A dissertation on osteo-arthritis / by W.H. Russell Forsbrook.

To W. H. Allchin Esqre M.D.

With the Author's Kindest Regards.

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OSTEO-ARTHRITIS

A

DISSERTATION

ON

OSTEO-ARTHRITIS

BY

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TO

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THIS SMALL WORK IS

Dedicated

WITH MUCH GRATITUDE FOR MANY KINDNESSES

BY HIS FORMER PUPIL

THE AUTHOR.

PREFACE.

THE following pages were originally written as a Thesis for the Degree of Doctor of Medicine of the University of London.

Slight additions and alterations have since been made, in order to bring the subject up to date, but the author sees no reason to alter his opinions.

He now publishes the work in the hope that others with more leisure and opportunity may further develop the pathology.

The author particularly wishes to tender his best thanks to Mr. H. M. Duncan for his kindness in perusing the revised sheets and in preparing the index.

Buckingham Palace Road, S.W.
December, 1892.

CONTENTS.

INTRODUCTION.

I HAVE attempted in this dissertation to faithfully record all that I have been able to gather of the history of this condition, and to show, by reference to settled truths, how the various contradictory opinions may become more or less harmonized, and the pathology of the malady explained.

With regard to the latter, I beg to observe that the view I have ventured to take can be but a theory, for the present at least, although proof is not wanting in the cases I have examined. Still, I quite recognise that very many more cases will have to answer the test before we can speak absolutely of its being proved.

How far my conclusions will be confirmed by future investigators time alone can tell. I shall feel quite satisfied, if the hypothesis seem feasible, to have made some slight addition towards the elucidation of the pathology of this disease.

I must apologize for all shortcomings in the following pages. The only excuse I am able to offer for such is, that, although working on the subject of this disease for the past two years, I have unavoidably been compelled to hurriedly piece it together during the last two months. I have profited by the labours of many of the writers on this affection, and to

the best of my belief have consistently avowed the source and degree of my debt.

If on some points I have ventured to disagree with authorities, whose opinion and experience I greatly respect, I have endeavoured to give my reason for so doing.

I have been guided in my choice of the term osteo-arthritis from its inclusion in the nomenclature of the Royal College of Physicians, not but that I would agree with those who consider arthritis deformans as the more appropriate name ; for I fail to see why the adoption of this term should not be permissible, even if we look upon the inflammatory changes in the joints as only secondary to degenerative ones. It is greatly to be regretted that so many different terms have been made use of for one and the same condition, the following being the most important synonyms :—

Goutte asthénique primitive (Landré Beauvais). Chronical Rheumatism ; Digitorum Nodi (Heberden). Nodosity of Joints (Haygarth). Usure des cartilages articulaires (Cruveilhier). Chronic Rheumatism of the Joints (Todd). Rheumatic Gout (Fuller). Chronic Rheumatic Arthritis (Adams and Duckworth). Rheumatoid Arthritis (Garrod). Osteo - arthritis (Spender). Rhumatisme chronique primitif (Charcot and Vidal). Rhumatisme noueux (Trousseau and Mathieu). Arthritis Deformans (Virchow and Senator). Arthrite Sèche (Deville and Broca).

September, 1891.

OSTEO-ARTHRITIS.

CHAPTER I.

History.

It is now nearly a century since osteo-arthritis was described as an independent malady, as distinct from gout or rheumatism, and it seems remarkable that a condition, so manifest in its fully developed state, should have remained so long undifferentiated; more especially when we consider its antiquity as evidenced by its marks left upon bones collected in Gurot, a town in Lower Egypt, by Mr. Flinders Petrie,[1] and having an approximate date, B.C. 1300, and also upon Egyptian bones of the Ptolemaic period collected by Eve.[2] Again, signs of it were detected by Della Chiaje[3] in bones dug up from among the ruins of Pompeii, and in bones from the catacombs of Paris by Lebert.[4]

The same changes were also seen in skeletons obtained from the graveyard of the ancient

[1] Museum, Royal College of Surgeons, 1891.
[2] "Brit. Med. Jour.," 1890, i., p. 423.
[3] "Arthritis deformans from Pompeii," ii., 555.
[4] "Handbuch der Pract. Med.," 1859, ii., p. 874.

convent of Marienthon in Pomerania (Virchow);[1] also in a skeleton found in a Roman sarcophagus in Smithfield by Dr. Norman Moore;[2] and lastly, the skeleton of the Norse Viking found buried in his warship in the neighbourhood of Christiana Fjord showed unmistakable evidence of this disease.

Sydenham,[3] in 1683, mentioned the condition as a modification of rheumatism. He spoke of the tortures experienced by patients improperly treated; of its recurring paroxysms, like gout; and of the general crippling and nodosity of the joints of the fingers caused by it. The subject was also referred to by Musgrave[4] in 1703, by Haller[5] in 1764, and by De Sauvages[6] in 1768; and John Hunter was well acquainted with its anatomical characters, but it was not till 1800 that the distinctive features of osteo-arthritis were first recognised. In that year Landré Beauvais,[7] to whom Dr. A. E. Garrod assigns the post of honour as having been the first to differentiate this affection under the name of "goutte asthénique primitive," published his thesis in which he showed that of two classes of cases which

1 "Archiv.," 1869, xlvii., p. 298.
2 "Path. Soc. Trans.," 1883, xxxiv., p. 226.
3 "Opera," Sec. vi., cap. v.
4 "De Arthritide Symptomatica," p. 24.
5 "Elementa Physiologica," vi., p. 9.
6 "Nosolgia Methodica," class vii., ordo i.
7 "Thèse de Paris."

were at that time looked upon as gout, one of them possessed a clinical history and a morbid anatomy of its own, and in this class he included cases of osteo-arthritis under the above name. Unfortunately, he also included cases of true gout, and cases of which the nature is obscure. By thus embracing under the same term several different conditions he very much weakens his conclusions, as is pointed out by Dr. A. E. Garrod, who also states that this inclusion of gouty cases is not surprising when it is remembered that rheumatism was not considered as a true joint affection in France at the time of Landré Beauvais. Beauvais himself speaks of rheumatism as attacking the middle of the limbs and having its seat in the muscles, whereas, in England, no such opinion as to rheumatism ever prevailed:—cases of osteo-arthritis being included under the name of rheumatism, and it was from this disease that discrimination had to be made. Four years later, 1804-16, Heberden in his commentaries gave a clear clinical sketch of osteo-arthritis, and thought it should have a distinctive name. He says:[1]—"The disease called chronical rheumatism, which often passes under the general name of rheumatism and is sometimes supposed to be the gout, is in reality a very different distemper from the genuine gout and from the acute

[1] Appendix, p. 414.

rheumatism, and ought to be carefully distinguished from both," and he added,[1] in describing its symptoms, that there was little or no fever, no redness of the skin, no great pain, but swelling of the affected part; that the disease was not particularly apt to begin in the foot, but if so, it soon left it and attacked other parts of the limbs, several of which, one after the other, became the seat of the distemper in the very first fit. That it was very crippling, and that one attack caused more weakness of the limbs than would have been produced by gout in many years. That the general health was affected, and that cramps were common; that the swellings which it occasioned were often remarkably great, and that some degree of them would continue for many years, or for the patient's life, particularly in the wrists and sometimes in the fingers and ankles. He also described the nodes on the terminal phalanges of the fingers, which have ever since been known as Heberden's nodes.[2] In 1805, Haygarth, of Bath, published his classical essay on the clinical features of the disease, in which he said there had been a want of discrimination in the application of the term rheumatism, and he distinguished osteo-arthritis from both gout and rheumatism and suggested the term "nodosity of joints,"

[1] *Ibid*, p. 416.

[2] Ch. xxviii., "Digitorum Nodi."

probably from the hard swellings which he had noticed around the smaller joints, particularly those of the fingers.[1] He goes on to say:—"A case happened to occur to my observation at a very early period, which, compared with others at subsequent times, convinced me that there is one painful and troublesome disease of the joints of a peculiar nature and clearly distinguishable from all others by symptoms manifestly different from the gout and from both acute and chronic rheumatism." In his series of thirty-four cases he adds[2]:—"I find two where the knees only were attacked; in all or nearly all the rest, the hands, chiefly the fingers, were affected. These diseased joints generally suffer pain especially at night, but in a less degree than might be expected from such a considerable morbid change. They feel sore to the touch. In one case the patient was attacked with severe spasmodic pains. As the disease increases the joint becomes distorted, and probably in bad inveterate cases even dislocated, and its motions become gradually more impaired. In a few patients a crackling noise was perceived in the joints when in motion, particularly the neck. The skin seldom or never appears inflamed. The nodes appear most nearly to resemble gout."

[1] "Rheumatic Gout," Adams, 1873, p. 2-305.

[2] "On Nodosity of the Joints, Clinical History of Diseases," 1805.

From his own table he calculated that he had met with the condition once in every 310 patients. In his opinion women were especially liable to the affection, and in them many joints became involved. He had only met with one case in a man, although he had studied the disease for twenty-six years, and that he considered due to injury. He added that, this disease did not affect the muscles, and that he had described the complaint in a paper written many years previously but never published. With regard to his remark that the disease did not affect the muscles, we may suppose that he intended to convey the notion that it did not primarily do so, for he cannot but have noticed the wasting of the muscles about the joints in all his well-marked cases.

From 1805 to the time of Cruveilhier, 1829-1840, there seems to have been a blank so far as any increase in clinical knowledge of this disease is concerned, for although Monsieur Chomel[1] wrote in 1813, he only alluded in an indefinite manner to the condition pointed out by Landré Beauvais, and was of opinion himself that the malady in question was rheumatism. Scudamore,[2] 1827, whilst referring to Haygarth's views on the nodosity of joints, said, that he had rarely seen the affection he depicted except as an effect produced by gout or rheumatism.

1 "Dissertations sur le Rhumatisme."

2 "On Rheumatism," p. 487.

It was not till Cruveilhier drew special attention to the necessity of studying its clinical features in the living being, with its anatomical characters in the dead, that any advance was made. He says[1]:—"This disease for a long time has been attended to so far as relates to its anatomical character," and, he added, that the time had arrived when it should claim the attention of the clinical physician, that its symptoms and treatment should get more consideration, and that it should take rank among the maladies of the articulations. He gave the name "Usure des cartilages articulaires" to this affection, and, like Haygarth, called attention to the crackling both heard and felt in the joints on movement, and was the first to show that true bony anchylosis was quite an exception. Sir Benjamin Brodie, who in 1833-50 published his works on diseases of the joints, called the disease rheumatic gout, and thought it had a certain relation to gout and rheumatism, but that it presented characteristic symptoms distinct from both. He said that according to his experience it would be found most in those who had led luxurious lives and had not been accustomed to much bodily exercise, and that excess in animal food was more likely to cause it than excess of alcohol; judging too, from the external appearance of the affected joints,

[1] "Anatomie Pathologique," Livraison ix., p. 10, xxxiv.

he was led to believe that bony anchylosis sometimes occurred.

