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Cancerous Disease of Bone

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W. HICKMAN, M.B.
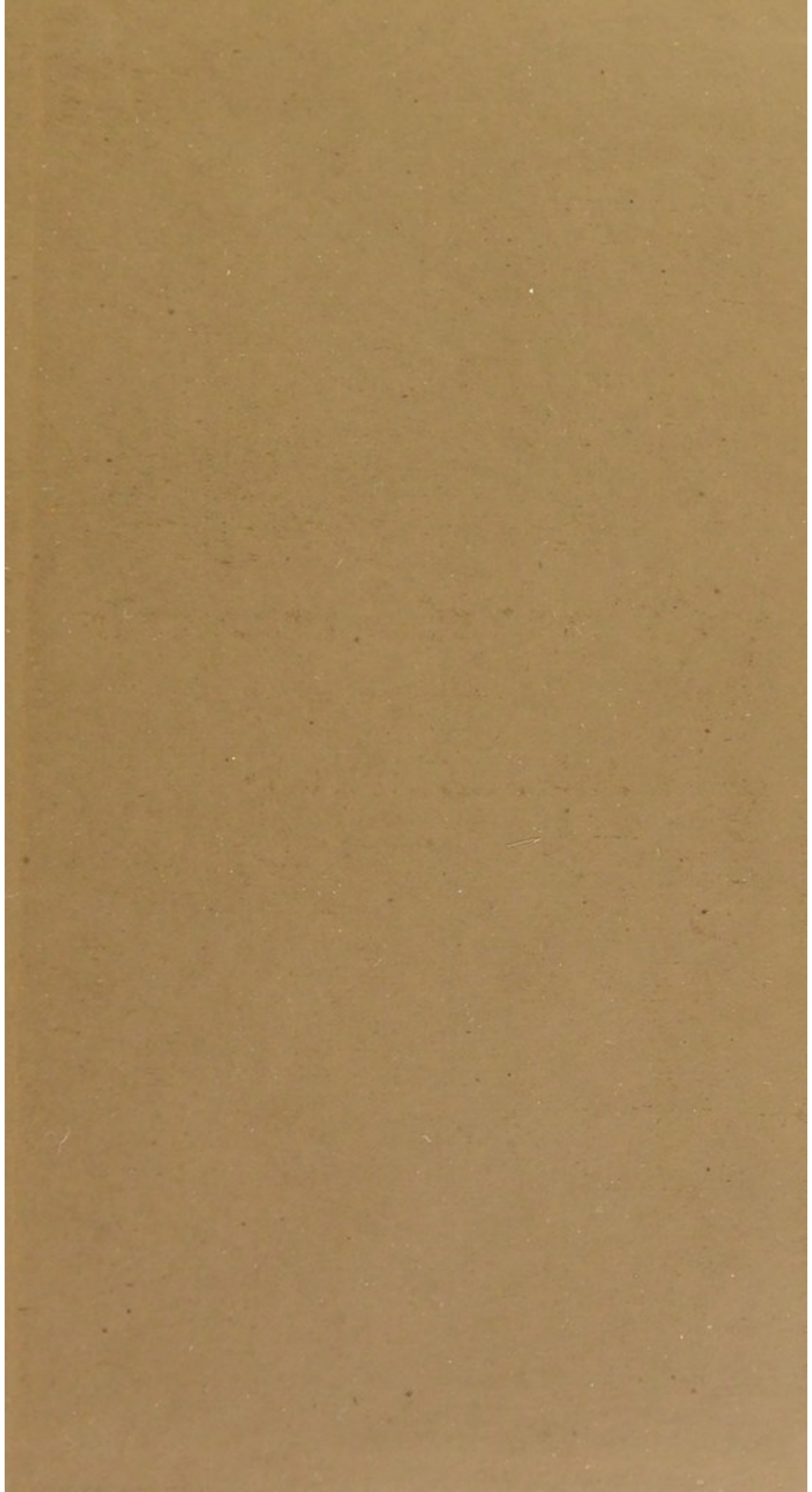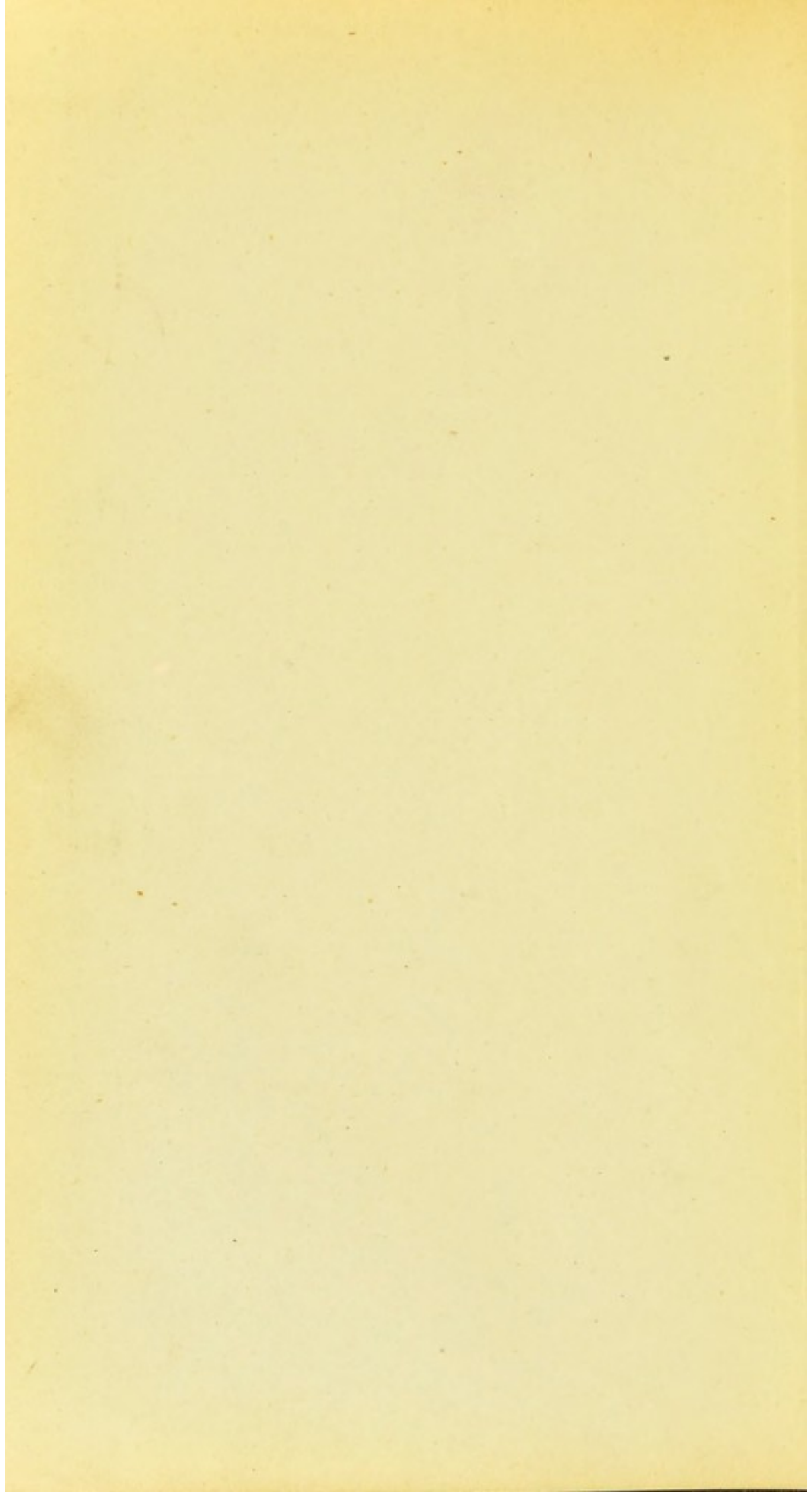
ON CANCEROUS DISEASE OF BONE.

ON SOME

VARIETIES AND EFFECTS

OF

CANCEROUS DISEASE OF BONE.

LISTON CLINICAL PRIZE ESSAY, UNIVERSITY COLLEGE, 1860.

BY

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THE publication of this little Essay, which formed a portion of the papers sent in for the "Liston" clinical prize, was deferred at first by the writer's departure from England, on what afterwards became a prolonged visit to the East.

Since his return, the occupation and anxieties consequent on settling down into general practice have afforded him neither time nor opportunity for a renewed investigation of the subject (involving as it would the study and comparison of cases by no means frequently met with), and it is now with some reluctance that he is induced, contrary to his previous intention, to entrust it to the indulgence and consideration of his professional brethren in its original condition.
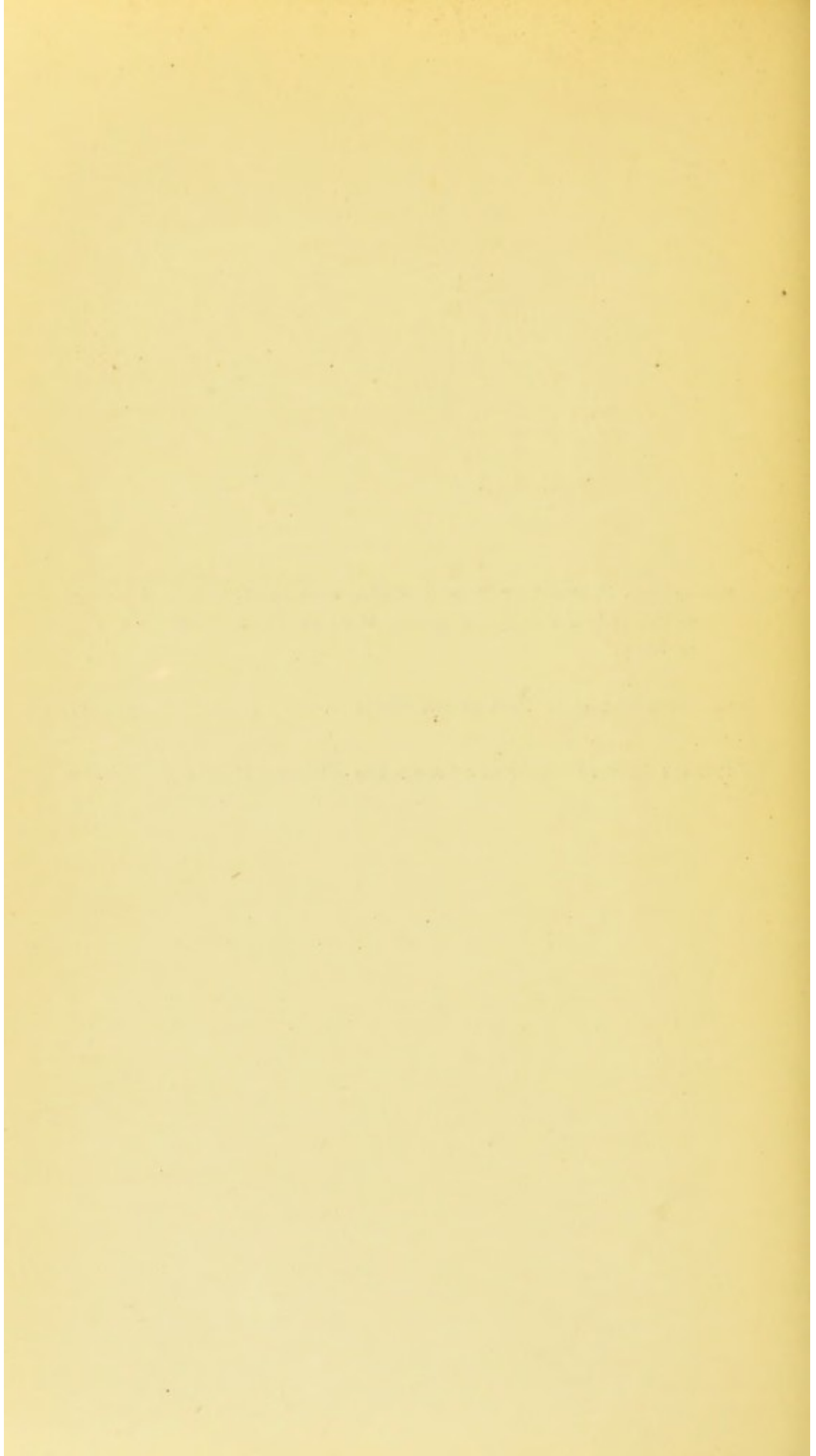
Dorset Square, 1865.

EXPLANATION OF THE PLATES.

ON CANCEROUS DISEASE OF BONE.

