated with a thin layer of cartilage.

The joint head does not fit with the part, which would have resorbed with the epiphysis. The other appearances speak against resorption of the epiphysis because the detached piece is on the edge very unequal, especially on the inside topped a triangular piece to the other edge, which almost looks like a demolition. The surface of the separated piece is cup-shaped, but with small hills and valleys. For the most part it is covered with a coarse white, apparently fibrous coating which appears thickest overlying the edges of articular cartilage, continuing smoothly into the cartilage. Histologically it resembles what has been described in the following case, ie, it is in great part covered with endothelial tissue. Beneath the surface, especially at the nearby parts of the articular cartilage are cartilage cells in connective tissue ground substance, deeper osteogenic tissue, and eventually the bone tissue of the head.

The spherical surface of the head is for the most part still covered with thick almost normal, the bone-bonded cartilage. The surface is uneven, especially near the apparent area of the removal of the head, which forcibly tore from the round ligament. Pieces of the excised capsule are simply thickened connective tissues, without any sign of tuberculosis. There were no obvious findings of arthritis deformans in the joint.

5. Ms. Stadelmann, 42 years old, presented on 4 June 1885 due to complaints in the right hip. The symptoms occurred without the woman knowing a cause, which gradually developed over the previous 3/4 years. She denied trauma. Now she complains that she limps, tires very quickly, and her hip has an intermittent and peculiar crunching sensation.

After repeated examinations one notices an effusion of the hip joint and on upward pressure a displacement of the

trochanter 4 cm above the seat iliac line. There is full passive motion of the joint including hip flexion, adduction and rotation, and with marked rotation of the foot with the hip extended one gets the impression that the trochanter is simply rotating around the long axis of the limb. Crunching noises and crepitation uniformly occur with repeated movements.

After these findings one concludes there must be dissolution of the head from the femoral neck, although the etiology remains entirely unknown.

On 13 June a longitudinal showed first thickening and then an inner surface of the synovial membrane studded with many thin synovial villi. The femoral head appears approximately in the area the epiphysis, but as we saw totally detached, and easily removed with the forceps. The round ligament is completely absent, however the socket is lined with cartilage. The femoral neck has resorbed almost entirely to the region of the lesser trochanter. On the surface it is found smooth and coated with a thin white layer of apparent cartilage. There are no signs of arthritis deformans on the femoral neck or the socket. No sign of tuberculosis. The synovial lining again consists of simple thickened connective tissue.

The femoral head is, as already noted, detached in the area of the epiphyseal line. In contrast, the detached fragment has no resemblance to the epiphyseal surface, because it is not concave or cup-shaped, but flattened in a plane which is interrupted only by a small defect at one edge. This detached fragment is quite smooth on the whole. On the surface thereof, the bone is compacted, while overall the piece shows various pea-sized bone defects (inflammatory shrinkage). Only in a small part of the detachment fragment is bare, consisting of relatively smooth bone, while the greater part of the surface is covered with white connective tissue of differing thicknesses. The connective tissue is firmly attached to bone. Microscopically the surface is studded here and there with villi of coarse connective tissue that, just as the villi, has a covering of endothelium. The bone closer to the connective tissues has cartilage cells with deeper osteogenic tissue and bone as in the previous case.

The convex surface of the detached head is well covered with cartilage and only at the insertion site of the old ligamentum teres is there a smooth pit with a cartilage-free bone surface. Over the cartilage is, however, a partly detached piece but still firmly attached in part, thinly covered with coarse vascularized connective tissue and has in some places an endothelial covering. This covering apparently grew at some points on the surface of the socket, and has probably been used for the nutrition of the detached piece.

Of the above patients as shown by subject 1 (previous article) as well as 1, 2, 4, 5 (this paper), a number of