Cruveilhier's contemporaries in the investigations of its morbid anatomy were Lobstein,[1] 1833, Deville,[2] 1848, and Broca,[3] 1850, in France; Aston Key,[4] 1833, Robert Smith,[5] 1835, who pointed out that many cases of injury to the hip joint resulting from accident were of the nature of osteo-arthritis in a localised form, Canton,[6] 1848, who described the changes which occur in the shoulder joint, and R. Adams,[7] 1857-73, in the United Kingdom. To Adams we are indebted for a valuable monograph on the subject, in which he has contributed greatly to the study of the morbid anatomy of this disease, also for an atlas containing beautiful illustrations of the changes produced in the joints:—according to him,[8] Edvardus Sandifort, of Leyden, in his Museum Anatomicum, 1793, was the earliest observer of the disease in the hip as found in the dead. Adams also showed from numerous dissections the identity of the changes of hip disease in elderly people with those which marked the joint lesions of the

1 "Anatomie Pathologique," ii., p. 348.
2 "Bull. de la Soc. Anatom.," xxii, p. 272; xxiii., p. 141.
3 "Bull. de la Soc. Anatom.," xxv., p. 435.
4 "Med. Chir. Trans.," xviii., p. 208.
5 "Dublin Jour. Med. Science," vi., p. 208.
6 "London Med. Gaz.," N.S., vi. p. 410.
7 "On Chronic Rheumatic Arthritis."
8 *Ibid.*, p. 46.

poly-arthritic variety of this disease, and he confirmed Cruveilhier's views on true anchylosis.

He denominated the disease chronic rheumatic arthritis or "rheumatic gout," and looked upon it as both a constitutional and a local affection. He thought the poly-arthritic form was in the majority of cases preceded by acute rheumatism, and proved that the monarticular variety often occurred after injury to a joint. Before Adams and his contemporaries the symptoms were referred to fractures. He described also, besides the foreign bodies found in the joints and known since the time of Ambrose Paré, others to which he gave the name of additamentary bones, and Todd,[1] 1843, speaking of the name given to this disease by Adams, (chronic rheumatic arthritis) prefered the term chronic rheumatism of the joints, although he considered the phenomena the disease presents due rather to irritation than to chronic inflammation. In 1852-60, Fuller in his work on rheumatism devotes a separate chapter to this disease which he commences as follows[2]:—"Closely allied to rheumatism, yet presenting some of the features of gout, is that obstinate, painful and distressing malady which is known under the title of 'rheumatic gout,'" and he adds in

[1] "On Gout and Rheumatism."
[2] Page 332.

a note: "Rheumatic gout is not a mere variety of gout or of rheumatism, nor is it a compound of the two diseases; it is essentially distinct from them both, has a special pathology of its own, and requires a distinctive title." He pointed out that in the frequency of its attacks, in the increased severity of each recurrence, in the obstinacy of its symptoms, in its invasion of the small joints in preference to the large, and in never involving the heart or its membranes, it was unlike rheumatism:—that it differed from gout in the fact that it might occur at any age, attacking the weakly and slender, and women more frequently than men, and several joints simultaneously, and in not generally having dyspeptic symptoms as a concomitant. Adams and Fuller, as already stated, clearly distinguished it from both gout and rheumatism, and mantained that neither the heart nor its membranes were involved in this disease as in true rheumatism. In 1853 appeared the thesis of MM. Charcot and Trastour,[1] which revolutionised the then conceived notion as to the nature of osteo-arthritis. Each of these eminent observers considered it as only a form of chronic rheumatism, thus actually reverting to the views of Sydenham, 1683, and this view is even now held in France and mantained in the latter writings of Charcot, as well as in the

1 "Thèse de Paris."

works of Besnier,[1] Homolle,[2] Lacaze-Dori,[3] and Mathieu;[4] whereas, in this country and Germany, on the other hand, the views of Heberden and Haygarth that osteo-arthritis is a disease distinct from gout and rheumatism have been maintained by the majority of writers on the subject.

In the years 1862, 1863, 1876, appeared respectively the three editions of the valuable work of Sir Alfred Garrod on the subject, and in his last edition he designated it by the name "rheumatoid arthritis," which he considered more appropiate than rheumatic gout. He says:—"The disease sometimes received its name according to the part involved—rheumatic gout, when the hands, wrist, and feet were attacked; chronic rheumatism, when occurring in the shoulder, elbow or knee; and morbus coxæ senilis when located in the hip-joint."

He classed the affection under three forms, namely, acute, chronic and irregular; and the chronic form he divided into general and local. He carefully distinguished the disease from both gout and rheumatism, and showed that it was unlike gout in there being no excess of uric acid in the blood, and unlike rheumatism in the heart not being involved.

[1] "Dict. Encylop. des Sciences Méd., Art. 'Rhumatisme'," 1876.
[2] "Dict. de Méd. et Chir. Prat., Art. 'Rhumatisme'," 1882.
[3] "Thèse de Paris," 1882.
[4] "Thèse de Paris," 1884.

Since Adams, Garrod, and Fuller wrote, the subject has been still further investigated by Senator, Jonathan Hutchinson, Dr. Ord, Sir Dyce Duckworth, Arbuthnot Lane, Dr. Spender, Dr. A. E. Garrod, and Messrs. Lane and Griffiths, and their investigations have brought about very great changes in the concensus of opinion as to the pathology of osteo-arthritis. Senator,[1] 1875-79, who described the disease under the term "arthritis deformans," was of opinion that it was a true constitutional malady. Jonathan Hutchinson,[2] 1880-84, looked upon the affection as arising out of the blending of the elements of gout and rheumatism, sometimes one element and sometimes another being in excess.

Sir Dyce Duckworth,[3] 1884-86, called it "chronic rheumatic arthritis," and looked upon it as a form of true rheumatism. Arbuthnot Lane,[4] 1884-86, maintained that osteo-arthritis was not a disease *per se*, and that the changes found in the joints were due simply to wear and tear. Dr. Ord,[5] 1885, considered the disease of reflex nervous origin. Spender,[6] 1888-89, described the malady under the term "osteo-arthritis," and pointed out some early

[1] Ziemssen's "Handbuch," 1875, 2nd edit., 1879, xiii, Hälfte i.
[2] "Pedigree of Disease," 1884, p. 126.
[3] Heath's "Dict. Pract. Surg.," 1886, i., p. 293.
[4] "Path. Soc. Trans.," 1884, xxxv., p. 299; 1886, xxxvi., p. 387.
[5] "Brit. Med. Jour.," 1884, ii., p. 268.
[6] "Osteo-arthritis," 1889.

nerve symptoms not before noticed. Dr. A. E. Garrod,[1] 1890, wrote a very valuable treatise on the subject and denominated it "rheumatoid arthritis." Messrs. Lane and Griffiths[2] in their work published 1890, divided this disease into rheumatoid arthritis, chronic rheumatic arthritis and osteo-arthritis; they considered the last a late stage of rheumatoid arthritis, and affirmed that there was no justification for the term in the comparatively early stages. To those cases only which had been preceded by distinct rheumatism, they assigned the term chronic rheumatic arthritis.

1 "Treatise on Rheumatism and Rheumatoid Arthritis."
2 "The Rheumatic Diseases, so-called."

CHAPTER II.

Ætiology.

If a generalisation were permissible from the study of the blood in a few instances of this affection, I would venture the opinion that the most important causative and constant factor immediately preceding the onset of osteo-arthritis is a condition of anæmia (not generally so marked as to be readily recognised in the face or buccal mucous membrane, although the conjunctivæ of the eyelids almost invariably exhibit it in some degree), which can easily be confirmed and its amount estimated by an examination of the blood. Real anæmia can be present even to the extent of the reduction of red corpuscles to 60 per cent., whilst the face is well coloured.[1] I have prefaced the discussion of causation by this statement, because on it are based my views on the much vexed question of the pathology of this disease.

Constitutional Condition.—A great deal has been argued for and against the constitutional nature of this disease, but I am of opinion that if all the circumstances under which it occurs be taken into consideration, there will

[1] "Lancet," 1891, i., p. 244.

be little hesitation at the present day in allowing it to rank among constitutional maladies. It might be said that it is easier to accept this so far as the generalised form is concerned, but less easy in the case of the local variety. However, a little consideration will show that in a large number of cases the disease is local only at the beginning, and that afterwards it becomes general; clearly indicating that the same agent in the system is at work in both cases. Again, it seems to me to be a constitutional malady of a very peculiar nature; the effect it produces is neither that of ordinary inflammation alone, nor of malnutrition alone, but of both combined.

Almost all observers agree that in the majority of individuals attacked with osteo-arthritis, there is a lowered condition of the system, that the subjects of it are rather below than above average health, and with this, so far as my own observations go, I most strongly concur. In some of the cases I have seen there have been family histories of nerve disorders, such as neuralgia and migraine, and in others an inherited tendency to gout and rheumatism. In writing of the most chronic form, Hutchinson says[1]:—"There is always joined with it an inherited tendency to gout."

[1] "Pedigree of Disease," p. 121.

Several writers have shown that this disease is very prone to affect the children of phthisical patients, and Lane and Griffiths[1] note that there is a taint of phthisis and gout combined in the family history of many of their cases.

Is not the connection between this disease and the tubercular diathesis probably due to the fact, in some cases at least, that these children have been born of parents, one of whom has suffered from arthritic disease and the other from phthisis, so rendering their offspring much more susceptible to the condition of body necessary for the manifestation of osteo-arthritis? Fuller,[2] in summing up this disease, says:—"The extraordinary obstinacy of its symptoms, the peculiar alteration in the structure of the joints, which form its most characteristic feature, and the class of remedies by which it is most successfully combated, all seem to indicate a close connection with some peculiar constitutional taint." Duckworth observes[3]:—"To state that all persons are not predisposed alike, is to affirm the existence in some of a habit of body peculiarly susceptible to the influences which caused it, and that such predisposition in the nature of a diathetic proclivity is found in many individuals."

[1] *Loc. cit.*

[2] *Loc. cit.*, 1860, p. 345.

[3] Heath's "Dict. Surg.," i., p. 293.

Heredity.—Direct inheritance is unquestionably a very powerful factor in this disease, but many difficulties surround investigations of this nature, and in this affection they become especially difficult on account of the confusion of terms, particularly as "rheumatism" and "rheumatic gout" have been applied to it indiscriminately, the latter term having also been given to gout itself. If, however, we are permitted to speak of an indirect inheritance, the matter becomes much more simple. By indirect inheritance, I mean that all individuals prone to this disease have had parents or grandparents, &c., who have suffered from gout or rheumatism, and that these ancestors by careful attention to health and surroundings have so modified the *materies morbi* of gout or rheumatism as to render it inactive in their descendants, but at the same time have transmitted to them the peculiar state of the system out of which an arthritic disease, like osteo-arthritis, can arise on the individual falling into a certain condition of lowered health from various causes. From this time onwards it becomes easy to see that the proclivity to osteo-arthritis may be directly transmitted from generation to generation. I shall refer to this part of my subject again when I come to speak of the pathology of the disease; at present suffice it to say that Hutchinson[1] has pointed out that gout may

[1] "Pedigree of Disease," p. 128.

with care and attention pass over several generations, and then produce sometimes cases of osteo-arthritis. Almost all the cases in which I have been able to trace back the family history for two, or at most three generations, have shown the ancestry as having been affected with some articular disease. The opinion of different writers as to heredity in this disease is worth chronicling.

Heberden himself asks[1]:—"Is it not in some degree hereditary?" and Adams mentioned it as so in some cases.[2] According to Sir Alfred Garrod[3] it is less so than gout, but Fuller said[4] that almost every case that he had seen in early life was either hereditary or else connected with uterine trouble. In an analysis of 45 cases Monsieur Trastour[5] found ten cases (22·2 per cent.) in which the father or mother suffered from rheumatism (rhumatisants) and three of his female patients had infants (déjà frappés) attacked with articular rheumatism. From this it is evident that Monsieur Trastour, and other French writers classed not only those cases as hereditary, in which parents, &c., had suffered from osteo-arthritis, but also those in which the parents had suffered from any form of rheumatism.