SPONTANEOUS FRACTURE OF BONE OCCURRING WITH THE
CANCEROUS DIATHESIS — INFILTRATED CANCER OF BONE
— MODE OF DEVELOPMENT OF CANCER IN BONE.

OF the constitutional conditions preceding and accompanying the so-called "spontaneous fracture of bone," that of the cancerous diathesis will be found by far the most common; the records of surgery, as well as the unrecorded experience of most surgeons, furnishing many examples of such combination, whilst it is comparatively rare to see this accident not so associated; the reason being that the remaining predisposing causes are either extremely rare in themselves—such as that peculiar fragility and softening of the bones constituting a special disease, mollities ossium—or are only occasionally and infrequently thus attended.*

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* The predisposing causes of spontaneous fracture enumerated by Erichsen are—mollities or fragilitas ossium, the cancerous cachexy, syphilis, a cancerous growth within the substance of the bone, pressure upon and absorption of the bone by a neighbouring tumour, and the brittleness and weakness induced by age.

Besides these causes it may also occur from necrosis, ulceration malignant and even innocent, and from general strumous disease.

B

That spontaneous fracture should be a not uncommon event in the history of cancerous disease of *bone* was only to be expected considering the eroding and destructive character of the deposit, but why it should occur when there is no apparent implication of the osseous tissue itself is not quite so obvious, and the explanation usually set up is that it is consequent upon the general atrophy induced by the cancerous as by other cachectic diseases, and which, affecting the bones, causes them to become rarefied, weak, and brittle, and liable to be fractured by a very slight degree of violence.

The following case will, I think, throw some light on this subject, and prove that this explanation, if it is not to be altogether given up, requires at least considerable modification :—

W. C., æt. 54, a tailor, was admitted into University College Hospital under the care of Dr. Parkes, on Dec. 8th, 1859, suffering from an enlargement of the liver, supposed to be cancerous, but of which the diagnosis was not quite certain. He had experienced symptoms of his complaint, such as nausea, diarrhœa, &c., for two years previously, and it appeared that one of his sisters had died of cancer of the breast; his father died at the age of 61 from a "stoppage in the stomach," his mother, aged 58, died of some chest affection; the rest of the family were living and healthy.

After remaining in the Hospital about two months, getting sometimes better, sometimes worse, he was discharged at his own request.

On March 2nd, 1860, he was re-admitted; he was then pale, very weak, had lost flesh considerably, and was suffering much from pain in the region of the liver, night-sweats, and diarrhœa.

He continued in much the same condition until March 19th, on which day being in bed, whilst in the act of pulling his shirt out from underneath him with his left hand, he felt and heard his arm suddenly snap, and found that it was broken.

On inquiry being now made, he stated that he had felt rheumatic pains about the lower part of this arm for three months; but, as he had been in the Hospital during nearly the whole of that time and had not previously complained of it, the pain could not have been very marked.

Being House-Surgeon at the time, I was applied to, and on examining the arm, found a fracture of the lower end of the humerus (left side). From the absence of swelling and from the emaciation of the patient, the outlines of the bone, and the direction of the fracture (from without—inwards and downwards), could be distinctly made out;—the bone was of its natural shape and *nowhere at all enlarged*.

The arm was put up in lateral angular leathern splints.

March 29.—He has had stabbing pains about the seat of fracture, where the arm is somewhat swollen. The splints have been taken off and replaced once or twice.

April 9.—The lower part of the arm at the site of the fracture is considerably enlarged; the swelling is uniform, smooth, rounded, and feels very hard; the cutaneous veins passing over it are much increased in size; the brachial artery is felt pulsating close beneath the skin. The limb is pretty firm at the fractured part.

He continued to get weaker after this, and was soon evidently sinking, and eventually died on April 23rd.

Post mortem.—Liver weighs 10¾ lbs. and is filled throughout with large masses of cancer.

Kidneys—right, weighs 8¾ oz.; left, a mere cyst; neither contains cancer.

No cancer in lungs, spleen, nor stomach.

Ileocœcal valve thickened and ulcerated; tissues around thickened by cancerous deposit, in parts opaque and milky (scirrho-encephaloid), in parts glue-like (colloid).

On making an incision down to the enlargement at the site of the fracture, the muscles were found expanded over a tense tumour, the size of an orange, bound down to the bone beneath by a fibrous tissue continuous all round with the periosteum: on section, this was softish, white, exuding an abundant milky juice on pressure,—it surrounded the fractured ends of the bone on all sides, and extended by a narrowed process into the medullary cavity of the upper fragment, where its cancerous characters became gradually less marked; hardened spiculæ of a bony material shoot in different directions into the mass, and are shown by the microscope to consist of true bone, having numerous lacunæ, and a sort of commencement of the formation of haversian canals.
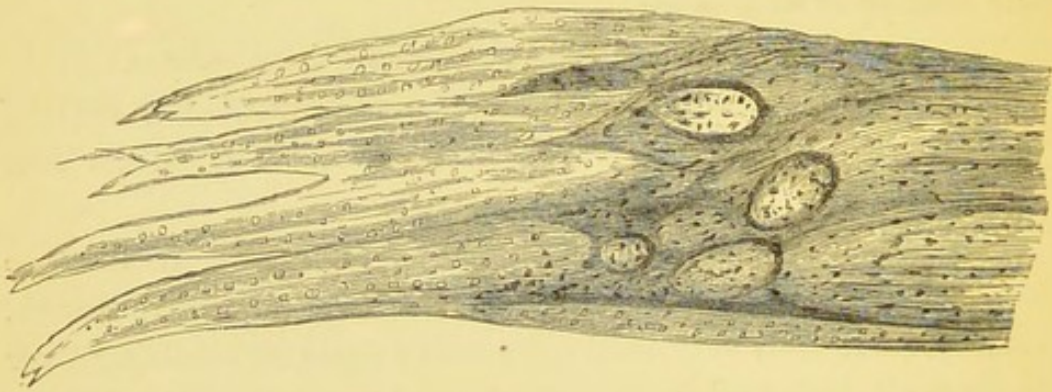
Fig. 1. Spicula of bone formed in cancerous tumour.

The muscles are perfectly healthy.

The natural outlines of the humerus are preserved, but the surface of the bone, where in contact with the tumour, is bare and rough, eaten into, as it were; it is also softened, but not to any considerable extent; there is no attempt at union of the fractured surfaces. The fractured ends of the bone are somewhat thinned, but very brittle, and the fracture appears to have been caused through the general fragility of the bone at this part.

A few inches above the tumour, the humerus when sawn across appears to the naked eye perfectly healthy, with the exception that some of the haversian canals on one side appear more injected than natural; the whole of the upper part of the bone is perhaps a little less hard than it would be in the healthy condition. The ribs were all rather brittle and softer than natural, being easily cut with the bone forceps, and broken across with the hand; they were not enlarged. On section, the compact tissue forming the walls was thinned, and the cancellous tissue appeared too abundant in proportion to it, and contained a reddish medulla. None of the other bones appeared softened, and attempts to break them were unsuccessful.

Fig. 2. Cancer cells. *a.* from tumour surrounding fracture.
b. from medulla of ribs.

On examination by the microscope, the usual elements of encephaloid cancer were found in the tumour;—a large number of cells, of delicate outline, with large nuclei, a large quantity of free nuclei

with nucleoli, some large cells without nuclei, but filled with granules, and some large kidney-shaped nuclei; no myeloid corpuscles.

The medulla of the ribs and of the humerus several inches above the tumour, and where apparently healthy, also contained numbers of the same kinds of cells, in fact were extensively infiltrated with cancer. (See Figures 2 and 3.)
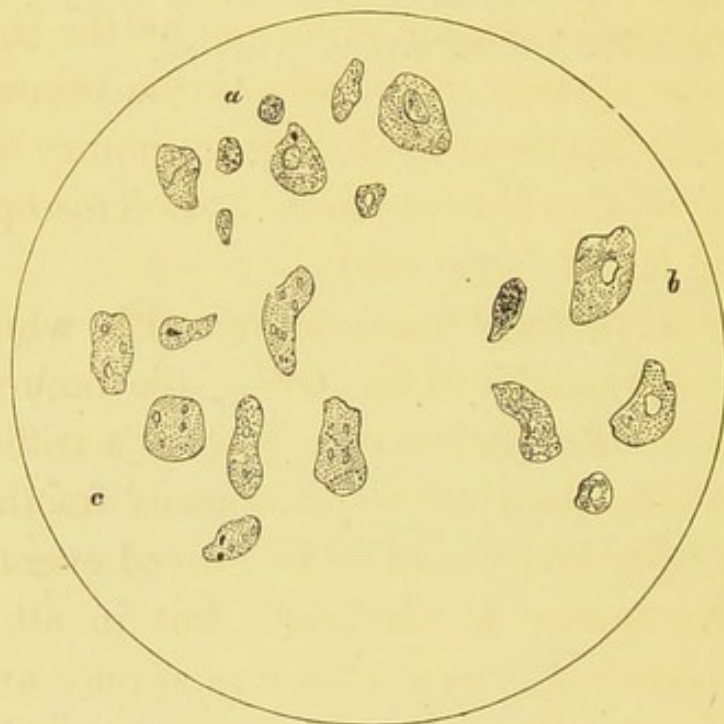
Fig. 3. Cancer cells from humerus.

a. from some inches above cancerous mass; bone apparently healthy.
b. from site of fracture.
c. from spongy tissue of articular end.

Here therefore the ribs were extensively affected by cancerous disease, without there being any sign of it visible to the naked eye; in fact, it could only have been discovered by the aid of the microscope.

There is no doubt also, that at the time of the fracture, the humerus was in the same condition, and had the patient died shortly before, or soon after this event, the disease might, and most probably would, have remained undetected.

This is a condition of things which appears to have hitherto received little or no attention, not, however, I believe, so much from its extreme rarity, as from its having been overlooked, owing to the absence of any symptoms drawing attention to the bones ; or, when some circumstance, such as the occurrence of spontaneous fracture, has led to an inquiry as to the condition of the bones,—from no microscopical examination having been made.

There are several cases on record in which, from the non-enlargement of the bone—the occurrence of a fracture from a slight cause, such as a trifling effort or blow—the so-called " spontaneous fracture " has been the first symptom of what proved eventually to have been cancer of the bone ; but in all of these cases the nature of the disease was at once evident at the post-mortem : the cancerous matter in many cases forming distinct tumours encroaching on the walls of the bone, sometimes even quite replacing them and reaching the surface of the periosteum.

" Cancer of bone," observes Rokitansky, " appears sometimes in the form of a nodule of about the size of a walnut or hen's egg, which is developed mostly in the medullary canal of the long bones ; it displaces the bony tissue, and producing atrophy of it by

pressure, is frequently the cause of one or more spontaneous fractures of the bone, which occur upon the most trifling occasion." *

Cruvielhier gives a case of the kind :†—a woman aged 40, applied at the Hotel Dieu to have a cancerous breast removed; but as she was in a very cachectic condition and the liver was also affected, the operation was not performed. Four months afterwards she was again brought to the hospital, having just broken her left thigh in rising from her chair; she died the same night.

At the post-mortem both femurs were found to be fractured, and when sawn across, " on vit qu'ils contenait un nombre considérable de masses d'apparence fibreuse, de volume variable, irrégulièrement disséminées dans le canal medullaire, et dans le tissu spongieux de ces os." He also gives another case in which the same conditions were present after a spontaneous fracture of the humerus.

In some of the cases, the cancer was of the infiltrated variety, but the infiltration was always at once evident to the naked eye, the interstices of the osseous texture being filled—if encephaloid, with a soft whitish substance of various degrees of consistence, from that of a " milk-white sap " (Rokitansky) to that of brain or a lardaceo-medullary substance ; or, if scirrhus, with a firm, elastic, grey and shining

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* Path. Anat. Syd. Soc. vol. iii. p. 191.
† Anat. Pathol. Livraison 20. Pl. I.

substance (Paget). Sir Charles Bell has described a case of this kind :*—a man, aged 45, fell down and broke his thigh. After the usual period of confinement, a tumour rose gradually in the very centre of the thigh, attended with great pain ; the limb was accordingly amputated. The tumour was then found to surround the fractured part of the bone, and to consist partly of a cartilaginous, partly of a soft pulpy greyish substance. The bone itself was also extensively diseased, a peculiar grey semi-transparent matter filling all its cells. The man died of secondary hœmorrhage, and on an examination being made of the remaining portion of the bone, the disease was found to extend up to its head.

