saying that they consist of spongy bone covered with articular cartilage, and have also submitted them to another competent authority who confirms my opinion."

In the *St. Bartholomew's Hospital Reports* (vol. vi, 1870, p. 1) Sir James Paget, after referring to a paper on "Quiet Necrosis" which he had contributed to the *Clinical Society's Transactions* (vol. iii, p. 183), writes:—"Not long after this case I had occasion to remove a loose cartilage from a knee-joint. The patient was 16, active, athletic, and, except at his knee, thoroughly healthy. At Harrow he had had many blows and strains of the knee, but he could not refer to any one of them as a cause of special injury. He had had for nearly a year all the usual signs of a loose body in the right knee."

After removal "this body looked exactly like a piece of the articular cartilage of one of the condyles of the femur. It was irregularly oval in outline, about an inch long, half-an-inch wide, and a line in thickness. On one surface it was convex and smooth, on the other concave and rough; and on this surface was a small prominent piece of bone, as if, with the cartilage, a piece of the articular surface of the femur had separated. The borders of the loose body were smoothly rounded off. In agreement with this general likeness to a piece of articular cartilage from a condyle was the microscopic structure of this loose body. In sections through its thickness was found a nearly homogeneous basis-substance, with cartilage-corpuscles, which, in arrangement and all their other characters, were exactly like those of articular cartilage.....Thus no character was wanting to make it certain that this loose body was a piece of the cartilage, together with a very small portion of the bone, of one of the condyles of the femur."

"I believe that the explanation of the formation (of such bodies) is to be found in the case of quiet necrosis referred to at the beginning of this paper. These loose bodies are sequestra, exfoliated after necrosis of injured portions of cartilage, exfoliated without acute inflammation, just as the piece of bone was, or as a tooth after a blow may be slowly detached from its alveolus and cast out....."

"The view that certain loose bodies in joints are pieces of articular cartilage, exfoliated after necrosis due to violence, is supported by the fact that they are frequently consequent on injury in perfectly healthy young persons, and that, when a particular injury can be assigned, it is always at some weeks previous to the first finding of the loose body."

When these descriptions were given, neither Sir James Paget nor myself knew of Mr. Teale's paper (*Medico-Chirurgical Transactions*, vol. xxxix, 1885, p. 31) in which he describes a "case of detached piece of articular cartilage existing as a loose substance in the knee-joint." In this case a brewer, aged 37, had, a year before, accidentally let a cask fall against his right knee. "Severe pain followed, and he was unable to work for three weeks, after which he followed his employment as usual for nearly twelve months until a few days ago, when he became suddenly lame, and was unable to bear his weight upon the leg. He then for the first time felt a flat substance moving about in his knee-joint." Mr. Teale removed the body, and, unfortunately, the patient, who had been a free drinker, died. "The substance, on being examined, was found to be flattened, circular in form, and irregular or ragged at its border. One of its surfaces had the appearance of cartilage, and was smooth, and slightly convex; the other was concave and rough, from a layer of bone." On opening the joint, "at the under surface of the inner condyle the articular cartilage showed a circular depression, about the eighth of an inch in depth, having a rough surface of bone at its base. On comparing this breach in the articular cartilage with the substance which had been removed, they were found to correspond accurately with each other, and, on placing the detached substance in the cavity in the condyle, the continuity of the articular surface was perfectly restored. It is, therefore, evident that the loose body was a portion of the articular cartilage along with a thin layer of bony substance." Mr. Teale believed that the injured piece of cartilage was cast off into the joint "by a slow process of exfoliation extending through a period of about twelve months" (Figs. 6 and 7).

Here, then, are six loose bodies from knee-joints. One, we are told by Mr. Simon, is "a broken-off bit of condyle," and Mr. Shattock has no doubt that it consists of a piece detached from an articular surface. A second was found by Mr. Teale to exactly fit into and make good a breach in the inner condyle of a femur. A third is minutely described by Sir James Paget, who states:

"Thus no character was wanting to make it certain that this loose body was a piece of cartilage, with a very small portion of bone of one of the condyles of a femur." The remaining three are in the St. Bartholomew's Hospital Museum, and are pronounced by Dr. Vincent Harris to have the structure of true bone and articular cartilage. All but the first are, I believe, sequestra detached by the process which Sir James Paget has termed "quiet necrosis."