1 *Loc. cit.*, Appendix p. 417.
2 *Loc. cit.*
3 "Gout and Rheumatic Gout," 3rd edit., 1876.
4 *Loc. cit.*, Note, p. 335.
5 "Du Rheumatisme," Nouveaux, Paris, 1883.

Monsieur Charcot[1] traced direct heredity in eleven out of forty-one cases (26·84 per cent.), and he related the case of a woman suffering from osteo-arthritis whose daughter and granddaughter were affected in the small joints; and he adds:—"Voila donc, trois générations successivement atteintes de la même affection." Mathieu[2] traced an inheritance in three cases out of eleven which he recorded (27·27 per cent.).

Sir Dyce Duckworth[3] says that heredity counts much more than was formerly believed, and that in most cases there is a clear history of rheumatic ailments in the ancestry of the patients. Dr. A. E. Garrod[4] states that out of 500 cases analysed by him there were family histories in 84 of articular disease, which were probably of this nature, giving a percentage of 16·8; and he adds that no fewer than 216, or 43·2 per cent. of the patients gave histories of articular disease in their families, among which gout held a more prominent place than osteo-arthritis itself. Only 12 (8 per cent.) of the patients gave family histories of rheumatism. In 21 cases which I have analysed I found family histories of osteo-arthritis in 6 (28·59 per cent.), gout in the ancestry of 7 (33·3 per cent.), and rheumatism in 5 (23·8

[1] "Maladies des Vieillards," 2nd edit., p. 223.
[2] "Thèse de Paris," 1884, p. 12.
[3] Heath's "Dictionary of Surgery," p. 293.
[4] *Loc. cit.*, p. 240.

per cent.) ; the histories of articular disease in the remaining 3 cases being doubtful. There was a history of phthisis in the mothers of two of these patients, and the father of the third possibly suffered from gout.

It has been pointed out by many observers, among whom may be mentioned Sir Alfred Garrod and Sir Dyce Duckworth, that the female children of gouty parents are especially liable to osteo-arthritis, and this is certainly borne out by the following case which came under my observation. The patient, whose father suffered from true gout, had three sisters (no brothers), two of whom suffered from osteo-arthritis. This case with others showing the same tendency will be referred to later on.

Frequency.—Of this disorder it is difficult to estimate the frequency. Haygarth calculated that he found it once in every 310 patients—equal to a percentage of 0·32.

Sex.—The influence of sex is noteworthy as being another important factor in causation. Very many more females than males suffer from this affection; whereas, gout is chiefly confined to the male sex, and rheumatism affects the two sexes more or less equally. This susceptibility of women has been recognised from the time of Landré Beauvais. Haygarth[1] observed that the disease was al-

[1] *Loc. cit.*

most peculiar to the female sex, and that out of 34 cases there was only one man, and that in his case it was due to injury. Adams[1] was of opinion that if the joints attacked in each sex were compared, it would be found that there were more men with the hip affected than women, but more women than men with the wrists and hands involved. Senator[2] says much the same; that the cases in which it begins in the hands and feet, and subsequently spreads to the larger joints, almost always occur in women, and that men are more liable to have it in the hip or the shoulder before any other parts are affected. Charcot,[3] Trousseau,[4] and Duckworth,[5] also found that it was more common among women, and Dr. A. E. Garrod,[6] in his 500 cases, met with only 89 men as against 411 women. Of the 21 cases I analysed, only two were men. The special liability of women is probably due to the powerful influence of uterine and ovarian disturbance; there is frequently an aggravation of the symptoms at the menstrual period, and still more so at the menopause, in those predisposed to osteo-arthritis.

Class and Occupation.—This complaint seems to attack persons in every position of life. Heberden said the rich and the poor were

[1] *Loc. cit.*, p. 13. [2] *Loc. cit.* [3] *Loc. cit.*
[4] "Clinical Med.," 1865, Transl. *New Syd. Soc.*
[5] *Loc. cit.* [6] *Loc. cit.*, p. 240.

equally liable to it; whereas, Haygarth thought it attacked persons in the higher and middle rather than the lowest classes of life, and Todd and Adams believed it to be more common among the labouring poor than among the higher classes. Brodie, as I have already observed, considered the sedentary, and those who had lived too generously, as more prone to this disease; but Scudamore looked upon it as the gout of the poor. Senator,[1] too, speaks of the disorder when beginning in a large joint as being seen indifferently in the rich and the poor, and he insists that it is the parts most used that are most likely to be attacked, as, for example, the fingers and wrists of watchmakers, and of women who have been accustomed to work excessively with the needle or at knitting. This overuse of joints, in those predisposed, has been pointed out by others also, among whom may be mentioned Sir Dyce Duckworth. My own cases are drawn chiefly from the upper and middle classes of life, and in some of them I found knitting, &c., had been much indulged in.

Age.—Osteo-arthritis may occur at any age, but according to Sir Alfred Garrod, it is more common before than after forty years. He has met with it, however, at the early age of four years, and as late as seventy years.

1 Ziemssen's "Cyclopædia," xiii., p. 141.

Heberden also mentioned its occurrence in one patient of twelve years and in another over sixty. Haygarth noticed it chiefly at the menopause, and Fuller stated that it might either occur at puberty, in those whose uterine functions were ill-performed, or at the menopause. Lacaze-Dori and Mathieu both wrote theses, the former on the occurrence of the disease in infants, and the latter on its occurrence in young adults (from fifteen to thirty years); but although infants and young adults suffer there is no doubt that the malady is specially prone to manifest itself in the early degenerative period of life. Dr. A. E. Garrod's[1] table shows that in women there is a steady increase in the number of cases in which the disorder commences up to the age of fifty years, but that after that age a rapid fall, the maximum occurring between the ages of forty and fifty. It further points out that there is no such increase in men, and that two maxima occur, one between thirty and thirty-five, and the other between fifty and fifty-five years. In most of my cases the disease commenced before the age of forty.

Habits.—It is not apparently dependent on excess of animal food or alcohol, as is the case in gout, but is more likely to be developed by deprivation, and unwholesome and unnutritious food, as is evidenced by its occurrence in

[1] *Loc. cit.*, p. 240.

Gurot, where the people were presumably vegetarians, and were not known to have had any alcoholic beverages.

Race and Climate.—Osteo-arthritis does not seem to be confined to any particular race. Charcot mentions the case of a negress who suffered from it. Cold and damp climates have always been supposed to be amongst the most potent causes of the disorder. This has been noticed by numerous investigators, among whom are Haygarth, Adams, Garrod, Duckworth, Charcot and Mathieu. Charcot is of opinion that the combined exposure to cold and damp must continue for some time in order to generate this affection. Mathieu considers that besides the combined action of cold and damp, the accompaniment of deprivation, or, as he terms it, "*la misère*," is a very potent cause of this malady in the young.

There is no doubt that it is much more common in Ireland than in England; and Adams[1] pointed out that the specimens in the museums of Holland were more numerous than elsewhere, except in those of Dublin. It is said to be unknown in the polar and equatorial regions, and cold and dry climates appear to have little effect in its production. On the other hand, the fact of its occurrence in Gurot, as shown by the collection of bones already mentioned, where the climate is warm

[1] *Loc. cit.*, p. 15.

and essentially dry, seems to prove that no condition of climate, without other factors, will prevent its occurrence in those predisposed.

Emotion and Shock.—There appears to be no doubt that overwork of mind and body, prolonged grief and anxiety, often precede an attack of this disease. Professor Senator particularly alludes to such antecedents, and both Sir Alfred Garrod and Sir Dyce Duckworth have drawn attention to the subject. Among 500 cases analysed by Dr. A. E. Garrod there were 34 in which there was a history of prolonged emotional disturbance. In a case of my own the man lost nearly all his invested money and had to fight a lawsuit in order to obtain possession of some large estate. This was stated to have occurred some few months before his hands and wrists became involved. It seems also that emotional disturbance is not confined to the causation of osteo-arthritis, but it is more or less marked throughout its course, as we often hear patients say that any worry or anxiety increases the pains in the joints. Cases have been reported, in which the cause has been assigned to shock, but it is difficult to see why such a momentary thing as shock should give rise to this disease, except by supposing that it produces a sudden onset of debility, for when the disease has been attributed to

emotion its effects have been active for some time. With regard to shock Dr. Wilks says: "We hear sometimes of fear turning the whole mass of the blood. I believe this is literally correct; I have seen now so many cases of anæmia, some of them fatal, occurring upon severe shock to the nervous system, that I have no doubt of the fact." Dr. A. E. Garrod[1] quotes two remarkable cases of Koht's which seem to have been produced by shock, both of the patients being men who were attacked with osteo-arthritis after having received violent mental shocks from the explosion of shells in their immediate vicinity. Professor Leyden also states that many sufferers from osteo-arthritis in Strasburg date the onset of the disease from the shocks they received during the bombardment of the city in the year 1870.

Derangement of Reproductive Organs.—The menopause has been looked upon by many from the time of Haygarth as a potent factor in the causation of this malady in women. Dr. A. E. Garrod observes[2]: "Of 411 female patients, 18 dated the commencement of the disease from some time in the two years immediately preceding the menopause, and no less than 41 from the two years immediately following that event; in five more the

[1] *Loc. cit.*, p. 242-243.
[2] *Loc. cit.*, p. 241.

disease began at the climacteric." Dr. Ord in a paper read before the Clinical Society in 1877, has pointed out more prominently than other observers, the relation of this disease to uterine and ovarian disturbance. In one of his patients it came on regularly in paroxysms a little before, throughout, and for a short time after each menstrual period, remitting in the intervals. He noticed also in three cases, in which the articular affection was confined to one side of the body, or began and continued severe on one side of the body, that there was pain and tenderness in the ovary on that side. Sir Alfred Garrod holds that the general lowered vitality, on which the uterine affections so often depend, count much more than the actual uterine disturbances themselves, and also that a sudden production of debility will give rise to this condition. He and others have also remarked that the disease may occur after prolonged lactation, severe hæmorrhage, rapid child-bearing, and pregnancy. Excessive venery in the male has been said to be a cause of the malady.

Traumatism.—Without doubt, injury to a single joint or joints often precedes the external manifestations of osteo-arthritis in those joints, and the disease may be confined to these or afterwards become generalised by involving one joint after another. Haygarth's case of a man who violently injured his wrist,

and in whom the disease immediately appeared in the structures of the injured articulation, and remained confined to it, is well known. Adams cites cases of severe concussion to large joints, which he assigns as the determining cause of osteo-arthritis in those articulations. Sometimes local injuries, singularly trifling, precede its onset, such as whitlows and boils. Besides these there are the special pathological injuries, as, for instance, when the disease follows an attack of acute rheumatism or gonorrhœal rheumatism.

Unclassified causes.—Among these may be mentioned as causes, chronic dysentry, and arterio-capillary fibrosis with contracted kidney (Duckworth).

CHAPTER III.

Morbid Anatomy.