One of the cases related by Salter in the ' Medico-Chirurgical Transactions,'† was also evidently an example of this kind :—a woman, aged 56, who had suffered for several years from a scirrhus cancer of the left breast, sustained a fracture of the right thigh whilst being lifted into a cart. Death took place in three months, and at the autopsy, the whole of the bone was found softened, distorted, its walls almost entirely absorbed, and the medullary cavity filled with a bloody pultaceous substance.

A preparation from a spontaneous fracture of the femur exhibited at the Pathological Society last year (1859) by Dr. Coote, shewed—" at the point of fracture, the inner part of the shaft has been softened,

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* Surgical Observations, p. 380.   † Vol. xv.

absorbed, and replaced by cancerous growths, while the cortical shell remains unaffected; thus occasioning the peculiar brittleness which disposes to spontaneous fracture. Above, the cancellous structure of the head of the bone is simply infiltrated with a white creamy juice; below, about one inch and a half from the seat of fracture, a distinct growth one inch long by a quarter of an inch thick, projects into the medullary cavity." *

* Cases of spontaneous fracture coupled with cancer of the bone *evident during life*— such as one related by S. Cooper (Med. Chir. Trans. vol. xvii.), one of Mr. Erichsen's, described in the 'Medical Times' (1853, vol. ii. p. 324), and of which we have a model in the University College Museum, and several given in the 'Pathological Transactions' (Mr. Birkett's, Dr. Habershon's, &c.)—do not of course apply here, from the presence of disease external to the bone *previously* to the occurrence of fracture.

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See also an interesting case brought before the Pathological Society this year by Mr. T. Holmes, and which has appeared in the transactions since the above was written. The left femur in this instance, of a patient having a scirrhous tumour of the right breast, was the seat of a spontaneous fracture, and at the examination post mortem " Numerous deposits of a hard white substance, of the consistence of fibro-cartilage, were found in the bone, lying immediately under the periosteum. Three of them were situated in the upper fragment, and, when removed, left deep pits in the bone. Another was found in the lower fragment, immediately below the seat of fracture, and had, no doubt, occasioned the giving way of the bone. It was about the size of a nut, and seemed to occupy more than half the thickness of the shaft. * * Numerous soft deposits, exactly similar to those above described, were found in the ribs on both sides. In several places they had no fracture; in others the ribs were so attenuated as to give way on the slightest force; in others, again, the bone had been replaced for some distance by the soft material, forming a tough flexible cord, in which small nodules of bone might still be found embedded."

This case is rendered still more valuable and interesting from the fact that firm and almost complete consolidation of the broken ends of the femur had taken place through the medium of a bony callus and fibrous tissue, leaving little doubt " that the fracture would have been firmly united had the patient lived a short time longer."

But there are a certain number of cases recorded of spontaneous fractures occurring to persons suffering from cancerous disease, in whom after death no cancerous material was discoverable in the bones, and in these cases the fractures have always been attributed to the atrophy, common to this and most of the chronic cachectic diseases, and the constant accompaniment of old age.

To this class belongs one of the cases related by Salter :—A woman, aged 82, had been long afflicted with cancerous ulceration of the mamma, and for some months had felt constant pain in the right thigh and had been lame with the limb on that side. Whilst standing up one day, she felt her thigh break across ; the fracture was found to be a short distance below the trochanters. Death took place five months afterwards, but no post-mortem could be obtained. The limb is said to have been very flexible after death, but nothing is said as to whether or not any tumour formed in connection with the fracture.

" But some of the spontaneous fractures in cancerous patients," Paget remarks,[*] " are due to the wasting and degenerate atrophy which the bones undergo during the progress of cancer, and which seems to proceed to an extreme more often than in any other equally emaciating and cachectic disease."

Curling, in a paper on Atrophy of Bone observes :—[†]

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[*] Surg. Pathol. vol. ii. p. 318.   [†] Med. Chir. Trans. vol. xx. p. 372.

" There are several well-authenticated cases on
record, of cancer, in which a remarkable fragility of
the bones has been noticed. In some instances this
is attributable to the disorganisation consequent upon
the development around or in the interior of the
bone of the peculiar matter distinguishing this disease.
In others, however, there is reason to believe, it is
simply owing to eccentric atrophy. I have little
doubt that this was the case in one if not both of
Mr. Salter's cases."

" But whether the atrophy in these instances," he
continues, " be only an accidental coincidence, or ori-
ginate in a constitutional defect favourable both to
the development of cancer and to the decay of the
osseous system, or whether the particular cases alluded
to were genuine instances of malignant deposit, are
subjects which must be reserved for future inves-
tigation."

Four forms of morbid condition of the bones are
enumerated by Walshe * as associated with the can-
cerous diathesis :—1. Atrophy of the spongy and
compact structures from defective nutrition ; 2. Ex-
cessive, and 3. Insufficient supply of saline materials
in their composition ; and 4. Carcinoma of their sub-
stance.

The first of these, atrophy from defective nutrition,
he regards as " singularly rare." " In the first,
second, and fourth cases, and especially the last, frac-

* 'On Cancer,' p. 126.

tures occur with extraordinary facility. In cases of cancerous deposition within the bones, the fracture may arise either from a complete transformation of a portion of the cylinder into cancerous matter, or from the pressure of a central growth causing absorption of the compact tissue."

There can be no doubt then that atrophy does occur in a certain number of instances, and occasionally gives rise to spontaneous fracture, and the question arises—on what does this atrophy depend ? Is it a simple atrophy from defective nutrition, like that of old age, and accompanying the constitutional condition of cancer ? Or is it attended with, and a consequence of, a local deposition of cancerous material ?

Now supposing this atrophy of the bone to be merely a part of the general atrophy of all the tissues of the body induced by the cancerous as by all other wasting diseases, should it not be expected to pervade the bones generally and with tolerable impartiality, or at all events to attack the symmetrical bones in a somewhat proportionate manner ?—But we do not find this to be the case, more commonly but one bone giving evidence (by spontaneous fracture) of its atrophic condition, and when the fractures are multiple, the bones affected being generally from dissimilar parts of the limbs or from different regions.*

* The absence of such direct ante-mortem evidence as spontaneous fracture does not of course prove that atrophy does not exist in other bones, but as so much increased work and liability to exposure to violence is thrown on the unbroken bones, it shows very clearly that this cannot in

It does not appear that the bone was examined microscopically by those authors who had described this condition of things; but if this had been done, I believe the last of the three solutions of the question offered by Mr. Curling, " that they are genuine instances of malignant deposit," would have been found the correct one in many if not in the majority or all of the cases, as it evidently was with regard to the patient W. C.

And it is rather remarkable, and bears very strongly in favour of this view, that in the only case (leaving out for the present one I believe to be of the same kind) I can find recorded, in which the bone was in an analogous condition, and was examined microscopically, a local deposition of cancerous matter was also found to have occurred. This is one described shortly by Sieveking : *—" A case of primary medullary cancer of the femur, which was regarded during life as a rheumatic affection of the hip-joint, exhibited at the post-mortem a remarkable fragility of the affected femur, the neck of which was broken during removal; the cancellar tissue of the bone appeared rarefied and filled with a reddish fat, and it was *only by the microscope* that the carcinomatous nature of the deposit, which was peculiarly well-marked, was revealed."

them have proceeded to anything like a corresponding degree, and the proof has pretty frequently been given on a post-mortem examination by unsuccessful attempts made to break other and corresponding bones (as in the case detailed).

* Manual Path. Anat. p. 771.

The other case I referred to, is one described by Mr. Solly as mollities ossium :—*

" A female, æt. 39, had suffered from feebleness and rheumatic pains in the limbs for some time, when one day as she was being lifted, her thigh broke; some time after this her clavicle became fractured, but reunited, and before her death, which took place 12 months after the first fracture, the humerus was also broken. On examination post-mortem, no cancer was found. The bones on section appeared vascular, soft, and filled with a soft reddish gelatinous solid. The red matter when examined under the microscope was found to contain—cells with a clear oval outline enclosing one bright central nucleus; others rounded with nucleus and nucleolus; a few also had a tendency to elongate into the caudate cells; besides these there were many other cells of irregular figure and shape, some with, others without central nuclei.

With regard to the nature of this case, Mr. Solly observes :—" After careful consideration of the facts, I am led to believe that the disease is of an inflammatory character. The microscopic examination of the red grumous matter showing cell development in its various stages, confirms my impression that it is an adventitious morbid product, and not simply the fatty matter of the bone altered by effusion of blood into it."

Now, with due deference to the opinion of Mr.

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* Med. Chir. Trans. vol. xxvii. p. 443.

Solly, but with the experience of the two cases mentioned (that of Sieveking and my own), I feel compelled to ask whether we may not take a different view as to the nature of the disease in his case?

That the matter contained in the bones was an adventitious product, its microscopical appearances left no doubt; but were not these much more like those of the elements of cancer, than of any inflammatory products?

Were they not indeed almost characteristic of cancer? And is it probable that mere inflammation would cause the development of cells such as those described?

I am aware it will be objected to its being cancer, that the patient lived for 12 months after the first fracture, and that one of the broken bones became reunited; but that these are not impossible occurrences (even in cancer) is shown pretty clearly by a case mentioned by Paget,* in which a cancerous femur was broken 8 months before death, but the broken ends became reunited, and at the post-mortem the " new bone with which the fracture was repaired, was infiltrated with cancer, as well as the original textures." †

That Cancer of Bone may thus occur as a primary disease, without cancer being found in any other organ (the absence of which seems to have drawn

* Op. cit. p. 317.
† See also the case of Mr. Holmes before cited, note p. 10.

Mr. Solly's attention away from this view of the nature of his case), is proved absolutely by the case of Sieveking.

With regard to Mr. Salter's cases, the fracture in one of them was doubtless due (as I have shown previously) to extensive cancerous infiltration of the bone; in the other, it was probably (in the absence of any post-mortem examination) owing, as suggested by Curling, to "eccentric atrophy," but this in turn seems as likely to have been the natural result of the patient's advanced age (82) as of her cancerous constitution.

It having been proved then, that the atrophy of bone accompanying the cancerous diathesis, is in many, if not in the majority of instances, attended, in its advanced stage at least, by the local accumulation of cancerous elements: it will be interesting to ascertain, if possible, whether this local accumulation be merely a coincidence of the atrophic condition of the bone, or whether the latter be secondary to and a consequence of the former.

It has been supposed that the compact tissue of bone is not capable of becoming the seat of cancerous formation; and if this were so, atrophy, in this structure at least, must necessarily precede the deposition of cancer.

But is this actually the case?

Cruvielhier observes :*—" Le tissu compacte ne m'a pas paru susceptible de cet altération en tant que

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* Op. cit.

tissu compacte ; mais sa transformation facile en tissu spongieux rend compte du petit nombre de cas dans lesquels il a été envahi."

Walshe, whilst admitting the fact, thinks that this is a somewhat incorrect way of expressing it,* and that " the truth is, that the primary morbid change, rarefaction, precedes the formation of cancer in the compact structure of bone." The humerus of the patient W. C., presenting, as it did, different degrees of atrophy, from an advanced stage to almost the condition of health, offered a good opportunity of resolving these questions, and I accordingly carefully examined by the microscope, hard and soft sections from different parts of the bone. First, a portion of the bone was taken for examination from several inches above the cancerous mass, where the bone appeared to the naked eye almost perfectly healthy, a piece of the hard bone being here sawn off transversely, and ground down as thin as possible. On examining this by the microscope, the appearances shown in Pl. I. fig. 1, were observed. The haversian canals were generally of small size, or perhaps slightly larger than natural (the drawing is taken from the inner side of the section, next to the medullary cavity, where the canals are of course naturally larger than towards the circumference), their shapes were pretty regular, with smooth outlines. In the specimen a space is seen (at a) which is very much larger than the openings of the other canals, this is

* Op. cit.

Fig. 1.