Fig. 6.

Fig. 7.

In this communication I have kept exclusively to the two chief points raised by Professor Humphry, though there are many others connected with the interesting subject referred to in his letter that would well bear discussion. I will only add that I entirely agree with his view, which no one, so far as I know, would question, that the great majority of "loose bodies" in joints are derived from the synovial membrane in the manner which he has described.

Since the above was written Sir James Paget has directed my attention to No. 647 in the College museum, which is thus described (Catalogue, p. 35): "A large piece of cartilage and bone, of the shape and about half the average size of a patella, removed from a knee-joint. It may be regarded as a portion of one of the condyles of the femur, which, probably after injury, was separated by a process similar to necrosis, but without acute inflammation. The articular cartilage is thinly extended over the edge of the bone. Presented by Sir Everard Home." Mr. F. S. Eve, Pathological Curator of the College, who has kindly examined the specimen microscopically, states: "I believe that in No. 647 the loose body was derived from the articular cartilage."

ON THE RELATION OF SCROFULOUS GLAND DISEASE TO OTHER FORMS OF TUBERCULOSIS: AN EXPERIMENTAL INQUIRY.¹

By FREDERIC S. EVE, F.R.C.S.,

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SOME two years ago, while writing a brief article on scrofula and tuberculosis for a student's Manual of Surgery,² my attention was drawn to the differences of opinion existing on the precise relation of scrofulous gland disease and affections described as tuberculous. I found that some clinical teachers with large experience in diseases of childhood still maintained that the two affections were practically distinct, while among pathologists some taught that scrofula and tuberculosis were synonyms for the same disease; others that in scrofula the tuberculous virus was so profoundly modified as to constitute a special variety. The latter view was strongly supported by some experiments of M. S. Arloing,³ which appeared to prove that inoculation with material from scrofulous

¹ Read before the Pathological Society of London, November, 1887.

² Treves's *Manual of Surgery*, vol. i, p. 216.

³ *Comptes Rendus*, tome xcix, 1884, p. 661.

glands was innocuous to rabbits, while it produced general tuberculosis in guinea-pigs.

The significance of this assertion, if well established, is clear, when it is stated that material from true tuberculous diseases produces visceral tuberculosis in both animals. The results of these experiments seemed of so much importance that I was desirous of testing the matter for myself, more especially as Arloing, in his first two groups of experiments, had only used glands taken from one patient. Further, I had observed such remarkable differences in the naked-eye appearances of strumous glands that it would have been no matter for surprise to have found that two or more diseases had been grouped under a single heading. This could only be tested by making experiments with a series of cases. Structures microscopically characteristic of tubercle and bacilli had been found in some glands; but in many others the histological appearances were indistinguishable from those of simple chronic inflammation, and might even simulate those produced by syphilis in other organs. For example, J. Arnold, who examined ninety cases, found giant cells very rare.

M. Arloing's experiments were, shortly, as follows: A juice was prepared from a single scrofulous gland, caseous in the centre, which was taken from a boy aged 14. This was injected beneath the skin of ten rabbits and ten guinea-pigs. Visceral tuberculosis developed in all the guinea-pigs, but the rabbits remained healthy, except that two showed yellow and caseous granulations at the seat of inoculation.

A second series of experiments were made with a gland subsequently removed from the same boy. The juice was injected into the peritoneal cavity of six rabbits and six guinea-pigs. As before, the guinea-pigs all presented tubercular lesions; the rabbits, on being killed, were found to be perfectly healthy. In two instances, pus from strumous abscesses gave similar results.

Some glands excised from the neck of a young woman produced tuberculosis both in rabbits and in guinea-pigs, but the patient died three weeks after the operation from miliary tuberculosis. Arloing appears to consider this case as outside the general category of strumous glands.

From these experiments he inferred that either scrofula and tuberculosis were nearly allied affections, but caused by different agents, or they were derived from a single virus, of which the activity was modified in the scrofulous form.

In my experiments I used small fragments of the glands prepared with sterilised instruments, and the possibility of infection of the animals with true tuberculosis was negated by the precautions taken. My experiments on rabbits are briefly as follows:—

EXPERIMENT I.—Rabbit inoculated beneath the skin of both ears. Cold abscesses formed at the seat of each inoculation, and remained stationary; but the animal continued well until the expiration of nine months, when, judging it to have escaped, it was re-inoculated in the peritoneal cavity.