Since osteo-arthritis is so seldom directly fatal, comparatively few opportunities arise for examining the joints in the early stages of this disease, and it is chiefly from those in whom a joint has been subjected to some surgical operation, or from those who have died from some intercurrent malady, that our knowledge of the morbid changes is derived. Very diverse opinions have been held by the various observers who have investigated the subject, both in this country and on the continent, not only as to the morbid changes themselves, but also as to the part first affected. Colles and Todd looked upon the changes in the articulations as essentially distinct from ordinary inflammation as is seen from the following passage, quoted by Fuller.[1] "The difference between this and ordinary inflammation is that two opposite processes are to be found going on at the same time; viz., absorption of the old bone and its cartilage of incrustation, with deposition of new bony matter, whilst in the ordinary inflammation there would be simply

[1] *Loc. cit.*, Note, p. 340.

a gradual enlargement of the bone." Fuller[1] himself said that the changes appeared to depend upon a process allied to perversion of nutrition rather than to ordinary active inflammation, and was disposed to consider them as due to a specific poison, quite unconnected with that of gout and rheumatism, though closely allied to it. Cruveilhier, Adams, and Brodie[2] on the other hand believed the changes to be inflammatory only, and pictured them as commencing in the synovial membrane. Sir A. Garrod[3] observes: "They appear to result from a peculiar form of malnutrition of the tissues of the joints being an inflammation accompanied by defective powers," &c. Others, among whom may be mentioned Dr. A. E. Garrod,[4] hold that the cartilages are the first to be affected, and Dr. A. E. Garrod agrees with Senator in believing that the changes are due to degenerative and inflammatory processes, but that the degenerative precede the inflammatory.

It seems probable that this problem may be best solved by adopting the view of Senator,[5] who believes that the changes in the joints are partly inflammatory and partly degenerative. With this view I entirely concur, and my

1 *Loc. cit.*, Note, p. 339.
2 *Loc. cit.*
3 Gout and Rheumatic Gout," 3rd, edit., 1876, p. 527.
4 *Loc. cit.*
5 *Loc. cit.*

reasons for so doing will be given when I come to speak of the pathology. Furthermore, I also agree with those who believe the cartilages to be the first to show the morbid changes, owing probably to their structure and blood supply, and with those who contemplate the inflammatory changes, as occurring only after the degenerative.

Some authorities, among whom were Drs. Wilks, Moxon, and Weichselbaum, considered that too much importance had been attached to the destruction of the cartilage, since they affirmed that this same destruction, only not so exaggerated, was seen in old people, merely as a result of senile change.

Changes in the Cartilages.—There is no doubt that, whether the cartilages are first involved in osteo-arthritis or not, the change is found in these tissues at a very early stage of its progress, and is often confined to a small portion of one or both articular cartilages. In some cases the morbid process commences in the central zone of the cartilage; in others it commences round the edges and spreads towards the centre in an irregular manner. Macroscopically, the central area of the cartilages first loses its natural brilliancy, becoming soft to a variable and slowly increasing degree, and presenting an aspect which has been likened to villi or velvet, due to the delicate fibrillæ produced by the breaking up of the matrix,

and the vertical tubules left after the capsules have been removed. After a time the central zone gets worn down and disappears, leaving a cavity with a more or less well-defined margin, at the bottom of which the denuded bone may be seen. With further extension of the disease the whole of the articular cartilages may become removed, permitting the denuded heads of the bones to come into direct contact. But while the central portions of the cartilage are thus vanishing, nature is busy elsewhere. Formative changes are taking place at the periphery at a very early period, in the shape of nodular outgrowths, which form a sort of a lip, or heaping up, presenting great irregularity both in arrangement, form and size. These outgrowths, at first small, afterwards increase in size by the continued proliferation of the cartilage at the edge, and eventually, by the deposition in them of lime salts, which always commences near the parent bone, they become transformed into bony masses or osteophytes. After these enchondroses have ossified they still remain covered with a layer of cartilage. MM. Cornil and Ranvier attribute the difference between the central disappearance of the cartilage and the formation of the enchondroses at the periphery, (although both are due to the same histological process), to the fact that the articular cartilages at the edges are covered by synovial membrane,

underneath which the proliferating cell elements accumulate, instead of escaping into the cavity of the articulation. It was formerly thought that the enchondroses were due chiefly to friction causing the disappearance of the central cartilage, whereas the margins of the cartilages were not exposed to this influence.

The intra-articular fibro-cartilages, such as those of the temporo-maxillary, and the knee-joints, are subjected to the same morbid process as those covering the heads of the bones, and disappear. In the knee-joint the semi-lunar cartilages occasionally become partially ossified.

Histologically, the morbid process consists, according to MM. Cornil and Ranvier,[1] of a proliferation of the cartilage cells throughout the whole depth of the articular cartilage as far as the edges, and the formation of capsules around them. Included in the enlarged primary capsules are a large number of secondary capsules, and these secondary capsules (some eight to twenty) are either included in a capsule common to them all, or are free from one another. Cornil and Ranvier mention that previous observers have mistaken these capsules for true cells, but this is an error they guarded against by using a solution of iodine, which stains the protoplasm of the cells

[1] "Manual of Pathological Histology," vol. i., 1882, p. 391.

brown, and leaves the secondary capsules colourless, or very slightly tinted. The matrix, owing to the enlarged capsules having gradually ruptured into the joint cavity and so emptying the tubules, splits into fibrillæ in a direction perpendicular to the surface of the cartilage, and this fibrillated condition, after persisting for a long time, finally disappears, the process being hastened either by friction, or according to Rindfleisch by the fibrillæ undergoing mucous degeneration.

The filaments are exceedingly delicate and may be composed merely of hyaline substance, but sometimes a few cartilage capsules may be found at the free extremity of those fibres which are club-shaped.

The lipping of cartilage, which is often seen in cases of gout, has been shown by Dr. E. T. Wynne[1] to be due to a totally different process from that which gives rise to the lipping in osteo-arthritis, although superficially the two are much alike. In looking at a gouty specimen, he perceived that the investing cartilage stopped short at the summit of the protuberance, becoming a little thinner at its periphery, the remainder of the outgrowth being protected by a thin layer of fibrous tissue, continuous with that of the periosteum and synovial membrane. He describes the appearance of the outgrowths as a sprouting of the can-

[1] "Lancet," 1889, vol. i., p. 933.

cellous tissue of the epiphysis, carrying the cartilage before it—in fact, a true exostosis.

The osseous changes.—After the absorption of the cartilage, the bony surfaces present in the majority of cases the appearance of having been converted into a white, polished, hard, dense, and ivory-like substance, and from this circumstance they are said to be eburnated. Sometimes, however, they present an open cancellous tissue. There are various explanations as to how this layer of ivory-like substance is formed. Fuller and Adams were of opinion that the bony surfaces, not having been adjusted to sustain the effects of friction and attrition, became partially worn down, and that the eburnated surface was produced by the mutual action of one bone upon the other. Adams believed that eburnation was seldom seen in the temporo-maxillary joint. Ziegler[1] is of opinion that during the time that the superficial layer of the cartilage is being converted into fibrillæ, softening is taking place in the deeper layers, leading to the formation of cavities, which sooner or later become filled by a growth of the vascular medullary substance from the bone, which leads to ossification. But Cornil and Ranvier[2] think it is due to the lowest layer of cartilage capsules, those nearest the bone emptying

[1] Virchow's "Archiv.," 1877, lxx., p. 592.
[2] *Loc. cit.*, p. 394.

their cellular contents into the medullary spaces of the bone, whence, they say: "It follows that the medullary spaces adjoining a cartilage of investment are filled with newly formed cells derived from the cartilage, and which have all the characters of the elements of embryonic medulla. The sub-cartilaginous osseous layer which contains this embryonic medulla is thin and has the appearance of a red line; the eburnated layer is derived from this by the successive conversion of the embryonic cells into bone corpuscles by the normal process of ossification." They add, however, that it may be produced by the inflammation extending in a direct manner to the cancellous tissue. There are others who regard this latter as the principal instrument in its formation. By the friction of the denuded bony surfaces upon each other, parallel grooves and lines are formed in the direction of the movements of the joints to which they are henceforth limited. As time goes on, still more prominent changes occur in the subjacent parts of the bone, which becomes wasted, loaded with fat, and slowly disappears. The necks of the humerus and femur may in this way become gradually shorter from the absorption of the intervening bony matter. As has already been stated, both Cruveilhier and Adams pointed out that true bony anchylosis very rarely took place,

but Bolby stated it might occur in the vertebral column. The apparent anchylosis is due in great part to the large size that the osteophytes may acquire, and by interlocking and obstructing each other they completely annihilate all movement of the articulation. The heads of the bones have sometimes exhibited a mushroom-like aspect, as though they had been moulded when soft (Volkmann). The bony epiphyses undergo some change, and Broca pictured the morbid changes of the bone as confined to these. Adams, on the other hand, described the alteration in the structure of the shafts of the bones in addition to the changes found in and about the articulations. He mentioned several cases in which the shafts of the bones were hypertrophied and of increased density. In one of his cases the lower jaw had its right ramus an inch longer than the left, and the condyle on the same side was three times its natural length, and in another case the ulna and olecranon had acquired a huge size; so that although the joints are apparently the primary seat of the disease, it does not limit itself to these, but affects other portions of osseous tissue also. The bones of the aged, affected with osteo-arthritis, are apt to become atrophied rather than hypertrophied and of increased density. All these facts go to show that the process concerned in the destruction

of the bone is not merely mechanical, for it may occasionally be seen in parts covered by cartilage.

Changes in the synovial membrane.—In a joint which has been laid open, the earliest change noticeable is a vivid vascular injection of the synovial membrane and its fringes. A little later in the disease the synovial fringes become hypertrophied and give off secondary offshoots by the budding of their villi, forming tufts. The villous processes produced are often long, and have hanging from them numerous spherical or ovoid bodies of different sizes like melon seeds, which may be cartilaginous.

The walls of the fibro-synovial capsules also become much thickened, and the capsules themselves distended with fluid which at a still later stage of the disease disappears. At the same time the capsular walls are still much more increased in thickness.

In the case of that of the hip-joint,[1] Adams says: "It may be nearly a quarter of an inch in thickness," and he added also that cases were not wanting in which portions of bone had been found contained in the substance of the synovial capsules of the joints. Ligaments also become absorbed in and about the affected joints. Often not a trace of the ligamentum teres of the hip-joint is to be found, nor the long tendon of the biceps, nor the

[1] *Loc. cit.*, p. 31.

glenoid ligament when the shoulder-joint is involved. With regard to foreign bodies found in the joints attacked with this disease, Adams believed their formation to be due to the deposition of a particle of lymph in the synovial membrane or in the subjacent cellular tissue, which becoming organised projected slightly into the joint, as a small tumour with a broad base. As this projects further into the joint it becomes constricted below its summit so as to form a neck, which slowly elongates and becomes thinner and thinner, till at length the distal enlarged extremity is cut off from its proximal attachment by a long peduncle. This enlarged extremity (foreign body) which may become cartilaginous or bony, either remains attached to its slender stem or becomes free in the joint. Besides these, he described what he called additamentary bones, which deepened and enlarged the cavities of reception for the heads of the bones. He considered them as new formations produced by the irritative ossification of the tissues in the immediate proximity of the joints. Cornil and Ranvier[1] explain the development of foreign bodies in the following manner:—

They say that the villi of the synovial fringes bud, that the fatty tissue disappears, and that its place is taken by embryonic cells, that some of

[1] *Loc. cit.*, p. 390, 395.

the embryonic cells in the buds become cartilage, whilst those at the periphery form a continuous layer of fibrous tissue. Furthermore they consider that these cartilaginous nodules may become osseous, that the peduncles uniting them with the synovial membrane may be very delicate, and that these peduncles are liable to become ruptured, in which way loose foreign bodies are formed, which are sometimes found in great numbers in the articulation. With regard to the effusion of fluid into the synovial capsule, different views have been taken in this country and on the Continent. Here it has always been considered to be a more or less prominent symptom in the earlier stages of the joint affection, the fluid becoming absorbed in the later stages; whereas on the Continent it has been held by some that there is little or no effusion into the joints at all (Besnier); and by Senator, that the articular fluid is either diminished, or that it is absent from the joints altogether. The analysis of this fluid from the hip-joint, as given by Hoppe-Seyler[1] is as follows: "Mucin 28·19 per thousand, albuminous substance 20·92, ethereal extract ·93, alcoholic extract 1·30, watery extract ·65, acetic extract 1·53, inorganic substances 8·79, total solids 57·28, water 942·72. The ethereal extract was found to contain cholesterin, lecethin, and traces of fat."