Fig. 2.
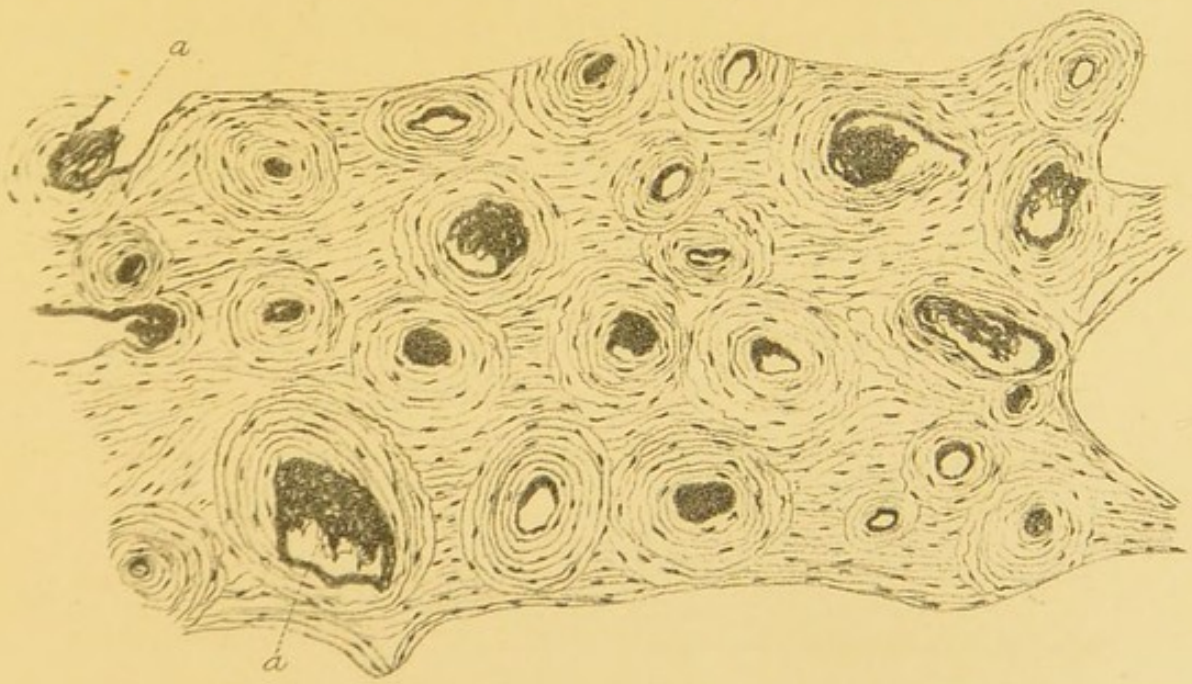
probably due to the natural approach to the cancellated structure at this margin of the bony wall (*i.e.* next to the medullary cavity).

The canals most of them contained a yellow substance, which, when examined by a higher power of the microscope, was found to contain numbers of granular cells evidently cancerous.

The lacunæ appeared perfectly natural, not enlarged, nor increased nor diminished in number, and of uniform size and shape.

The laminæ surrounding the canals also were not separated from one another, but preserved their usual distance, regularity, and direction. A longitudinal section of the bone at the same part (fig. 4) confirmed these results; the osseous texture preserving its natural appearance, the haversian canals being of the usual and uniform calibre, and proceeding in the regular manner through the bone.

It would thus appear that, with the exception of containing cancerous material in its canals, this por-
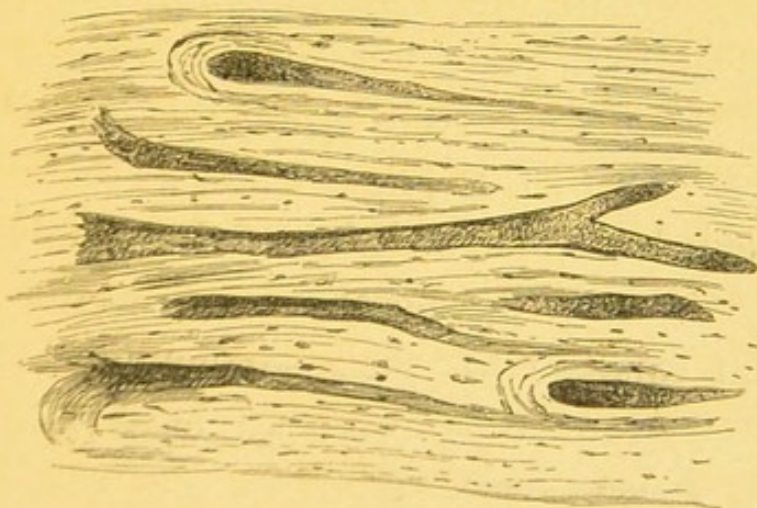
Fig 4. Longitudinal section of humerus some distance above fracture.

tion of bone at least deviated little, if at all, from the structure of health.

A transverse section was next taken more in the neighbourhood of the cancerous mass, where the bone was obviously somewhat affected. This (also of hard bone prepared as the last) is shown in Pl. I. fig. 2, which represents a portion of the central part of the wall of the bone at about equal distances from the external surface and the medullary cavity.

Here a different state of things is manifest, but still the difference is not very marked. The haversian canals are, however, much enlarged, and of very irregular shapes, their outlines also do not preserve their natural evenness; in some, portions of the laminæ at the side have been as it were eaten away (as at *a*).

The laminæ themselves and the lacunæ here, as in the last specimen, retain their natural appearance.

The bone was next examined in the immediate vicinity of the fracture (and here from its brittleness it was found impossible to get sections of the hard bone, and it was therefore placed in dilute hydrochloric acid to dissolve out the earthy matter, after which sections were readily obtained, of which two are represented) Pl. II., figs. 1 and 2. These show a very decided morbid condition of the osseous texture. Instead of the small, smooth, round openings of the haversian canals with their surrounding regularly-disposed concentric laminæ, we have large rough irregular spaces, encroaching in different directions on the various 'systems' (if I may so term them) of
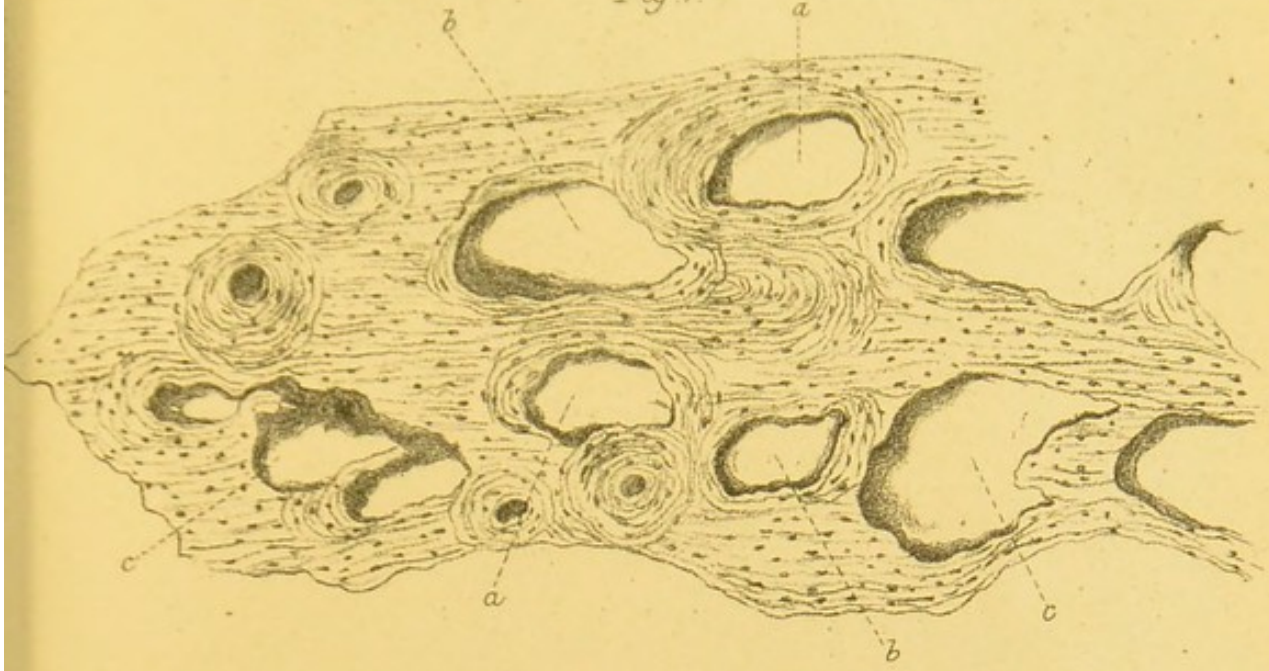
Plate 2.

Fig 1.

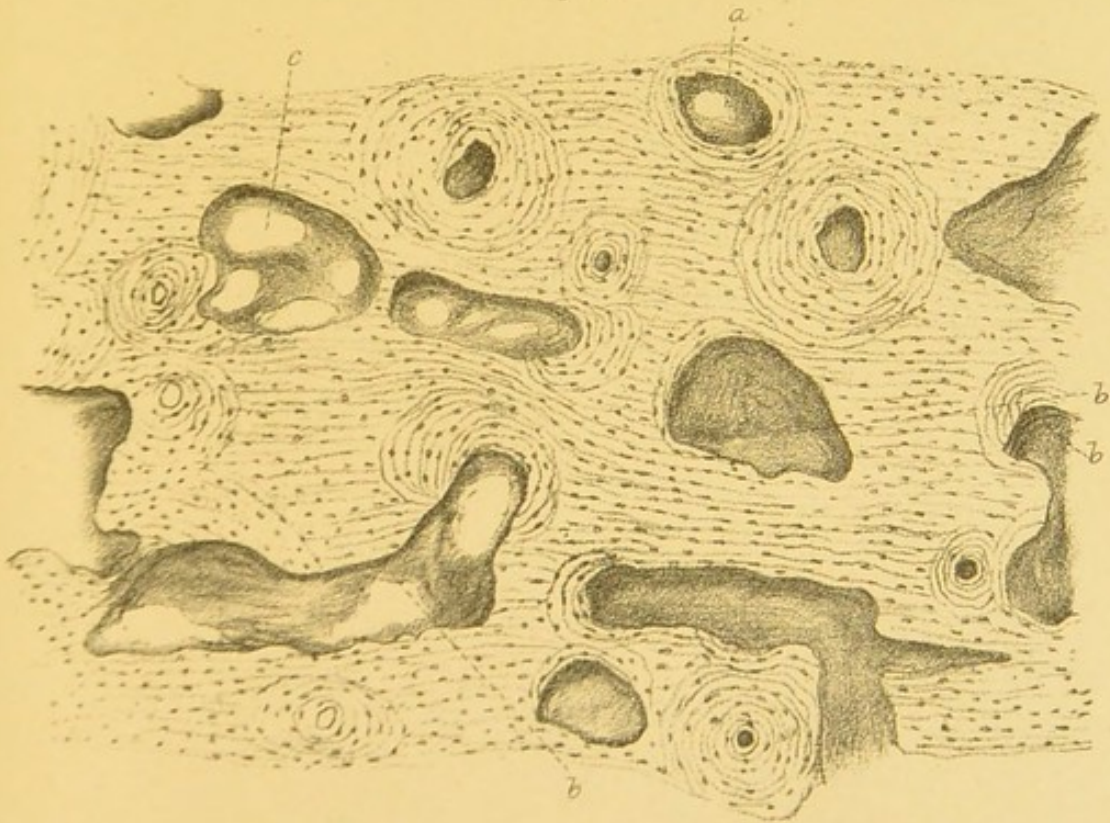
Fig 2.