EXPERIMENT II.—Rabbit inoculated in anterior chamber of eye with portions of a non-suppurating gland. A large mass of caseous material formed and ultimately projected from the eye (drawing shown). Animal killed three months after inoculation. Tuberculosis of lungs and liver. Brain healthy.

EXPERIMENT III.—Rabbit inoculated in anterior chamber with portions of caseous material and adjoining gland tissue from a strumous gland. No growth formed in the eye. Animal killed in two months and a half. No disease anywhere. Sections were made of these glands, and, after careful staining, no bacilli could be demonstrated. The gland substance had become in great measure transformed into fibrous tissue.

EXPERIMENT IV.—Rabbit, previously inoculated beneath the skin (see Experiment I), again inoculated in abdomen. Killed after lapse of eleven weeks. Three large caseous glands were found beneath and below liver, and in the latter were yellow threads and stripes, found, on microscopic examination, to be tuberculous. Lungs and other organs healthy. Pus containing many bacilli still existed in the abscesses of the ears, but the visceral tuberculosis may probably be ascribed to the last inoculation.

EXPERIMENT V.—Rabbit inoculated in abdomen. Killed after lapse of four months. Tuberculosis of lungs; other viscera healthy. An enlarged lumbar gland.

Glands from four other patients were also used for inoculation of guinea-pigs, and each time with positive results. Altogether, glands from ten different cases, taken at hazard, were used; but in one (not cited above), in which a rabbit was inoculated in the eye, the animal died in twelve days, and only minute yellow

nodules were found in the liver. The nature of these nodules could not be absolutely determined. Eight of the remaining nine cases were all proved to be tubercular.

As regards the results of the experiments on rabbits with glands from five different subjects, the material from three cases produced visceral tuberculosis; from one case, cold abscesses; and in one instance (Experiment III), in which a rabbit was inoculated in the anterior chamber, it escaped infection altogether; no bacilli could be discovered in this gland. The animal in which cold abscesses occurred was inoculated beneath the skin.

I need hardly call attention to the marked manner in which these results differ from those of Arloing above described. While my experiments were in progress Arloing was pushing his somewhat further in the direction indicated by his first experiments.⁴ Believing that scrofulous glands never produced visceral lesions in rabbits, and that in struma the activity of the virus was attenuated, he sought to find if this could be increased by passing it twice through guinea-pigs. His experiments showed that the passage of glandular scrofula through the guinea-pig in two successive generations did not augment its virulence as regards rabbits. He also found that local tuberculosis of joints and bones only produced cold abscesses in rabbits, but, on passing the virus through a guinea-pig, tuberculosis of the lungs developed in rabbits. "This fact merits," he says, "to be taken into serious consideration at a time when there is a tendency to confound tubercle and scrofula as a single affection. It justifies once more the difference that we have established between the two morbid states. If it is not yet proved that they are the work of a distinct virus, it will be granted that true gland scrofula is yet more removed from the primitive virulence than local tuberculosis. Perhaps it is sufficiently removed to constitute a *fixed variety* analogous to those micro-organisms which, after having lived for many generations in a certain species of animal, have become incapable in consequence (in spite of all known means) of killing the species which had furnished them and among which they made numerous victims."

These later observations I have also repeated, with equally dissimilar results.

EXPERIMENT I.—Two rabbits were inoculated respectively in the abdomen and anterior chamber of the eye with organs from a guinea-pig rendered tuberculous by strumous glands. The rabbit inoculated in the abdomen was killed two months after, and showed tubercles in the peritoneum covering the cæcum (opposite the abdominal wound), caseous lumbar glands, and tuberculosis of the lungs. The other rabbit died after the lapse of five weeks. The portion of tissue placed in the anterior chamber had increased, but there was no visceral tuberculosis.

EXPERIMENT II.—A rabbit was inoculated with portions of the lung of a guinea-pig rendered tuberculous with strumous glands. It died without apparent cause in eleven days; but a caseous abscess and some tubercular material had already formed in the groin, and there were numerous yellowish-white points in the liver.