[1] A. E. Garrod, *loc. cit.*, p. 280.

Suppuration in osteo-arthritis is of rare occurrence. Three cases, however, in which it supervened have been lately reported by Mr. Mansell-Moullin, in the "Lancet."[1] In rare cases hæmorrhage takes place into the affected joint, as pointed out by Dr. Hilton Fagge,[2] who mentioned a case of Dr. Goodhart's in which liquid blood was found in both knees and ankles. The deformity in this disease is often greatly increased by the presence of bursæ, distended with fluid, in the immediate neighbourhood of the affected joints.

Muscular changes.—Although muscular atrophy is well-marked there are no definite facts concerning the morbid changes. The fact, however, that not all the muscular fibres are atrophied to the same extent, although the whole length of the muscle is involved (as proved by Debove), points to osteo-arthritis as belonging to the class of arthritis known as nervous. Valtat, in examining the muscles of animals suffering from arthritic muscular atrophy, noticed that they were paler than usual, and that the fibres were merely narrower, without any interstitial changes, but he could find no lesion in the cord or nerves. It has been observed in osteo-arthritis that the muscles are of a palish brown or dead-leaf colour.

[1] Vol. ii., p. 125, 1891.

[2] "Principles and Practice of Medicine," vol. ii., p. 557.

Changes in the Nerves.—The nerves in the limbs may become tender as well as painful, probably indicating some degree of peripheral neuritis. Pitres and Vaillard, as noted by Dr. A. E. Garrod, saw several cases in which peripheral neuritis was present, and they believed that there was an invariable relation between the existence of peripheral neuritis and the development of trophic changes in the muscles and skin. In one of their cases the muscles of the leg were much atrophied, and the nerves supplying them had also undergone great degenerative changes. In another case the muscular wasting was trifling and the nerve showed no change. But as they found little evidence of disease in the nerves supplying the affected joints, they came to the conclusion that the lesions of the peripheral nerves could not be the real cause of the joint mischief.

Although the inter-vertebral articulations may be involved and the cartilages disappear, and movement may become absolutely impossible, especially in the cervical region, the cord is rarely if ever compressed, but the narrowing of the foramina may injure the nerve-roots and sometimes set up a descending neuritis (Gowers). Occasionally the atlo-occipital joint has been involved, or this, together with the vertebræ in its immediate vicinity, giving rise to degenerative changes in the cord itself.

Sometimes also injury has been discovered in the nerves of the medulla, as resulting from the narrowing of the foramen magnum, or from the odontoid process projecting into the canal.

Visceral changes.—Professor Charcot and M. Cornil have both recorded cases of cardiac lesions, the endocardium or the pericardium being involved. Prof. Charcot has seen, *post-mortem*, several cases of pericarditis and recent valvular disease. In some cases the mitral, and in others the aortic valve was affected in individuals who had suffered from osteo-arthritis, and in whom there was no antecedent history of rheumatism. The valves had lost their translucency, were dense and firmer than usual, and exhibited little vegetations upon their surface, but sometimes the morbid changes produced were insufficient to give rise to any murmur during life. In this country as a rule, the only visceral changes found, post-mortem, are of the nature of an intercurrent malady from which the sufferer has generally died.

CHAPTER IV.

Pathology.

In framing any theory as to the pathology of this disease many questions have to be taken into consideration, such as its being merely a form of chronic rheumatism, its relation to gout, its diathetic character, its causation and treatment, and generally the views of various authorities up to the present time. The majority of writers in this country undoubtedly look upon osteo-arthritis as quite distinct from chronic rheumatism, and there is no doubt that by far the greatest number of cases of osteo-arthritis arise as an independent malady, quite apart from any antecedent attack of rheumatism. The obstinacy of its symptoms, the symmetry of its invasion of joint after joint, and, in the vast majority of cases, leaving its mark on each joint involved, the rare occurrence of cardiac lesions, the special susceptibility of women as compared with men (whereas, in rheumatism, the two sexes are affected more or less equally), and the peculiar alteration in the structure of the joints that is so constant a feature, differentiate it from rheumatism. It might be added also that

the age at which osteo-arthritis is most liable to arise is later than in rheumatism, and that the causes of the two diseases are very different, with the exception of exposure, which is common to both. It must not be forgotten, however, that so eminent an observer as Charcot looks upon this disease as simply a form of rheumatism, and he insists on the not infrequent occurrence of cardiac lesions, which he has confirmed by examination in the post-mortem room. From gout it is readily distinguished by the absence of excess of uric acid in the blood, and of urate of soda in the joints, for when the latter is occasionally found in joints affected with osteo-arthritis it is most probably due to one disease engrafted upon the other, in the same way as osteo-arthritis is found associated with osteitis deformans.

With regard to the fact that women born of gouty parents are so especially susceptible to osteo-arthritis, rather than to gout, is not the possible explanation to be found in the menstrual flow, which, by recurring at regular periods from puberty, depurates the blood, unloads it, and washes away, so to speak, its excess of uric acid, or its formative base? In this way it may be supposed that the individual is still left with an arthritic diathesis, and is ever ready, should the immediate exciting cause of osteo-arthritis arise, to develop this malady.

When we consider the vast number of individuals who are exposed to the influence of one or other of the causes which produce osteo-arthritis in the few, without contracting this disease; we are irresistibly led to the conclusion that there is some essential difference in the constitution of the few who do suffer with osteo-arthritis from the rest of mankind, and that this something is of the nature of an inborn predisposition. Hutchinson[1] has classed as arthritic any disease which involves many joints, or a single joint, by recurrent attacks, and he includes all arthritic affections which are not of a gouty nature under the term "rheumatism;" viz., rheumatic fever, osteo-arthritis, and gonorrhæal rheumatism. He further thinks that those who possess the arthritic diathesis develop gout under the influence of dietetic causes:—rheumatism as the result of exposure. Duckworth[2] observes: "The disease is one of several manifestations of the rheumatic branch of the basic arthritic diathesis; gout is regarded as another branch of the parent-stock. This position necessarily entails an indirect relation with all forms of diathetic arthritic disease; hence the occurrence of chronic rheumatic arthritis is not antagonistic to the onset of other phases, both of rheuma-

[1] *Loc. cit.*

[2] *Loc. cit.*, p. 293.

tism and gout." He adds also: "The nervous system is markedly implicated in arthritic diathesis." Adopting the opinion of those authorities who consider that this disease is dependent on an arthritic diathesis, I would state my belief in a basic arthritic diathesis capable of division into offshoots, of which osteo-arthritis is one, and gout and rheumatism are others; and that these offshoots, too, may become associated by marriage in the same way as a tubercular diathesis may be associated with an arthritic offshoot.

The history of nearly all the cases in my experience bears out this hypothesis of an arthritic diathesis, and I would venture, in the first place, to define my meaning of the term; namely, a predisposition, either hereditary or acquired, to errors in the nutrition of joints, and, concomitantly, of other tissues, determined by a morbid and unstable condition of the nerve-centres (vaso-motor centre, which acts either as a trophic centre itself, or has very intimately related to it a distinct trophic centre which acts in conjunction with it) concerned in the medulla, and which are ever ready to be affected (centrally or reflexly) on an exciting cause presenting. "The greater the degree of hereditary proclivity, the less the need for the exciting cause." [1]

Most of the theories of recent years are

[1] Hutchinson "Pedigree of Disease" p. 71.

based on the assumption of an abnormal nervous system interfering with the nutrition of the joints. One strong point in favour of this view is the great analogy between this condition, and the arthritis occurring in locomotor ataxia, the only difference being that one or more of the larger joints are affected in the latter disease, and that the process is much more acute. Fuller[1] observes, in speaking of osteo-arthritis: "The symmetry of local symptoms affords additional evidence of the poisoned condition of the circulatory fluid," and, he adds, that this peculiarity has been shown by Dr. Budd in all conditions connected with a vitiated condition of the circulation, and further, in alluding to the *materies morbi* of gout, he says:[2] "It may be hereafter discovered that rheumatic gout is dependent on some other perversion in the relative proportions of the constituents of the blood." Todd[3] was inclined to think that in this malady there was an abnormal nutrition occasioned by the presence of a peculiar matter in the nutritive fluid, affording certain points of resemblance to chronic inflammation, yet differing from it in a very marked manner. Sir James Paget is also of opinion that symmetry of symptoms is due to a faulty condi-

[1] *Loc. cit.*
[2] *Loc. cit.*, p. 345.
[3] "On Rheumatism," p. 169.

tion in the circulatory fluid, but Hutchinson believes that this condition is mainly produced from the nervous system, and is in no way connected with the state of the blood. Professor Senator, too, speaks of the symmetrical onset and progress of osteo-arthritis as being especially due to a central cause situated in the nervous system, and he regards the changes in the joints as partly inflammatory, and partly degenerative. Duckworth[1] says: "The nervous system is markedly implicated in the arthritic diathesis, and both rheumatic and gouty diseases point to the probability of there being a trophic centre or centres for joints situated in the spinal marrow. Morbid and unstable conditions of these may result in a definite neurosis, which itself may be either inherited, acquired, or modified in particular instances."

Mr. Arbuthnot Lane[2] regards osteo-arthritis as not a disease *per se*, and looks upon the joint lesions as simply the local results of wear and tear caused by the pressure of the opposing surfaces upon each other. It is difficult to reconcile ourselves to this view, when we take into consideration that there cannot possibly be any appreciable amount of wear and tear in the joints of those who have never

[1] *Loc. cit.*, p. 293.

[2] "Path. Soc. Trans.," 1884, vol. xxxv., p. 299; 1886, vol. xxxvi., p. 387.

been accustomed to hard work, such as the rich, or invalids who have been confined to bed for some years. Then, again, the peripheral and symmetrical distribution of the joints involved tells against this theory.[1] Dr. Pye-Smith holds that osteo-arthritis is often the result of a senile change.

It is seen that some authorities as Remak, Senator, and Duckworth, look upon the disease as of nervous origin; others, as Fuller, as due to some perversion in the blood, and others again regard it as due to the combined action of both these systems. I shall follow in my arguments these latter observers, and consider it as brought about by a vitiated condition of the blood acting on the nervous system in those predisposed.