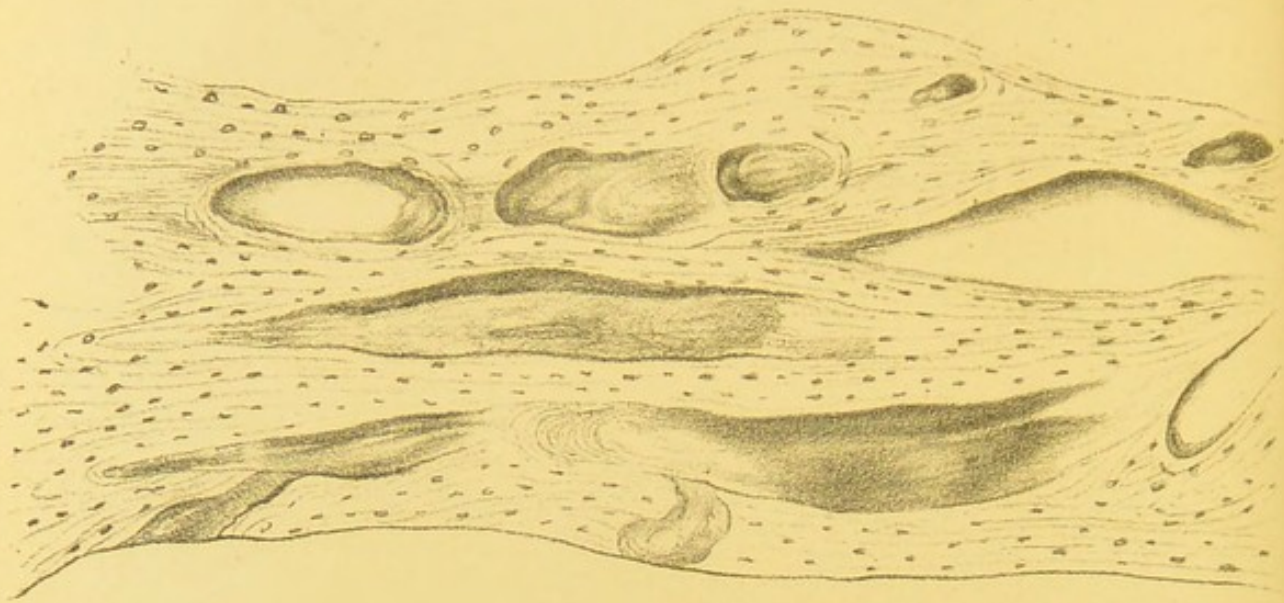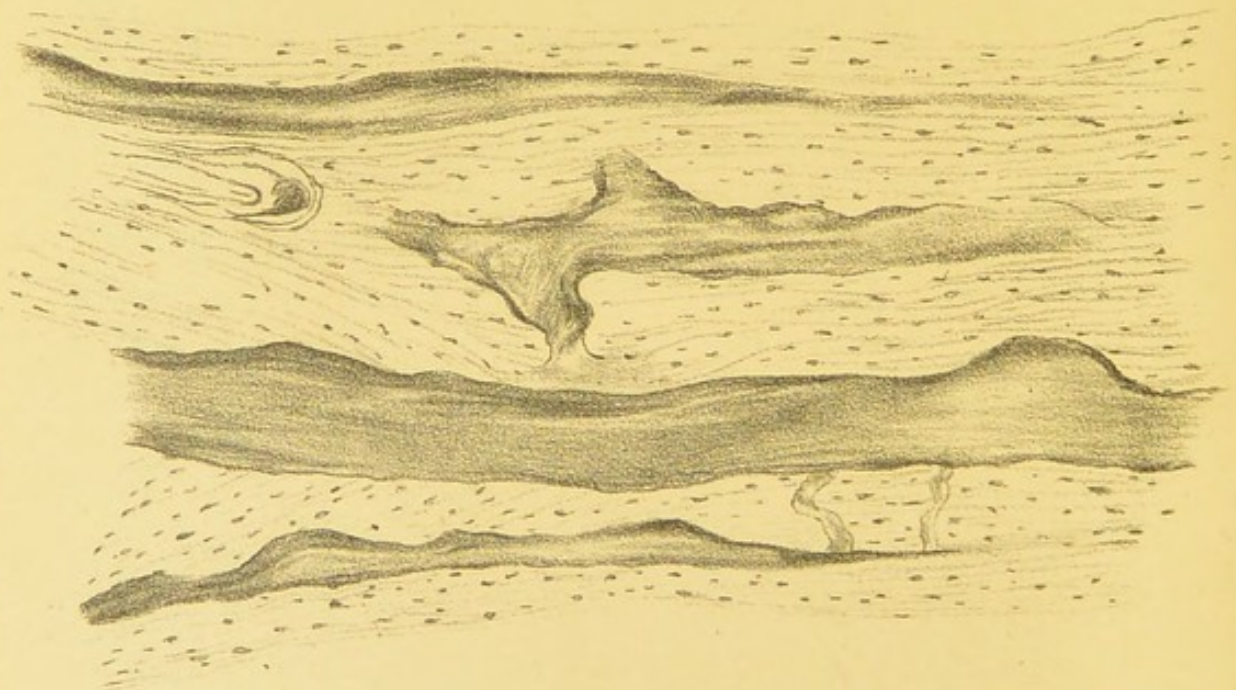

W. Hickman del.

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Plate 3.

Fig. 1.

Fig. 2.

laminæ in their neighbourhood. Some of these are evidently, from the more or less thin layer of concentric laminæ still surrounding them (*a, a*) the enlarged haversian canals; in others, where the wall of the cavity reaches to the intermediate laminæ, this origin is not so evident (*b, b*), but in most even of these there are sufficient remains of concentric laminæ at some part of their margin to indicate pretty clearly that their origin must have been the same. In the instances (as at *c, c*) where the spaces are surrounded only by the intermediate laminæ, it is probable that the whole of the concentric layers surrounding a canal at these spots have been removed, the perfect chain of links furnished by the intermediate forms between these and the simply enlarged canals proving sufficiently (in the absence of any evidence in favour of another derivation) their like origin and nature. In several instances (seen especially in fig. 2) the remains of several systems of laminæ are seen intersected by these spaces, showing that several of the canals have been here fused into one by the diseased action going on.

The appearances shown by oblique and longitudinal sections at the same part of the bone corroborate this view of the origin of these spaces (Pl. III.).

The haversian canals are here seen to be enlarged considerably in their whole length, and at intervals still more distended, constituting a sort of varicose condition; and a section across these, especially

where thus varicose, may be easily imagined to give the appearances of the irregular spaces seen in the other figures. By these sections too no other spaces but those of the haversian canals are brought into view, which they necessarily would be if any such existed.

As in the former cases, even at a part of the bone in so advanced a state of disease as this, the lacunæ and laminæ, where present, are unaltered, and preserve their natural appearance as in healthy bone.

The matter contained in these cavities, was found to consist principally of cells, and there could be no doubt of its being cancerous.

Of the ribs, from their thinness and brittleness, it was difficult to get good sections, but when obtained (Pl. IV. fig. 1) an advanced degree of atrophy was at once seen, the outer layer of bone consisting of merely a single row of haversian canals with their laminæ, the whole of the inner canals being absorbed to form the large cancellar spaces left in the interior. This contrasts strongly with the appearance of the healthy rib, in fig. 2, taken from a beautiful section kindly lent me by Dr. Harley (to whom I am indebted also for several valuable suggestions during this investigation, and who has kindly overlooked several of the drawings and compared them with the original specimens).

The results of the microscopic examination of the bones may be thus summed up :—

Where the bone presented almost its natural
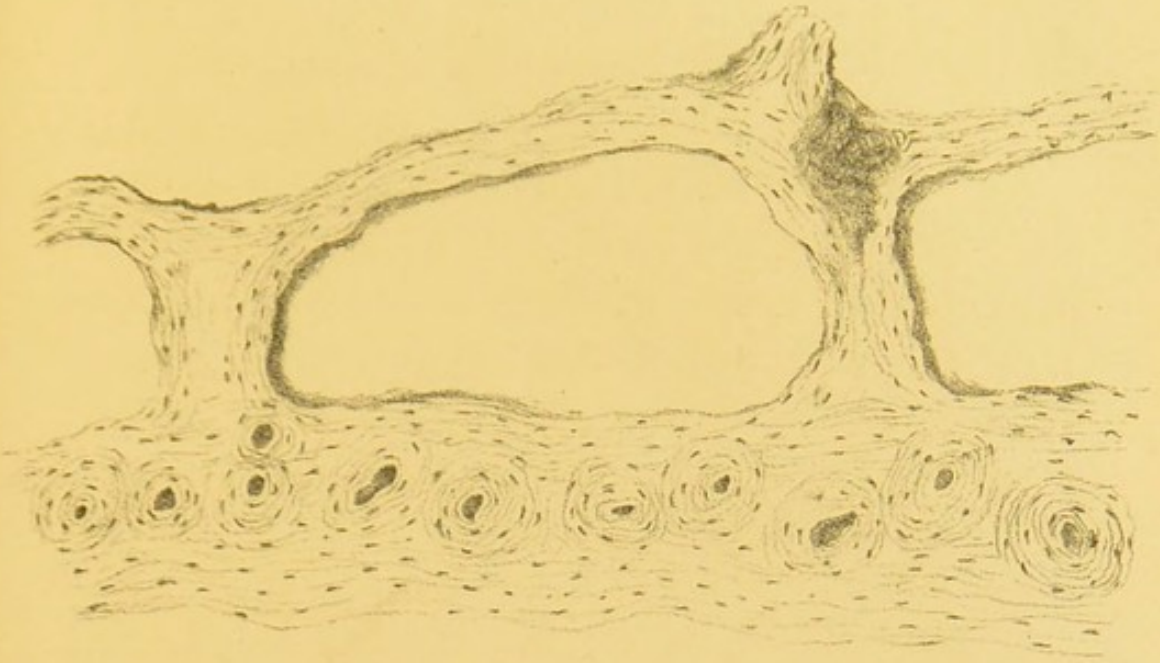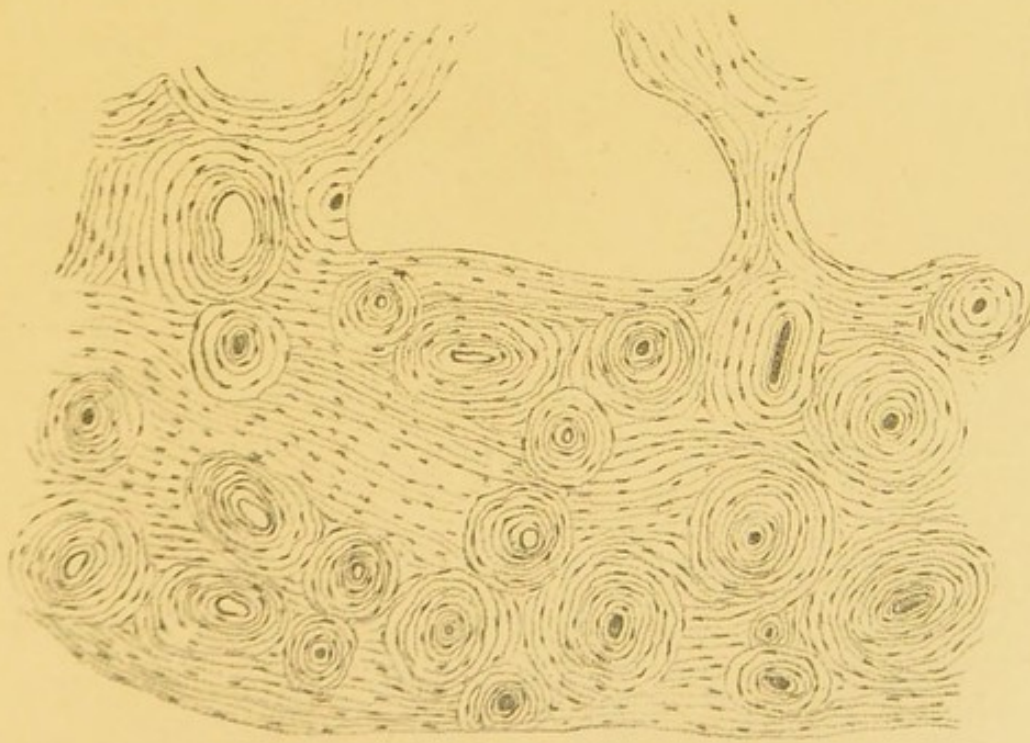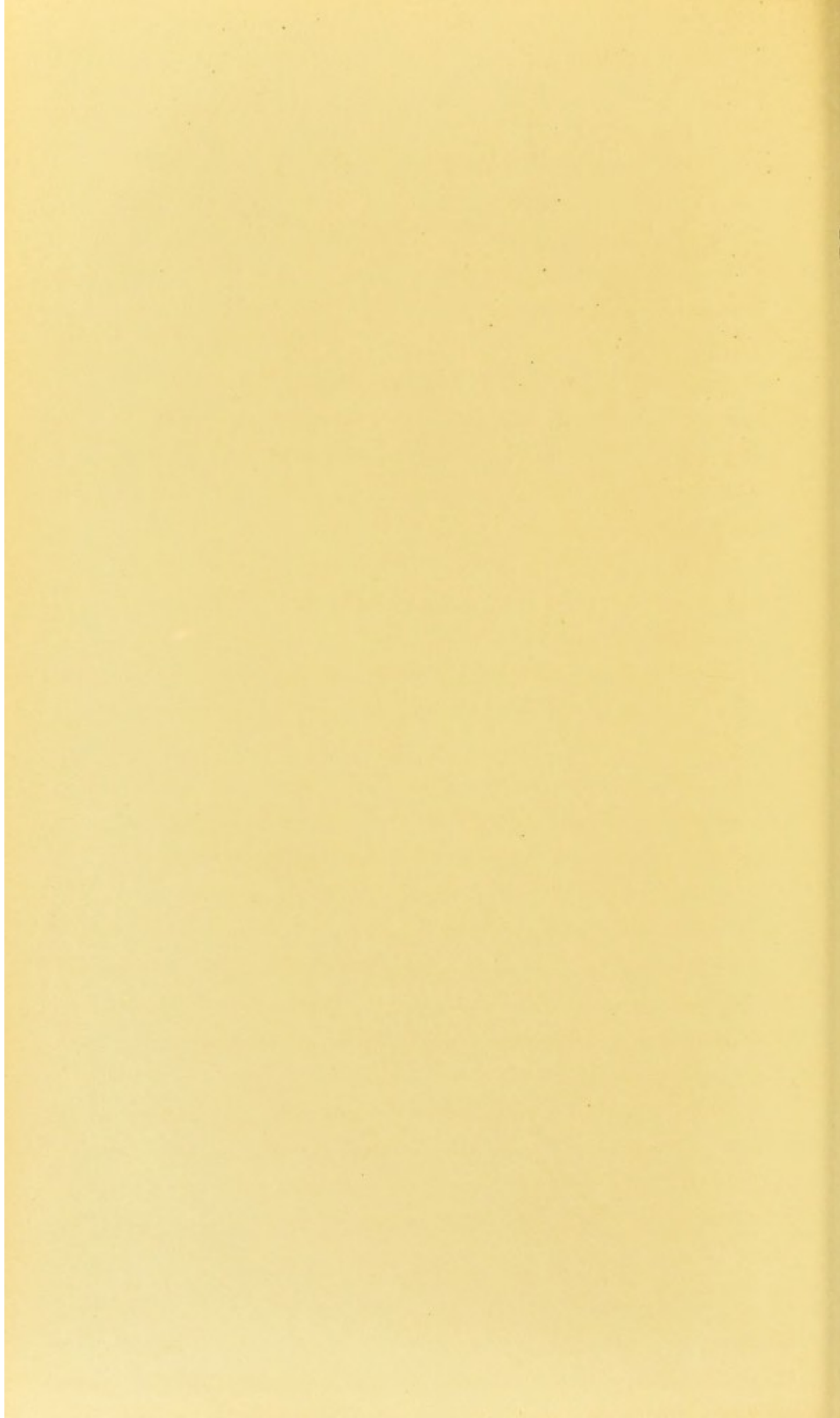
Plate 4.