similarities. In all these cases it was the peculiar finding of pieces completely detached from the surface of the bony articular ends, without any way to explain the findings from the known causes (trauma, acute, purulent or tuberculous osteomyelitis). Also after removal of the detached pieces the rest of the joint had no findings of any peculiar other disease, particularly arthritis deformans, because after extracting the body the joint had the appearance of the state with the joint located. First let us presume trauma to be causal, which could have occurred in the two cases of detachment of the femoral head base on the gross anatomical findings and one might consider a seizure history, which was excluded by the patient in the one case and confirmed by the husband of the other. With such a history you would still most likely assume the frequently observed femoral neck fracture, here the femoral head fracture. On the other hand, I think the other three patients 1 (in the previous article), 1, 2 (this paper), both by history and by the position and shape of the detached body precluded avulsion. How to explain the sudden detachment of cartilage piece of bone from the mid articular surface without any other serious injuries of the articular ends in the living, has yet to be demonstrated by experiment on cadavers. We would be happy to see that by an experiment the head of the radius, the ulna, or at any other joint end can detach or that we could observe such occurrence by certain forces in the living, but we cannot accept that until further notice that one could succeed in creating flat detachments of the articular surface, as we have described above, and incurring demonstrable injury to the articular surfaces. However it is conceivable that a particular point of the articular surface once hit by a sudden impact and severe contusion affecting the adjacent tissue, and as a result of this contusion a destruction of many nourishing vessels in the region, a subsequent rejection of the same leads to corresponding section of contused surface subsequently detaching. We had hoped that with the 3 described cases a consistent finding alone of examination of the opened joint and that of the remote joint body showed the error of the assumption that it was an avulsion of a normal piece of the joint surface, but rather pathological cartilage formation. Just as in patient Rath (Case 2, I part), however, detached parts of the joint created a foreign body, the anatomic findings were those of ordinary free bodies, and we believe that here, as in the case of a similar number of foreign bodies, the trauma was only the reason for the emergence of symptoms in the presence of existing joint bodies.

If we thus exclude the trauma induced loose bodies and as avulsion during trauma alluded to above brought about by significant trauma, and if we allow that secondary detachments from the joint surface may occur after local contusion of certain sections the articular through the known dissection process which necrosis initiates, an

assumption which we incidentally cannot support by our own observations, there remains the larger number of our observations of small detached unchanged pieces of the articular surface, which as free bodies are still unexplained. Because even though we admit that the findings of such joint pieces, as we have the same described in the elbow, from the knee and the hip joint above, could be explained by the assumption of traumatic origin in the simplest way for the observer, so we have shown that a such an assumption is absolutely inadmissible. Although through the causes which lead under certain circumstances to separation of certain portions of the articular ends are well known to us, the same cannot be explained. The nature of the free body and the joints we studied certainly excludes both the acute and chronic (tuberculous) inflammation as the cause of the disorder. Nor, was there any arthritis deformans, a disease that only occasionally causes exceptionally large detachment of joint sections. We also conclude that it is not the destruction of joints such as occurs in tertiary syphilis, so the known causes for detaching parts of the bony articular ends are exhausted. The vast majority of our patients were young and in other respects healthy, especially since they were not nervous individuals.

If we start by dismissing the options discussed by the findings, it remains for us only to assume that in the cases described by us to be a casting off of broken pieces of parts of the articular surface through a process of dissecting osteochondritis. At the ankle (case 2) were also still the remains of this process as demonstrated with lacunae containing multinucleated giant cells, whereas the remaining cases had, especially in the hip joints, reparative processes on the side of the detached bone already blurred by the effects of dissection. But we are well aware that we say nothing about the nature of the process, if we assume

that the detached bodies have become free by osteochondritis dissecans. The cause of this is not explained by the anatomical process, and we'll stick with the preliminary finding of fact.

Let us summarize the conclusions of our view of the importance of trauma in the development of mobile joint bodies; we will formulate the same as follows.

1. The occurrence of immediate loose bodies brought about by an injury to the articular surface is relatively rare in healthy joints and conceivable only as a result of severe trauma.
2. From such violent actions loose pieces of the articular surface can occur by avulsion with ligaments, or even entire sections of a joint surface, such as the radius head, the femoral head, can be prevented by a levering effect dissipating the violence or also by the same violence inducing a lateral piece. However, it is absolutely inconceivable that flat pieces of the surface of an articular surface, as we have described in the elbow joint of and the knee, are immediately detached by a traumatic event without any serious injury to the joint.
3. It is quite conceivable that such pieces are so subject to injury, that the same necrosis with subsequent dissecting inflammation leads to their separation.
4. There is a spontaneous osteochondritis dissecans, which without any other considerable damage to the joint brings about detached pieces of the articular surface. A great part of remote traumatic events associated with loose bodies must be considered as having occurred in this way.
5. The etiology of the proposed pathological processes is still unknown.