Now it has been shown by Sir Alfred Garrod that uric acid in the blood in excess is the *materies morbi* in gout, and, according to the theory of Dr. Latham, uric acid in excess, together with lactic acid, is the *materies morbi* in rheumatism, and this uric acid, which stimulates the vaso-motor centre in the medulla, is supposed to act on an already enfeebled centre, rendering it less powerful, and, as a conse-

[1] Since this was written Mr. Arbuthnot Lane, in a paper to the Lancet January 30th, 1892, looks upon the local variety of this disease, arising after an injury to a joint, as a distinct condition in a large majority of cases, which he calls "chronic traumatic arthritis" although the morbid anatomical signs are the same as those found in osteo-arthritis.

quence, the continuous stimulation, instead of exciting the centre, exhausts it. As gout and rheumatism have been considered as two divisions of a basic arthritic diathesis, of which osteo-arthritis may be looked upon as a third, it may be inferred that the last named disease is due to some perversion in the constituents of the circulatory fluid. If this be granted, I shall endeavour to show from the cases I have examined that there is an abnormal condition of the blood immediately preceding the onset of osteo-arthritis, and continuing during the whole time that the affection is active.

In all the cases I have investigated, one circumstance has been forcibly impressed on my my mind, whether in an early or in a late stage of the malady, viz., that there has always been a certain amount of anæmia, sometimes little, sometimes much, and believing there to be some close relation between this anæmia and the onset of osteo-arthritis, I have been led to examine the blood, in which there has invariably been found a deficiency of oxygen, as measured by the number of red corpuscles and the percentage of hæmoglobin. When we consider the recognised causes of this disease, (for instance, long continued action of cold and damp, oftentimes accompanied by deprivation, uterine troubles, excessive hæmorrhage, over-lactation, as a sequela of acute

rheumatism and of gonorrhœal rheumatism, and lastly any sudden onset of debility, especially after injury to a joint, or after shock or emotion), we cannot help noting that the majority of these causes of osteo-arthritis are just such as we might imagine would produce a malady having its origin in the nervous system, the latter being acted upon by a perversion of the constituents of the blood. With regard to shock and emotion, it should be stated that they can of themselves exalt or inhibit some portion of the centre in the medulla, in the same way as a deficiency of oxygen, and so become a factor in causation. Again, the satisfactory results of treatment which follow that directed to the improvement of general nutrition, and the great benefit often derived from electricity all point in the same direction. Arguing from this, I hope to show how such deficiency of oxygen may produce the most important phenomena of osteo-arthritis. To assist me in this matter I have called in the aid of physiology, and find that a deficiency of oxygen stimulates the vaso-motor centre in the medulla, through which many disturbances of nutrition can be explained without the hypothesis of a special trophic centre. By the action of the vaso-motor centre alone, which has already been premised to be in a morbid and unstable condition, we can explain almost all the phases

of this disease, but the interpretation would be rendered much easier if we could imply the existence of a centre devoted to the nutrition of joints, and in most intimate relation to the vaso-motor centre. The vaso-motor centre in the medulla is most probably a multiple centre, made up of minor centres governing particular vascular areas, and so associated that they may, according to circumstances, act together or in part. Stimulation of any part of this general centre causes constriction of the vessels of certain vascular areas to such an extent as either to diminish their calibre, or, in the case of the smaller vessels, to obliterate them altogether, but prolonged stimulation gives way to dilatation. Furthermore, the effects of stimulation may be general or local, according to circumstances, and the general can be separated from the local, as the two are opposed to each other.[1] Putting all these facts together, we may conjecture that in those predisposed to osteo-arthritis this deficiency of oxygen in the blood will stimulate their unstable vaso-motor centre in a certain way; that is to say, being unstable, it will be easily excited by a small deficiency of oxygen, and more violently so by a large deficiency, and that continued excitation (for a time) will cause constriction almost to obliteration of the minute vessels supplying the smaller joints,

[1] "Foster's Physiology," 1887, p. 141.

and, it might be added, the small peripheral nerves also, in this way cutting off their blood supply and consequently interfering with their nourishment. Likewise the blood supply through the vessels of the nerves going to the joints, &c., will be more or less interfered with, thus giving rise to degeneration of some of their fibres and so becoming another factor in the malnutrition of the joints.

On account of this deprivation of blood, the joints, though at first subject to a mere functional disturbance would ultimately undergo an organic change. After a time this continuous stimulation of the vaso-motor centre must end in its exhaustion, giving rise to dilatation of the vessels and inflammatory changes in the joints, and perhaps in the small peripheral nerves also. These two forces repeated over and over again, for they must alternate with each other, would explain, according to the degenerative and inflammatory theory, the morbid features found in the joints in osteo-arthritis, and also the changes in the shafts of the bones themselves, for their nutrition would be interfered with through their independent nutrient vessels. It may here be stated that however exhausted the centre becomes it always in time recovers tone, and in this case of deficiency of oxygen, overtone, so to speak. Again, it may be supposed that there are different degrees of he-

reditary instability of the vaso-motor centre, and the more unstable it is to commence with, and the greater the deficiency of oxygen, the sooner will stimulation bring about exhaustion, and so produce a more or less acute attack of osteo-arthritis. On the other hand, the more stable the centre, and the less the deficiency of oxygen, the more chronic will be the disease. Given the stimulation great and not prolonged, and the exhaustion more or less rapid, we should get manifestations of an acute attack, but given the stimulation slight and prolonged, and the exhaustion slow, we should have all the phases of a chronic attack. In the most chronic form of all, viz., Heberden's nodes, we may suppose that the deficiency of oxygen is very small, and that the stimulation, therefore, is very slight and prolonged and the exhaustion transient. The reason that only some of the joints are affected at a time is due to the fact that although the general centre is stimulated, the general and local effects are often opposed, and also to the local vaso-motor centres regulating minute vascular areas (about joints) which may be opposed to the effects of the general centre. This stimulation of the vaso-motor centre in the medulla explains why the lesions in polyarthritic osteo-arthritis are more or less symmetrical. Coming to the local variety of this disease, which chiefly affects

the larger joints (especially of men), it is, of course, just possible that here an arthritic diathesis may be acquired, but it seems more probable that the injured joint sets up in the system, through shock or otherwise, the perversion of the blood that will apparently develop the disease in those predisposed, and a joint in these persons which has had its nutrition interfered with by injury is much more ready to take on action on an exciting cause arising. For, although we speak of the stimulation of the centre in the medulla, the blood with its deficiency of oxygen may possibly act directly on some local vaso-motor centres influencing the vessels in a vascular area about a joint, and thus produce, for a time at least, only the external manifestations of this disease in the injured joint; and when it always remains confined to this joint we may conjecture that the immediate exciting cause has disappeared from the system, whether by treatment or not, for we see numbers of cases of slight anæmia at least in which the anæmia disappears without any medical interference. Many cases have been reported, however, in which the disease has begun locally, as the result of injury or otherwise, and has afterwards become general. Now, if the polyarthritic form may be produced in the way described, it is not very difficult to believe that the same process

may be at work in the local variety. In the case of a very trivial injury, such as a whitlow, we have often seen this produce a certain amount of anæmia, probably quite sufficient in persons predisposed to this malady to give rise to it, and much more readily can we foresee this condition to follow slight injury to a joint in old people, whose articular nutrition is generally at a low ebb.

It has been shown that the local variety of osteo-arthritis, in which the larger joints are more generally involved, has its analogy in the arthropathies of locomotor ataxia, but even in the latter disease the small joints of the fingers have been known to suffer (Westphal); pointing to a resemblance again between the affected joints here and those in general osteo-arthritis. Thus the only difference between this essentially nerve arthritis, and that in osteo-arthritis is the acute and rapid course of the former, and as these changes in the joints in locomotor ataxia have been considered as due to disturbances of the vaso-motor centre alone, which seems to be capable of acting as a trophic centre, or of the vaso-motor centre and a trophic centre combined, this is a strong point in favour of osteo-arthritis being also due to vaso-motor disturbance. But, of course, there is no reason why this disturbance should not be produced in a different manner in loco-

motor ataxia; thus, for instance, the action of the vaso-motor nerves may be deranged by disease of the spinal cord, but this is probably not the sole mechanism by which these changes are produced. Besides these similarities between osteo-arthritis and loco-motor ataxia, there are other nerve arthrites due to concussion of the spine, resembling osteo-arthritis in the way of peripheral and symmetrical distribution, but their clinical features have been much more allied to those of gout and rheumatism, which run a rapid course and in which recovery has ensued. Dr. A. E. Garrod[1] quotes three cases of this character, one of Dr. J. K. Mitchell, one of Sir William Gull, and one of Mr. M'Ardle.

This theory of the action of deficiency of oxygen in the blood, on the vaso-motor centre, or on this and a hypothetical trophic centre combined, seems to explain many of the symptoms of osteo-arthritis, particularly the early ones. Take for instance the pain experienced about the joints and in the muscles in the earlier stages of this disease (before swelling and tension can have given rise to it).

Anæmia is one of the most powerful causes of nerve pain in all its forms, and it has been said that vaso-motor disturbance, or at least secondary vaso-motor disturbance, may account for neuralgia.[2]

1 *Loc. cit.*, p. 287.

2 Gowers' "Diseases of Nervous System," vol. i., p. 743 and 757.

The same vaso-motor disturbances apply also to transient œdema, which sometimes occurs as an early symptom. The various trophic changes in the skin, such as glossiness and atrophy, are probably due to degenerative changes in the peripheral nerves, brought about by the partial cutting off of their blood supply for comparatively long periods, and it may be supposed that it is through a local vaso-motor mechanism governing some particular tract that these changes are induced. The local erythemata and ecchymoses, and the scalding sensations sometimes complained of in the hands and feet, and the occasional general sweating, seem to be due to the dilatatory part of the disturbance, but the local sweating occurring later, especially in the palms of the hands and soles of the feet, and now and then on one side of the forehead, is due to the same factor in a local vaso-motor centre.

The pigmentation it seems probable may result from the alternation of constriction and dilatation of the vessels of some vascular area, and of the vessels of the peripheral nerves themselves; also the rapid and high tension pulse observed in some cases, and the slow pulse in others can be reconciled by supposing that the cardio-inhibitory centre itself, or the vagus, has its nutrition damaged and its action interfered with by the vaso-motor dis-

turbance. Further, we may presume that its inhibitory action is much depressed by want of its accustomed nourishment, which, on account of the chronic constriction of its vessels, it does not receive.

This theory also explains why the swelling due to effusion into the joint or joints affected is not the first external manifestation, for it is only when the vaso-motor centre becomes exhausted after stimulation that dilatation of the vessels takes place. In the same way this exhausted condition will explain, in acute cases at least, the occasional redness and heat of the skin which is sometimes observed. When the exhausted centre has recovered its tone, or according to the view taken in these pages, its over-tone, the same operation takes place over and over again, increasing the changes in the joint as long as the disease is active.

Such a striking element as muscular atrophy in osteo-arthritis is familiar to everyone, although Haygarth observed that the muscles were not affected. It is difficult to understand his meaning, for, in another place, he said that the muscles were subject to spasm; but perhaps we may imagine that he considered these were not organically affected in the early stages, for it can scarcely be conceived that he should not have noticed their wasting late in the malady. The usual explanation of

muscular atrophy is that it is contingent in the first place on the discontinuance of physiological activity necessitated by the diseased state, and in the second place on neuritis following the affection of the articulation. The investigations of Raymond[1] seem to point to a reflex trophic condition as the cause of atrophy in osteo-arthritis generally.