Fig. 1.

Fig. 2.

texture, even on minute examination, the haversian canals of the compact structures (as well as the cancellous tissue) were filled with cancerous matter.

Nearer the seat of disease, where the bone was obviously altered, the canals were enlarged and irregular in shape, also containing cancer.

Close to the site of the fracture, these characters were much more marked, the laminæ surrounding the canals being, as it were, eaten away irregularly, and the canals coalescing with one another, forming large rough spaces.

Nearly the whole of the wall of the rib was converted into large cellular spaces, merely a single row of canals with their laminæ being left.

The lacunæ and laminæ where present, preserved their natural appearance, and the spaces and cavities in the bone were all due to the enlargement and varicose condition of the haversian canals.

From these facts we may draw the following deductions, which will be fairly applicable, I think, to the majority if not to all the cases analogous with the one from which they are derived :—

This form of atrophy of the bones (accompanying the cancerous diathesis) is attended even at its earliest stage, and is probably preceded by, the deposition of cancerous matter.

The cancerous material is deposited primarily in the haversian canals and the cancellous tissue, and the medulla contained in these is probably its original seat in infiltrated cancer of bone, and not

the endosteum, the lacunæ, nor the interlaminar spaces.

Coincidently with, and in consequence of, this development of cancer within the haversian canals, their walls became encroached upon and absorbed, and a condition of atrophy is thus induced which proceeds *pari passu* with the development of the cancer.

And to sum up, I think we may fairly arrive at the conclusions that:—

There is a peculiar form of infiltrated cancer of bone, which may be either primary or secondary, in which the cancerous nature of the disease is only discoverable by the microscope :

The compact tissue of bone, as such, may be and commonly is invaded by cancer even at an early stage :

Infiltrated cancer of bone originates in the medulla of the cancelli and the haversian canals, and not in the lacunæ, the interlaminar spaces, nor the endosteum :

The development of cancer in bone is attended by the enlargement, breaking up, and coalescence of the haversian canals:

By this breaking up, &c. of the haversian canals, a condition of rarefaction and atrophy is produced which may proceed to an indefinite extent, and which at an advanced stage reduces the bone to a degree of brittleness corresponding to fragilitas ossium, and, at a still more advanced stage, to a state of softness

and pliability characteristic of the disease called mollities ossium :

Probably many of the cases which have been hitherto called fragilitas or mollities ossium, have been instances of this form of disease :

The atrophy of bone stated to accompany the cancerous diathesis is in most if not in all instances a result of cancerous disease of the bone itself:

And that:—Many of the cases of spontaneous fracture which have been attributed to atrophy—either with or without cancer existing elsewhere in the body—have been really due to cancerous disease of the bone.

SCIRRHOUS DISEASE OF BONE IN THE HORSE.

A specimen kindly lent me by Professor Harley, has afforded me the opportunity of investigating a form of cancerous disease of bone in one of the lower animals, and of comparing it with a kindred disease in the human subject.

For the short history of the case, I am indebted to Professor Varnell, of the Royal Veterinary College.—A yearling filly had been observed for some time to have a swelling forming on the left side of its face below the orbit. After a time the breathing became obstructed from the growth of the part inwards, and the animal was sent up to the Veterinary College. Mr. Varnell trephined the bone at the site of the swelling, but without permanent relief, and it being found afterwards that the animal was blind, it was accordingly destroyed. On examining the head after death, the antrum was found to be considerably dilated, and its outer wall greatly hypertrophied. A portion of this wall was sent to the College (University), and I afterwards obtained from Professor Varnell a corresponding portion of healthy bone from the opposite side of the face.
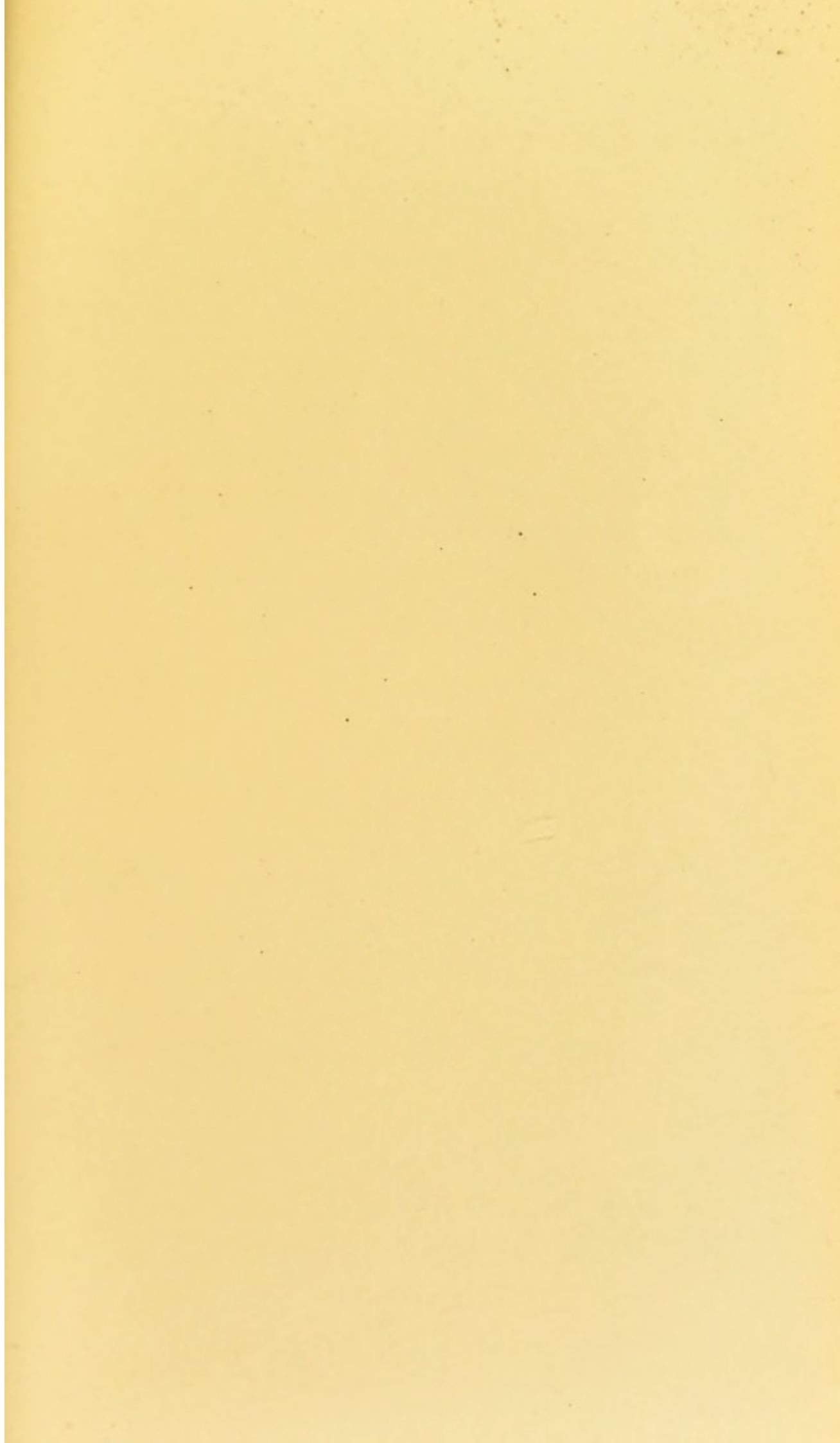
Plate 5.

Fig 1.

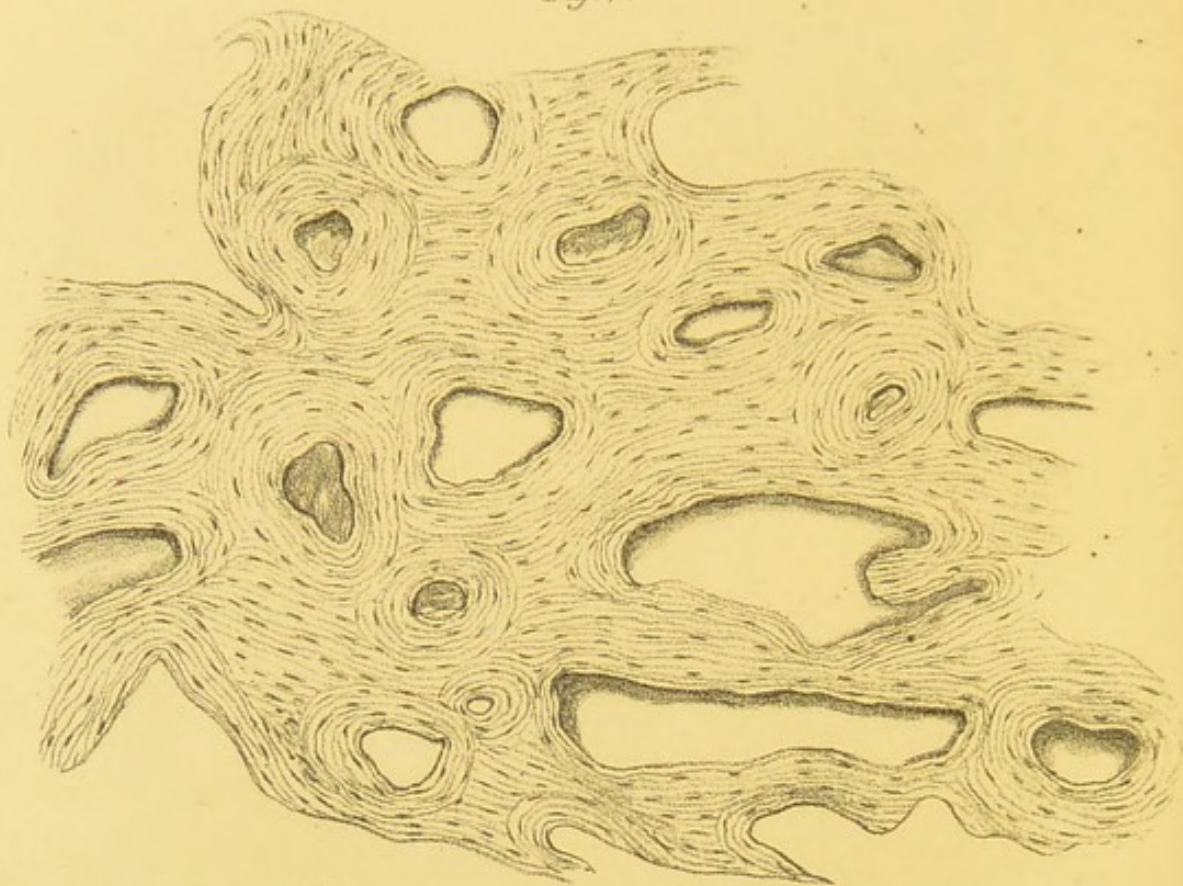Fig. 2.