EXPERIMENT III.—Two rabbits were inoculated in the abdomen with tuberculosis of a guinea-pig excited by strumous glands. One died in seven weeks and the other was killed. Both showed general tubercular peritonitis and general visceral tuberculosis.

In the first and third of these experiments, the virus was certainly intensified by passing it through the guinea-pig, for these are the most acute cases of tuberculosis I have been able to induce by strumous gland disease in rabbits, the tubercles being disseminated over the peritoneum (specimen shown).

Here are the intestines of a rabbit inoculated in the peritoneal cavity with miliary tuberculosis which had been passed through a guinea-pig, and it may be seen that there is very little difference in the result in each case (specimen shown).

It is difficult to reconcile the discrepancies between M. Arloing's results and my own. As in his first series he used glands from only one case, the virus may have been of an exceptionally mild type; or the failure of rabbits to take tuberculosis when the material was injected in solution into the peritoneum may, perhaps, be explained by the virus being absorbed immediately and destroyed by leucocytes. When introduced by small fragments of glands, as in my experiments, a certain amount of inflammation may be excited, and a more favourable nidus obtained for the growth of organisms. This was evident in cases of tubercular peritonitis, for in these a mass of gelatinous granulations on the

⁴ See *Comptes Rendus*, September 27th, 1886, p. 559.

inner surface of the wound in the abdominal wall formed the focus of infection, as shown by the distribution of the tubercles on the peritoneum.

The similarity in point of histological appearances between scrofulous and tuberculous lesions has formed the subject of several excellent memoirs. I have examined sections from most of the animals experimented on, and find no essential differences between them and the same lesions produced by the inoculation of miliary tuberculosis, only slight alterations in accordance with the acuteness or duration of the disease.

Like other observers, I have found tubercle bacilli, although in very small numbers, in strumous glands; but in abundance in those organs which I have examined from the rabbits and guinea-pigs inoculated experimentally. The bacilli in the visceral tuberculosis were generally uniformly stained with even outlines; but in the strumous abscess in a rabbit which had existed for eight months they were nearly all "beaded" or uniformly stained, and often collected in groups not unlike clumps of micrococci. These changes in the form of the bacilli in acute and chronic cases of tuberculosis have been noted by MM. Raymond and Arthaud.⁵

In investigating the relation of strumous disease to other forms of tuberculosis, it was necessary to consider the possibility of its belonging to the form of tuberculosis described as *tuberculose zoogloïque* by Malassez and Vignal,⁶ and which has also been observed by Eberth. This disease in its coarse anatomical characters cannot be distinguished from tuberculosis; but, on investigating the lesions microscopically with appropriate reagents, the bacilli of Koch are not to be found, while at the periphery of the caseous centres of the nodules are dense masses of micrococci, usually distributed in zoogloea, but in part in chaplets. The precise relation of this disease to bacillary tuberculosis has not yet been determined. Malassez and Vignal discovered it in guinea-pigs which had been inoculated with a tuberculosis of the skin; and recently Chantemesse⁷ obtained the same disease by inoculating guinea-pigs with portions of sterilised cotton-wool, through which the air of waiting rooms used by phthisical patients had been passed. Malassez and Vignal incline to the opinion that zoogloëtic tuberculosis may coexist with the ordinary bacillary form. In their experiments bacilli appeared in animals inoculated with a third series of cultures of micrococci, of which each generation had been passed through a guinea-pig. It is even possible that the micrococci may be simply contaminations of bacillary tuberculosis. The subject, therefore, requires further investigation, especially in tuberculous products from man. With the reagents employed by the authors above mentioned I have carefully searched two specimens of strumous gland, and many diseased organs both from rabbits and guinea-pigs inoculated with strumous glands, but have found nothing like zoogloea, except in one gland. Here were some darkly stained granular masses, but the granules were not well defined, and disappeared when the field was fully illuminated by removing the diaphragm. They were probably nothing more than masses of granular caseous material.