Dr. Ord is of opinion that, in some cases, at least, there is a progressive distrophy of the joints marching with progressive atrophy of muscles and with atrophy of other tissues of the limbs. Vulpian[2] explained the wasting of the muscles as due to some change in the nutrition of the ganglion cells of the cord. Gowers points out that muscular atrophy cannot be explained by disuse; first because that which results from disuse is trifling and tardy, and, secondly, because other muscles of a limb of which the movements are suspended to the same extent exhibit no atrophy. He further observes that the morbid changes in the muscles are often similar to those consequent upon slight degeneration of the pyramidal tracts in the spinal cord, which he believes to be directly occasioned by the changes in the termination in the pyramidal fibres in the grey matter. It seems probable that even in muscular atrophy vaso-motor dis-

[1] "Revue de Med.," No. 5, 1890.

[2] "Leçons sur l'appareil vasomoteur," 1875.

turbance is still the prime mover, for although there are some reasons for believing that comparatively little constriction on stimulation takes place in the arteries supplying the muscles, still, some of the motor nerves themselves supplying the muscles, whether about the joints or in the limbs, would be deprived of their proper blood supply; thus interfering with their nutrition and inducing a certain amount of degeneration, and this might be effected through the general centre or by local vaso-motor mechanisms.

The same reasoning can be applied here as was first used in the case of the joints to show why the atrophy is not general, but, of course, this does not deny that the necessary loss of function occasioned in the muscles of the limb or joint is an important factor in the case; in fact, one would think that it would rather accelerate the vaso-motor disturbance.

CHAPTER V.

Clinical History.

Although the changes observed in the articulations of individuals suffering from osteo-arthritis are always identical, wide differences exist in the clinical aspects, in degree rather than in kind, of the various forms of the disease. It may assume, for instance, the form of a generalized affection, idiopathic or secondary (irregular) which may be acute, sub-acute or chronic in its onset, involving many joints, especially the peripheral ones, in a perfectly symmetrical manner; or it may be local, attacking only one or two of the larger joints and becoming limited to these. It may, however, commence locally and afterwards become generalized, showing that even here the same factors of immediate causation are in existence as in the primary polyarthritic form. Dr. Charcot in his annotations to the second edition of Sir Alfred Garrod's work has given the following summary of the different forms of this disease:—1. Rhumatisme articulaire chronique primitif, généralisé ou progressif (the rhumatisme noueux of others). Cases in this group are chiefly distinguished by

the tendency of the disease to become general ; the small joints of the extremities, those of the hands, for example, and especially the meta-carpo-phalangeal joints, are symmetrically affected, and during the progress of the disease most of the other joints are successively attacked in a definite order, and for the most part irreparably injured. 2. Rhumatisme articulaire chronique primitif fixé ou partiel. In these cases the disease usually remains localised in one or two of the larger joints, producing deep-seated mischief sometimes called arthrite sèche, or morbus coxæ senilis. 3. Nodosités d'Heberden—usually classed among gouty affections and confined either to the extreme joints of the fingers or the next row, usually leaving free the metacarpo-phalangeal joints, which in the first group are affected earliest and most severely. These three types pass into each other by insensible transitions, and frequently all of them are united in the same subject, differences depending on local manifestations rather than on any essentially pathological distinction.

It has already been stated that osteo-arthritis may commence at any period of life, but it often differs in the acuteness of its onset according to the age of the individual. It is only occasionally acute, more frequently sub-acute, but much more commonly chronic in its course. Children and young female adults are more

liable to suffer from the acute or sub-acute idiopathic polyarthritic form, which either runs a rapid course, successively attacking many joints, so that great crippling may result in the space of a few weeks or months, or it may begin acutely and become arrested after several articulations have been invaded. Sometimes, however, after all acute symptoms have disappeared it will run an ordinary chronic course. In advanced life the disease as a rule is very chronic in its progress, invading tardily joint after joint, but there are exceptions to this, and the sequence of events may be much more rapid, *i.e.*, may be sub-acute at any age. Sir Alfred Garrod relates a case in which the onset was acute, but the causes of lowered vitality which existed having been removed, the patient rapidly gained flesh and strength, and the tendency to joint affection was at an end, but not without having inflicted irremediable lesions. It may be somewhat difficult to differentiate between an acute attack of osteo-arthritis and an acute or even sub-acute attack of rheumatism, but it is mainly distinguished from the latter disease by both positive and negative signs as will be shown under diagnosis. It is as well to mention here that in children suffering from an acute attack of this malady, cardiac affections are not developed, as is so often the case when they suffer from acute rheumatism, but that

its objective symptoms are always seen in the articulations; whereas, these latter often escape in children suffering from acute rheumatism. Sir Alfred Garrod, Lacaze-Dori[1] and others cite cases in which they have observed the disease at a very early period of life. Sir Alfred Garrod's case occurred in a child of four years, but it has been known to commence at a still more tender age by Dr. Moncorvo, of Rio. As compared with more advanced years, the deformities are much less prominent in these young children than the swelling of the involved joints, which is often very great. Dr. A. E. Garrod mentions, on account of their rarity, two cases that he had observed in children—both were girls, one nine and the other ten years of age. In neither case was the heart involved, nor was there any appreciable difference between the manifestations of the disease as seen at this age and those observed in adult life. It must, however, not be forgotten that there are other varieties of multiple chronic arthritis arising in children in which the heads of the bones are not enlarged, although the deformities present certain similarities to those seen in osteo-arthritis. Two cases of this nature have been reported, one by Dr. Barlow and the other by Dr. Pasteur, in which the de-

1 "Etude clinique sur les rhumatismes nouveux chez les enfants." Thèse de Paris, 1882.

formities and immobility were similar, but in which there was no enlargement of the heads of the bones from osteophytes. These cases somewhat resemble also those of "rhumatisme chronique fibreux" first described by Jaccoud. Here the articular cartilages are more or less normal, no bony outgrowths are present, but fibrous bands are developed about the diseased joints, which greatly interfere with their mobility, and by their contraction, together with that of the muscles, produce the permanent deformities resembling those resulting from osteo-arthritis.

Preceding the actual onset of osteo-arthritis there is usually a condition of lowered vitality, consisting of a depressed state of the nervous system, associated more or less with anæmia. In describing the course of idiopathic poly-arthritic osteo-arthritis, I propose to discuss, first, those symptoms which are more or less general, together with those early ones to which attention has been drawn during the last few years, and which precede the articular lesions by a longer or shorter period, thus proving that they are not dependent on the joint lesions. Secondly, those referred to the articulations, and muscles, and later local symptoms. In the first group there is more or less general debility, chilliness, languor, anorexia, anæmia, sometimes accompanied with a sallow complexion, frequent headaches of the migraine

type, occasional giddiness, various neuroses and after a time emaciation. In an acute attack where the inflammatory changes are more marked than the degenerative, there is a certain amount of febrile derangement present, the duration of which, however, is not usually prolonged, and the rise of the temperature-curve seldom attains any great height, is irregular, and not in any way significant. Although Drs. Howard and Homolle had already mentioned tingling of the extremities as occurring early in this disease, Dr. Spender, I believe, was the first to point out most of the following early symptoms.

Nerve Disturbances—Sensory.—He describes various paræsthesiæ, such as tingling and numbness of the extremities, and a sensation as if the hands and feet had been scalded. In one of my cases, the patient, a lady, complained much of these unpleasant sensations. He mentions severe migraine as being frequent, and an early pain in the ball of the thumb or on the inner side of the wrist, which he contends is all but pathognomonic of the affection. Nerve pains of different kinds hold a prominent place in the malady. The muscles are sometimes the seat of cramp or of intense pain of a spasmodic nature, and often-times pain is assigned to the joints or even to the bones themselves. *Motor.*—He agrees with Dr. Ord in believing that muscular

atrophy is early developed, and that natural atrophy only occurs later in the malady.

Circulatory.—Among conspicuous circulatory symptoms he mentions increased velocity and tension of the heart's action, and a rapid pulse associated with high tension, which quickens synchronously with the earliest objective sign. There is either a continuous rise till 110 or 130 beats per minute are attained, with scarcely any deviation day or night, or the pulse may remain for years from 80 to 90 beats per minute. There is no doubt from the observations of others also that a rapid pulse does occur in many cases of osteo-arthritis, but, on the other hand, there must be many cases in which the pulse rate is scarcely, if anything, raised above normal. In nearly all my cases the rate has been under 80 beats per minute. This may possibly be explained by the remark of Lane and Griffiths that a rapid pulse is much more frequent in adults under thirty years than in individuals over that age. Another phenomenon which Dr. Spender with others note under the above heading is icy and purple coldness of the extremities, particularly the hands. Sir Dyce Duckworth was (according to Dr. A. E. Garrod) apparently the first to draw attention to the palpitation of the heart which often occurs.

Early Skin Changes.—Dr. Spender emphasises also the importance of certain pigmentary

changes as seen in patches about the forehead, the temples, &c., or in the disseminated form of freckles; their favourite seat being the dorsal surface of the forearms where they exist in numbers from four to eight, not in the course of any particular nerve, however, but with a tendency to symmetry. Of the disseminated form he says:—"I must express an opinion that there is no single point so diagnostic, so absolutely connotative of early osteo-arthritis. My observations lead to the belief that it exists in about two-thirds of the undoubted cases." Dr. A. E. Garrod does not quite agree with him, for although he has met with one or two cases in which there has been pigmentary derangement, he does not consider that it is more common among individuals attacked with osteo-arthritis than in those not suffering from this malady. I must here state that in two of my own cases, at any rate, there were well-marked freckles. In one case they existed over the extensor surface of the forearm and the dorsum of the hand, but in the other they were very prolific over the face, neck, shoulders, arms, and hands. Lane and Griffiths state that they have seen cases with a distinct collar of pigmentation round the neck and patches on the chest wall. Dr. Spender points out, too, an odd neurotic phenomenon in the form of small patches like bruises, disappearing with the same play of

colours as an ordinary bruise and then reappearing. Œdema without albuminuria, often transient in the early stages of the disease, has been, however, noticed by many, and occurred in case No. V.

Another early symptom to which he directs attention, and which has now been noticed by many observers, is local sweating, as, for instance, about the soles of the feet and the palms of the hands, or even over still larger areas. Lane and Griffiths, however, say that general sweating is antecedent to local sweating. On the other hand Dr. Fuller stated that in many of his cases the skin was abnormally dry, and that the patients did not perspire. Turning now to the second group of symptoms we come to the articulations.

Articulations.—Although the victims of this disease complain of a peculiar rigidity, intensified at the moment they begin to exercise the affected joints, especially in the morning, after a night's rest, and of pain of a burning or gnawing character, increased on movement, and at night by the warmth of the bed, accompanied by little or no swelling, the earliest objective sign is usually some enlargement of the involved articulation; an enlargement which is slow, yet steady in its advance and apparently not accompanied by any increase of local action. The shape assumed by the swollen joints, in those cases in which

it can be readily seen, as in the peripheral ones, is in typical instances, fusiform. In addition to the preceding there is developed early in the injured joints, sometimes before any swelling, a crackling sensation (first mentioned by Haygarth) which may be both heard and felt on movement; but later on in the disease this gives place to grating, which is due to the rubbing of the heads of the bones upon each other after they have lost their cartilage. Occasionally a joint which is the seat of osteo-arthritis suppurates.