On comparing the two pieces of bone, the diseased part was seen to be several times its natural thickness; it was also more spongy than natural, especially on its inner surface. Lining the inner surface, was a layer,
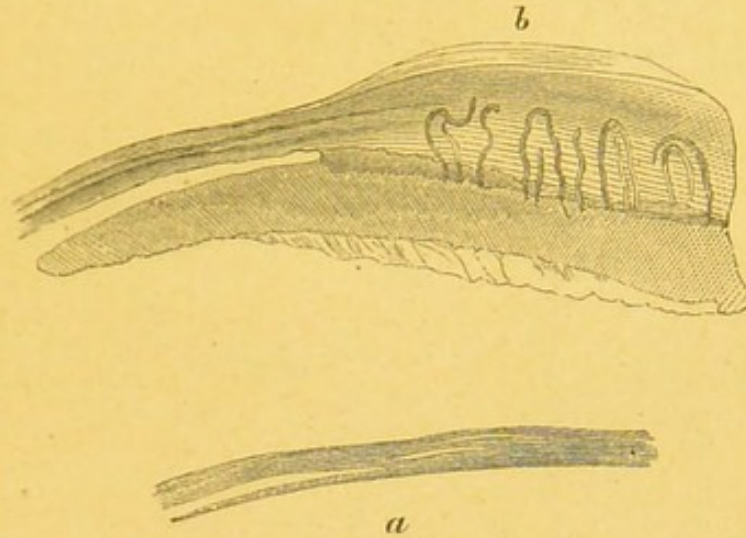
Fig 5. Portions of bone from filly, natural size.
a. Section of outer wall of antrum, healthy.
b.   ,,   ,,   ,,   ,,   diseased.

about $\frac{3}{8}$ in. thick, of a tough material, of the consistence and appearance of scirrhus, which also invaded the substance of the bone for a short depth.

On examination by the microscope, this was found to contain cells of the appearances figured (fig. 6), consisting of "a fibroplastic substance degenerating into scirrhus, or having scirrhus superadded." (Dr. Harley).

Transverse sections of the bone (taken where the disease was less obvious than in many parts) when placed under the microscope (Pl. V.), exhibited a striking similarity to the sections of the humerus in the case of spontaneous fracture: the haversian canals

being enlarged and fused together and converted
into large irregular spaces, occupied by the same
material as that lining the surface of the bone ;
the same kinds of cells being obtained from the bone

Fig. 6. Fibroplastic and scirrhus cells.
a. from tumour. b. from interior of bone. c. from bone at site
of sections figured. d. from portion of "opaque line" men-
tioned ..fter.

at the site of the section as those in the mass itself
(fig. 6. c). The contrast between the healthy and
diseased bone is well seen on comparing Pl. V. fig. 2.
and Pl. VI. fig. 1.

On the confines of that portion of the bone which
was more evidently affected by the disease, were seen
opaque lines shooting out as it were and forming
loops and free ends in the adjoining substance of the
bone (Pl. VI. fig. 2).

Plate 6.

Fig.1.

Fig.2.

a

b
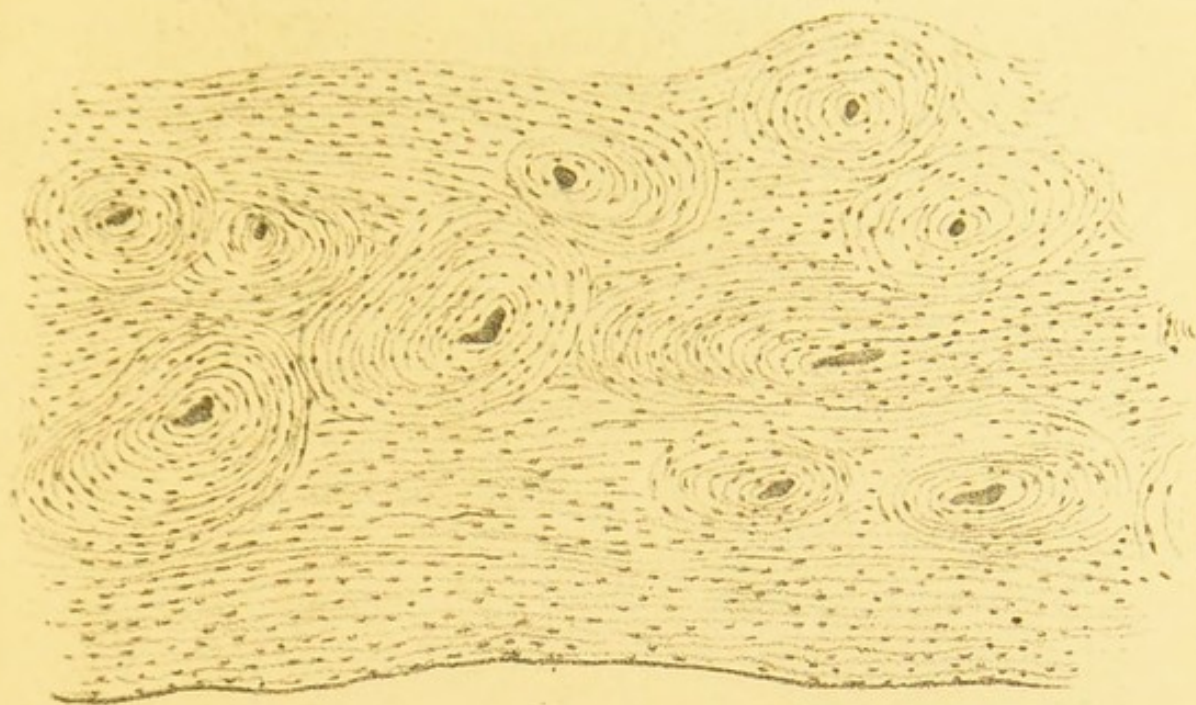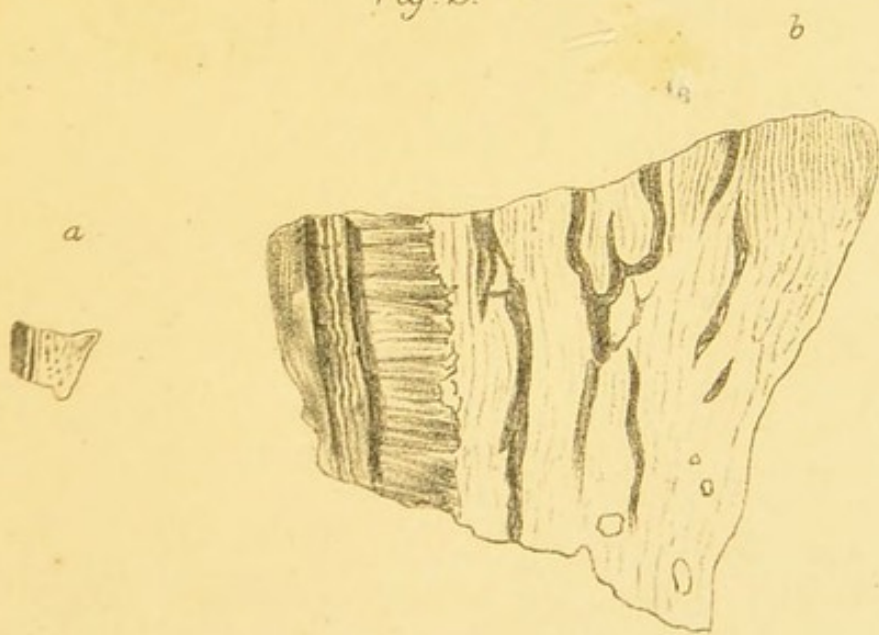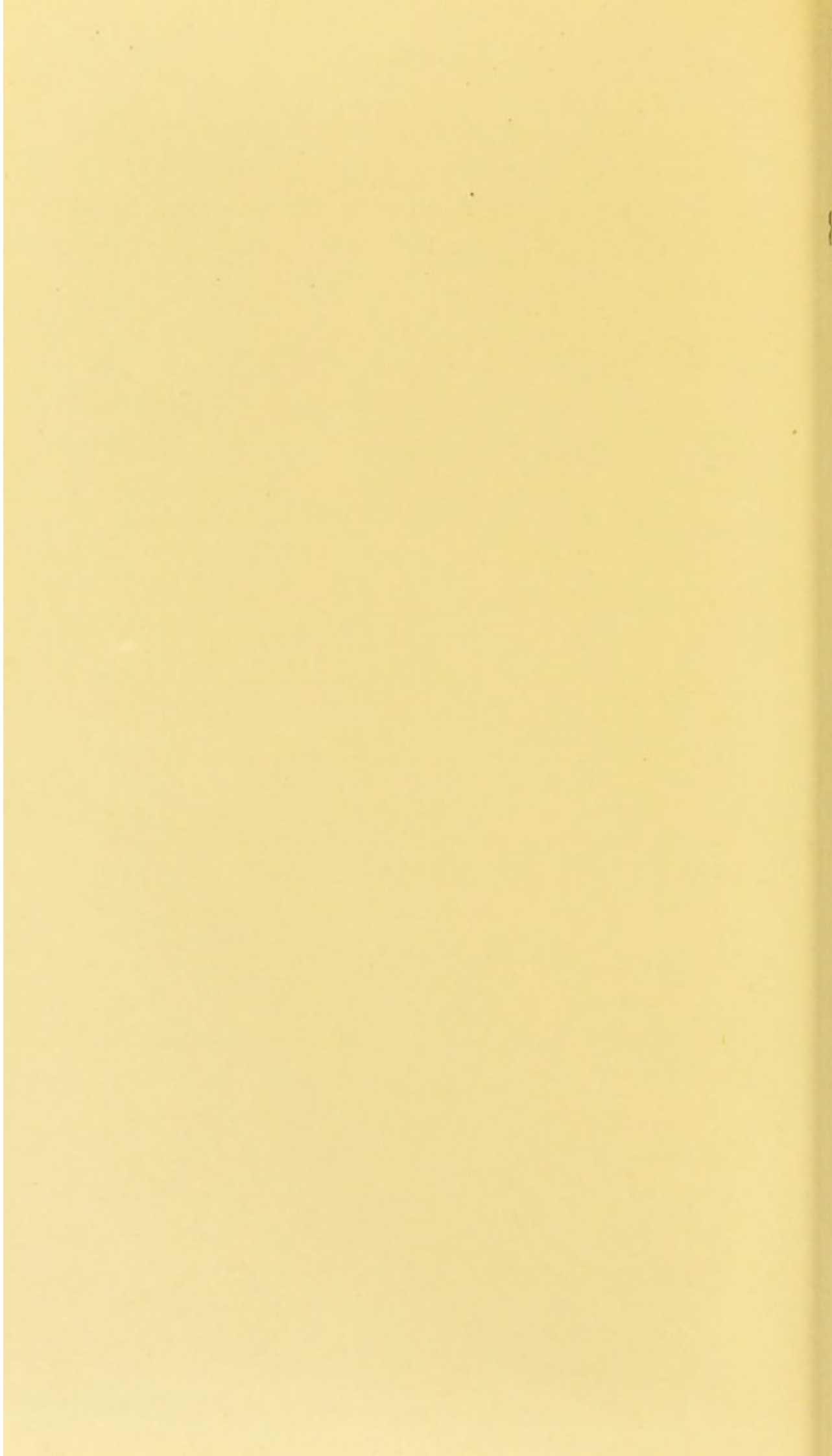
These lines were composed of an exceedingly tough material, and it was difficult to make out their exact relation directly, but on examining this part of the bone with a lens of low power (as seen at *b*) it became evident, from the branches given off from the sides of these, and from the existence of several intermediate forms between them and the proper haversian canals, that these were the haversian canals, or rather the large irregular channels into which they had been converted, filled with the scirrhus material.