In passing I may here state that I have much pleasure in confirming, as regards strumous glands, the observation of Mr. Treves,⁸ which has been combated by high authority, that many of the "giant cells" are clearly formed by lymph coagula lying in lymph sinuses. I may also call attention to a curious condition of the lungs of some guinea-pigs which had been inoculated with tubercle. They are studded with rounded cavities, some larger than a pea, and many of these projected beneath the pleura, looking like bullæ. On microscopic examination they appeared to be formed by the softening of the caseous centres of tuberculous nodules, and by dilatation of the minute bronchi. The occurrence of cavities in the tuberculous lungs of animals has been denied by Chantemesse.

To conclude, while I have shown that the virus of strumous gland disease produced visceral tuberculosis in rabbits as well as in guinea-pigs, yet I admit that the disease in rabbits is not so acute and rapidly fatal as that following inoculation with, for example, acute miliary tubercle. The difference is one only of degree, not of a kind permitting us to infer, with Arloing, that struma is a specialised form of the tuberculous virus. We must, therefore, fall back on another explanation of the clinically innocent course of strumous gland disease; and we find it probably in the locality or soil in which the virus is implanted. Taking cervical gland

disease, if the virus is not inherited from a consumptive or strumous parent, it may be surmised that the common bacillus of phthisis is implanted in the lymph follicles of the pharynx or tonsil, in one of the adjoining mucous membranes on the skin, and is carried direct to the glands. These, acting as filters, arrest its progress permanently, except in some cases in which suppuration and ulceration take place, when the surrounding textures may become implicated, and general dissemination ensue. The malignancy of the virus may be somewhat attenuated under the local influence of the lymph cells and leucocytes in the gland, but to admit that the virus producing the disease is *ab initio* specialised, would be to infer that the strumous disease could only be produced by the virus of struma, and no other.⁹

In conclusion, I would emphasise the objections to the use of the terms "scrofula" and "struma" for lesions resembling tuberculosis.

Teachers must often be asked by students as I have been, What is the difference between a strumous and a tuberculous testicle?

Further, any evidence tending to connect more closely strumous gland disease with general tuberculous affections encourages us to persevere in the practice of early operation (where possible), with the view of completely eradicating the disease.

PERICHONDRITIS OF THE LARYNX.

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A VERY instructive case has recently occurred in my clinic, of which I append the notes. The patient, C. T., aged 43, a big, strong-looking man, by occupation a policeman, applied at the Throat Hospital on September 20th, 1887. He gave the following history. He had been a policeman for sixteen years, had never had any illness that he remembered, except an injury to the knee, which kept him in hospital for fifteen weeks. The father is alive and well, the mother dead fifteen years before from "cancer of the breast;" all other relatives were healthy. The patient himself, though frequently pressed, could give no history of syphilis. At Christmas, 1885, he had caught a severe cold, suffered sore throat, and loss of voice and dyspnoea on lying down in bed. Under treatment he got somewhat better, partly regaining his voice, which, however, never became so clear as formerly. From time to time he caught cold, and suffered extinction of the voice, but was not ill enough to relinquish his work. He attended the Victoria Park Chest Hospital at Christmas, 1886. In July, 1887, he went to Yarmouth, and on returning home continued his work until coming to this hospital in September, 1887.

I saw him first on October 25th, 1887, and then found upon laryngoscopic examination that, situated under the right vocal cord, projecting beyond its edge, and occupying the anterior third of its subglottic portion, was a swelling, smooth and red, having all the appearance of a neoplasm (Fig. 1). The vocal cord of that

Fig. 1.

side was nearly motionless upon deep inspiration, and its surface was congested. The left cord was well abducted, and presented no abnormal appearance. The ventricular bands of both sides were a little thickened, just as in chronic laryngitis. The voice was hoarse but not extinct. No history of pain in any part could be obtained. Breathing was easy, and the patient's general condition satisfactory.

Bearing in mind the age of the patient, the history of the case, and the resemblance of the subglottic swelling to a new growth, I thought the case might possibly be one of malignant disease of the larynx. I therefore proposed to the patient that on my next

⁵ *Prophylaxie de la Tuberculose*, p. 38.

⁶ *Arch. de Physiologie*, February 15th, 1883, February 16th, 1884.

⁷ *Annales de L'Institut Pasteur*, March, 1887.

⁸ *Holmes's System of Surgery*, vol. i.

⁹ For two cases in which the inoculation of circumcision wounds by tuberculous virus was followed only by caseous abscesses, see *Lancet*, January 28th, 1888.