This case thus affords a strong corroboration (and which is, I think, rendered the stronger from its being a different variety of the disease, and occurring in a different class of animal) of some of the results obtained from the last, and more especially of the connection of the disease with the haversian canals.

PRIMARY ENCEPHALOID OF THE PERIOSTEUM — SCIATIC HERNIA.

Cancerous disease originating in the periosteum would appear to be sufficiently uncommon, in that since it was described by Sir Astley Cooper under the title of 'Fungous Periosteal Exostosis,' it has been generally overlooked. Stanley, in his treatise on diseases of the bones, mentions cases of "Malignant Disease of the Periosteum;" but these were evidently of an epithelial character, and he does not appear to have noticed true cancer originating in this structure. The following case, however (and one having a remarkable similarity to it is recorded in the 'Pathological Transactions'*), affords a good example of encephaloid disease of the periosteum :†—

Emma T., æt. 18, single, admitted to University College Hospital, under the care of Mr. Quain, October 22, 1859. Has generally enjoyed good health, but has been losing flesh and

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* Vol. v. p. 247.

† Cancer of the scirrhous variety originating in this situation appears to be still more rare. A case is recorded by Cruvielhier (Anat. Pathol. Liv. 20, Pl. 1), in which the periosteum surrounding the clavicle was thus affected, the bone itself remaining sound, being merely corroded superficially.

strength during the last six months. Two months ago began to have some pain in moving the right leg, and six weeks ago found she had a small lump on the outer side of the right hip. Other members of family are in good health.

Present state.—There is an enlargement, about the size of half a cricket-ball, on the dorsum of the right ilium, at the upper and back part, extending upwards to the crest, forwards half way towards the anterior spine and downwards as far as the sciatic foramen; it is very hard, smooth, immoveable, and not discoloured over the surface. The girl complains of an aching pain in it, which is worse at night; she also suffers from pain down the back of the thigh, the leg and the foot; the toes on that side feel numbed. There is no enlargement above the iliac crest nor in the iliac fossa. She is thin, pale, with little appetite; can only walk with great difficulty and by considerable assistance; tongue pale, pulse good. Ordered—leeches to tumour; and a mixture containing Pot. Iod. and Inf. Gent.

Nov. 11.—Has been entirely confined to bed last three weeks; has had much pain in the tumour and down the right leg, the numbness in which is still more marked, and the sensibility much diminished, pinching, &c. being hardly felt. Has only been able to obtain sleep by means of draughts of Tr. Opii. But little appetite; flesh much wasted.

Nov. 22.—For several days has required to have the urine drawn off by the catheter; to-day she passes it naturally.

Dec. 10.—Urine now constantly dribbles away, there is no retention. Pulse very weak and small—126. She is unable to move the right leg without the assistance of her hands, nor can she move her toes on this side. The tumour seems diminished in fulness towards the lower and anterior part, but the upper and posterior part is firmer.

Dec. 19.—Bowels act after enemata, otherwise have not acted for a week. "Pins-and-needles" sensations in foot and toes. She now takes ¾ gr. of Morphia every night.

Dec. 27.—Tumour is harder and more prominent, its base is more extensive. A small swelling was observed yesterday upon

the posterior part of the *left* ilium, but to-day this is not to be detected.

Jan. 1.—The swelling is again apparent on the left side; it is about two inches in length by one inch broad, is situated by the side of the sacrum, apparently just over the sacrosciatic notch; it is tender to the touch, not very prominent, hard and non-elastic to the feel.

Jan. 2.—The swelling on the left side has again disappeared.

Jan. 3.—The swelling again apparent in the morning, disappeared in the afternoon. Patient sleeps very badly, is greatly wasted, and very weak.

Jan. 9.—Much pain in back and both limbs. Right thigh, leg, and foot œdematous. P. 134.

Jan. 13.—Patient has had a slight cough and pain in the chest for last two days. Right leg still swollen.

Jan. 24.—Patient gradually getting worse; pain more severe, emaciation great.

Jan. 31.—Some difficulty in breathing last few days.

Feb. 3.—Patient evidently sinking fast; breathing much affected.

Feb. 5.—Death at 5 a. m.

Post-mortem, Feb. 7.—Body extremely emaciated, right thigh and leg swollen and œdematous.

Lungs, covered with masses of cancer from a pea to a walnut in size, and on section appear to have their proper substance almost replaced by cancerous deposit; under the parietal pleura covering the ribs and diaphragm, are also large masses of cancer.

Left supra-renal capsule contains encephaloid matter.

On the back of right ilium is a subcutaneous swelling, oval, 6 in. by 4½ in.; it is softer than during life. On dissecting the skin from the gluteal region, the gluteal muscles, the latissimus dorsi, and the sacrolumbalis are found to be infiltrated with disease, and on removing these a mass is found occupying the outer surface of the ilium extending up to the crest, backwards over part of the sacrum, and passing into the pelvis through the sacrosciatic notch; this is throughout adherent to the surface of

the bone, and the latter being softened, parts of it are torn away on removing the tumour; the bone is much thinned, and at one spot quite eaten away. On opening the abdomen, and removing the pelvic viscera, the right iliac fossa is seen to be occupied by a large mass of the diseased product lying beneath the iliac muscle and vessels, continuing on to the front of the sacrum, and downwards through the sciatic notch to join the mass on the exterior; on removing this the bone is left bare, rough and softened, and perforated at some points. These masses on section are soft and white, and yield an abundant milky juice, being evidently of an encephaloid character.

On tracing the mass in the pelvis below the iliac vessels, it is found to have connected itself with the iliac vein; on opening this it is filled to a length of four inches by cancerous deposit, the remainder of the vein being occupied by a firm blood-clot; in the opposite direction cancerous matter is found running up into the vena cava, but loosely in a sort of pulp of mixed coagula and cancer; the arteries are quite unaffected.

The glands of the pelvis are unaffected by cancer, being of natural size and of a pink colour.

On making an incision on the left side of the pelvis, in order to ascertain the nature of the vanishing tumour observed there during life, fæcal matter is brought into view almost immediately below the skin, and it is found that a portion of the sigmoid flexure occupies the sciatic foramen, and on slight pressure from the interior of the pelvis may be made to protrude, forming a tumour having all the characters of that observed during life.

The disease in this instance appears to have commenced in the periosteum, on the external surface of the ilium, and to have travelled rapidly along it, advancing upwards till stopped by the firm attachment of this membrane at the epiphysis, and extending in the opposite direction to the sciatic notch,

round this to the front of the bone, and across the sacrum; covering thus a large superficial extent of the bone, but not passing deeply into it. On the mass being stripped off from the bones, which was done with ease, the surfaces of the sacrum and ilium were left bare and rough, but did not otherwise appear diseased; the ilium, where covered on both sides by the tumour, was thinned, the thinning being greatest in the centre, and the bone gradually acquiring its proper thickness towards the circumference of the tumour. In some parts the bone was completely eaten through, but even here, though the masses on each side came in contact with one another, they were perfectly distinct, separating with ease and showing no sign of union : it was evident that the loss of substance by the bone was due entirely to absorption from pressure, and not to the internal development of cancer. That this was the case, and that the disease primarily affected the periosteum, is corroborated by the fact that, when the bone in the immediate vicinity of the tumour was examined microscopically (both by Dr. Harley and myself), no cancer cells were found in it.

There was nothing particularly remarkable in the progress of this as a case of carcinomatous disease, but several of the peculiarities in the pathology of cancer were exhibited in a marked manner. One of the most common modes of extension of cancerous disease, that by implication of the lymphatic vessels and glands, was here absent; but the transmission of

the morbid product directly through the blood was so evident, that this case in itself would be a sufficient proof of that method of its extension—cancer substance itself being found mixed up with the blood in the vena cava, and its transmission to the lungs being shown by the enormous development of cancer in these, whilst the other viscera were free from it.

The slightness of the symptoms produced by this accumulation in the lungs, almost replacing as it did their proper structure, and the lateness with which even these appeared—only three weeks before death, though the disease must have made considerable progress for some time before this—are very remarkable, although not uncommon, in the history of cancer. (A case of *primary* cancer of the lungs running a completely latent course, taken from my own notes, will be found in the last edition of 'Walshe on Diseases of the Lungs.')

The freedom of the arteries from disease, when the contiguous veins are very much implicated in it, has been not unfrequently noticed; in this case, from the way in which the vein was occluded, it might have been expected that œdema of the limb on that side would have been early and have become extreme; but on the contrary it did not come on till late, and was never very marked.

The peculiar vanishing tumour on the left side of the pelvis was rather a puzzle during the life of the patient, simply from the fact of a sciatic hernia, which it proved to be at the post-mortem, not presenting

itself to the mind. As showing an example of this rare form of displacement—a result perhaps one of the least likely to be expected of cancerous disease—the case becomes peculiarly interesting, although, unfortunately, from the accompanying circumstances, little or no practical benefit can be derived.

Here was a small but evident tumour situated over the left sacrosciatic foramen, somewhat hard to the feel, rather tender on pressure, not altering in its characters under manipulation, producing no symptoms (the constipation that existed having preceded it by some weeks), and disappearing after a certain time, to re-appear and vanish in the same manner—under what influence could not be ascertained. At the autopsy it was proved distinctly that the tumour had consisted of displaced intestine.

In the few cases of this kind on record, either no external swelling at all has been perceived, or else the intestine has been contained in a large pendulous bag. Thus it is stated by Scarpa :*—" It has been rarely observed before death, so that it is difficult to give any account of the diagnostic symptoms ; this may arise perhaps from the great thickness of the gluteus muscle preventing the tumour being felt. Verdier mentions a case where the tumour extended from the anus to the middle of the leg ; after death it was discovered to be a hernia, containing not only a portion of omentum, jejunum, ilium, and mesentery,

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* Treatise on Hernia, translated by Wishhart.

but also the cæcum, the lower part of the colon, and part of the rectum. These parts had passed out by one of the sciatic notches, sliding over the sacro-sciatic ligaments; the stomach occupied the middle of the abdomen, it was situated longitudinally, and the duodenum approached towards the orifice of the hernial sac." Lawrence also says:*—" Since the sac is covered at this point (the sciatic foramen) by the gluteus maximus, it could not be perceptible exter-nally until it had acquired a considerable size; and the resistance of the muscle would probably oppose its increase. Hence we do not find that it has ever been recognised in the living subject."

The case mentioned by Monro† as having occurred to his father must, from the slight description he gives of it, be regarded as very doubtful.

In that mentioned by Sir Astley Cooper,‡ of fatal strangulation of a sciatic hernia, no external tumour appears to have been observed, though it was no doubt looked for, as all the symptoms were present and a hernia was suspected.

In this case the hernia was predisposed to by several concurring causes. The diseased mass in the pelvis greatly contracted its area, and constantly growing from the right side and above, and ex-tending downwards and to the left, it tended to press the viscera of the pelvis in that direction. By the

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* On Hernia, p. 621.

† Morbid Anatomy of Human Gullet, &c., Alex. Monro Jun. p. 380.

‡ Anat. and Surg. treatment of Abd. Hernia. Part 2.

encroachment of the disease the sacral nerves, both spinal and sympathetic, were interfered with, and the lower part of the bowel was completely paralysed (so that the fæces were retained for some time before death); but as the upper part of the intestine and the abdominal muscles retained their power, the only result of any effort at defæcation was to exert a lateral pressure on the walls of the pelvis through the intestine contained in it; and this part of the intestine was the more ready to yield to this pressure, inasmuch as it was very loosely attached by means of a long mesorectum and mesocolon.

The sciatic foramen too was rendered more lax, and ready to give way to any pressure, from the general wasting of all the structures, especially the muscular, passing through it, both from inaction, and from the atrophy consequent on the particular cachexy: for the same reason, the structures outside the pelvic cavity, thinned and wasted as they were, had little or no power in controlling the production or increase of the hernia, or in preventing its being perceptible externally, as is usually effected by the gluteus maximus.

Here the opening was so free, there was such an absence of any attempt at constriction, that the hernia seems to have been both produced and returned by the general movements of the body, and it was not precisely determined what particular event caused either its descent or its disappearance.

The impression given by the swelling to the fingers, owing to its being filled with fæciform material, was so like that given by the cancerous mass on the opposite side, as to cause it at first to be thought of the same nature: had it been only partially filled with air, its true nature would doubtless have been at once detected.

That a more careful examination of the opening, the sac, &c., was not made at the post-mortem, is to be regretted, but perhaps the less so, as, from the circumstances to which the hernia owed its origin, and the nature of the accompanying disease, it could not be taken as a precedent in any case where active interference would be called for.