Another common early symptom is stiffness of the jaw, which, however, in by far the greater number of cases passes off without treatment, as was I believe, first pointed out by Sir A. Garrod. In an acute attack there would be, besides enlargement, some heat and occasional redness of the skin covering the joint. It seems to be a matter of doubt whether the swelling, at first seen, is due to enlargement of the heads of the bones, and rendered more prominent by synovial and bursal distension; or whether it is due to the distension of the synovial capsule and the neighbouring bursæ alone. If we could adopt the views of Senator and others who maintain either that the articular fluid is diminished or that there is no fluid at all in the joint, we should have to admit that the primary swelling was due to the enlargement of the heads

of the bones. It is impossible, however, to reconcile this view with the primary swelling as seen in this country, which is more or less elastic and has somewhat the sense of fluctuation. Dr. A. E. Garrod and some others seem to think the primary swelling due chiefly to the enlargement of the heads of the bones, but intensified by synovial and bursal distension. Others again, as Sir A. Garrod and Messrs. Lane and Griffiths are of opinion that the bones do not participitate in the swelling in early cases. I agree with those who look upon the swelling as partly due to bony enlargement, and partly to synovial and bursal distension; for I am of opinion that more or less synchronous changes are going on in the joints, and it depends on the structures involved, and the length of time the change has been in operation, as to which tissue presents the most prominent objective signs. Nevertheless, there is no doubt that at a later stage of the disease the enlargement is entirely bony, as the fluid becomes absorbed. In a still more chronic form of osteo-arthritis, known as Heberden's Nodes, in which the disease is confined to the terminal inter-phalangeal joints of the fingers, the thumbs usually not being attacked (although in one form of the affection the carpo-metacarpal joints of the thumbs only are involved), the enlargement is partly bony and partly synovial. Little nodular swell-

ings may project, one on each side of the articulation, on its dorsal aspect, glistening and elastic. When (in extreme cases) the disease is limited to the terminal phalangeal joints of the fingers, there is well-marked radial deviation, which is always irreducible, but when the other phalangeal joints of the fingers are involved there is only the usual typical swelling, without deviation. But as soon as the metacarpo-phalangeal joints become affected, deviation of the fingers to the ulnar side quickly follows, which, however, is reducible in its early stages. While the radial deviation is referred to undue formation of nodular osteophytes upon the ulnar side of the articulation, it is uncertain how the ulnar deflection is produced; it is developed only after joint lesions, and may occur after an attack of acute rheumatism in which the articulations are not left otherwise injured. Whether it be due to muscular action, such as of the extensors, or to atrophy of the abductor indicis,[1] it is (almost) certain that the relaxation of the ligaments which ensues from arthritis is an essential factor in the causation of the deformity.

The atrophy of the abductor indicis would be another important factor in this deflection were it not for the fact that it is not constant,[2]

[1] Dr. Herringham.

[2] Sir Dyce Duckworth.

for the forefinger having been deprived of its customary support bends the others towards the ulnar side. Dr. A. E. Garrod[1] says: "I am inclined to believe that ulnar deflection does not depend upon muscular action but upon the weakening of the support given by the ligaments of the metacarpo-phalangeal joints, in consequence of which the fingers fall towards the ulnar side." In severe cases as we ascend the limb from the distal extremity, whether it be an upper or a lower limb, the natural configuration of all superficial joints will be more or less lost, and the swellings in and about the joints may so obliterate the natural depressions and curves as to render the limb between two articulations of more or less uniform thickness. The expansion of the bursæ in the vicinity will increase the disfigurement, and this is especially so in the case of the forearm. Dr. Adams[2] pointed out that the bursa over the olecranon was often distended, and when filled with fluid sometimes contained a cartilaginous body, and that the distended bursæ of the tendons of the flexor muscles of the fingers formed synovial tumours. In those joints which are at a greater distance from the surface, such as the hip and the shoulder, although the same morbid changes exist, the disease is not so readily

[1] Page 252.
[2] *Loc. cit.*

recognised. The chief points to be noticed are that the movement of the joint becomes gradually more and more impaired, and that the symptoms are slowly progressive, and that at a later stage of the disease grating is present.

The intervertebral articulations.—Spondylitis.—The vertebral column is not frequently attacked, but when it is, the cervical and lumbar regions suffer more than the dorsal, and the atlo-axial articulations most of all, probably from the freedom of movement here. Although there is the same enlargement in the intervertebral articulations as in all others, which may be felt in thin individuals, the cord is very rarely compressed. The symptoms are local pain and tenderness, and if the nerve-roots should be injured from pressure, caused by narrowing of foramina, radiatory pains, and sometimes pain and tenderness in the nerves of the limbs. There is impaired movement, occasionally going on to anchylosis, especially in the cervical region: spasmodic torticollis and signs of injury of the sympathetic, and of the nerves of the medulla, have been noticed in disease of the cervical vertebræ. A curious impairment of the movement of the head has been observed in disease of the atlo-occipital joint, or of that together with the contiguous vertebræ.

Articulations rarely invaded.—Sir Alfred

Garrod[1] has shown that the ossicles of the internal ear undergo morbid changes resembling those seen in other joints; becoming fixed and producing deafness. He has also seen cases in which he is inclined to believe the arytenoid cartilages of the larynx have been affected, producing an alteration of the voice, or even sometimes complete aphonia.

The more frequently invaded articulations.—In the general form of osteo-arthritis, the joints are involved centripetally, usually the upper limbs before the lower, and with well marked symmetry. Messrs. Lane and Griffiths[2] say, that the upper extremities are more liable to be the seat of the disease in women, and the lower in men. The small joints of the hands are most subject to be invaded.

Out of Haygarth's 34 cases there were 20, and out of Dr. Ord's[3] 38 cases there were 24 in which the affection existed in the articulations of the hands. Dr. A. E. Garrod, from an analysis of 500 cases has noted that the malady first attacked the joints of the hands in 252 cases. He gives the following table as the result of his analysis :[4]—

[1] *Loc. cit.*
[2] *Loc. cit.*
[3] *Loc. cit.*
[4] *Loc. cit.*, p. 249.

Joints Affected.	Total	Percentage.
Hands and Feet... ...	430 ...	... 86·0
Knees	303 ...	... 60·6
Feet	172 ...	... 34·4
Ankles	137 ...	... 27·4
Wrists	133 ...	... 26·6
Shoulders...	125 ...	... 25·0
Elbows	125 ...	... 25·0
Hips	73 ...	... 14·6

From this table it is seen that next to the hands the knees come in order of frequency, but it may be mentioned that Haygarth only found two cases out of his total in which the knees were involved. The most commonly affected joints of the hands are the proximal phalangeal articulations of the second finger, the index finger, and the thumb respectively; the ring finger is but seldom affected. The temporo-maxillary joint is invaded in about 25 per cent. of all cases, and when so affected has been shown by Sir A. Garrod to be a diagnostic sign of extreme value, especially as it is unusual for this articulation to be attacked in other arthritic diseases.

The symmetrical arrangement of the joint lesions in osteo-arthritis is well exhibited also in the small peripheral articulations. The malady frequently begins in the same joint or joints of both hands, but occasionally the lesions are more severe on one side of the body, or are even entirely unilateral throughout.

The muscles atrophy.—Osteo-arthritis in a

joint, whether acute or chronic, is almost invariably accompanied with atrophy of the muscles that govern its movements. Drs. Spender and Ord are of opinion that the atrophy is an early symptom in this disease, but there is little doubt that in by far the greater number of cases the joint lesion apparently precedes their wasting. I say apparently because, in many cases at least, there is a progressive atrophy of muscles taking place concurrently with the change in the joints, which may not be readily appreciable on account of the process affecting the atrophy of muscle being slower than that producing the morbid change in a joint. The muscles become flabby before any wasting can be observed, and the atrophy always involves the whole of the muscle, whatever its length, although, if a large one, some sets of fibres waste more than others. The atrophy continues for some time, depending on the acute or chronic nature of the disease, and then becomes stationary, or it may continue as long as the joint mischief is active, or even after this has ceased to be so. The atrophy may be very slight, or so exaggerated as greatly to add to the distortion which ensues from the enlargement of the articular ends of the bones. Occasionally fibrillary twitchings have been noticed in the atrophied muscles, or the individual has even suffered from shaking palsy.

Dr. A. E. Garrod[1] mentions one case in which dropped-wrist was associated with this disease. The extensor muscles of the affected articulation are principally involved, but in some cases both the extensor and flexor muscles suffer, and at times also some of the muscles in the vicinity of an affected joint are attacked, although they may have nothing to do with its movement.

In osteo-arthritis of the wrist we see atrophy of the extensors of the forearm, and of the fingers; the wasting of the interossei and of the abductor indicis being commonly very prominent: when the ankle is affected there is atrophy of the muscles of the calf. In osteo-arthritis, like other forms of arthritic muscular atrophy, the electrical reactions may be normal, but usually there is a distinct and sometimes a great increase in the myotatic irritability, although this is not constant, which is associated with proclivity to spasm of a cramp-like nature, or even to clonic spasms which may be painless. The tendon reflexes are usually much exaggerated, not only of the affected limbs but of others also; but while they may happen to be increased in one case, in investigating other precisely similar cases we may find them either lessened or normal. It seems that when the limb on one side is affected before the corresponding limb of the opposite side,

[1] *Loc. cit.*, p. 260.

the reflexes may be more exaggerated in the limb last attacked, whereas they have been found greatly increased in late stages of the arthritic lesions.

Distortions.—The muscular distortions seen in osteo-arthritis are common, not only to this disease, but to some other chronic forms of arthritis, and to certain non-arthritic diseases of the nervous system. It is by means of the pronounced and tenacious spasmodic contraction of the muscles that the various distortions, so frequently seen in a well advanced attack of osteo-arthritis, are produced, and which after a time become persistent and fixed from perpetual shortening of the affected muscles.

The character of the distortion exhibited is contingent on the comparative strength of the opposing sets of muscles, *i.e.*, the extensors and flexors. In severe cases there may be partial displacement of the heads of the bones, or in young people separation of the epiphyses. Joints and tendons may become dislocated also, and in exceptional cases dislocations may arise in articulations not themselves affected. The deformities as met with in the upper extremities have been classified by M. Charcot[1] into two chief types with secondary derivatives.

[1] *Loc. cit.*, p. 201.

First type.—This is the most frequently seen, and is characterised :—

1. By the flexion of the terminal phalanges upon those of the second row at an obtuse, or even an acute angle.

2. By the extension of the second phalanges upon the first.

3. By the flexion of the first phalanges upon the heads of the metacarpal bones.

4. By the flexion, at an obtuse angle, of the metacarpus and carpus upon the forearm.

5. In a great number of cases there is an inclination of all the phalanges towards the ulnar side of the hand, then a deviation of the second phalanges on the first phalanges towards the radial side. The former of these lesions is often the basis of the first distortions which signalise the onset of the malady.

There are two varieties of this type ; in the first most of the characters mentioned above are preserved, only the second phalanges form a straight line with those of the first.

In the second, the flexion of the terminal phalanges upon those of the second row, gives way to extension.

The *second type* is characterised :—

1. By the extension of the distal phalanges upon those of the second row.

2. By the flexion of the second upon the first phalanges.

3. By the extension of the first phalanges upon the heads of the metacarpal bones.

4. By flexion, more or less pronounced, of the metacarpus and carpus upon the forearm.

5. In certain cases there is a deviation of all the phalanges towards the ulnar side of the hand.

The varieties of this type are two also. In the first there is flexion of all the articulations of the hand except the distal articulations, which are extended. In the second, there is the same flexion of all articulations except those between the first and second phalanges, which are extended.

When the thumb is affected, the metacarpo-phalangeal joint is found especially altered. The first phalanx of the thumb is more frequently maintained in flexion, sometimes in extension. The other articulations of the upper extremity participate to a certain extent in these deformities. Thus, flexion of the elbow is more or less pronounced, sometimes exaggerated, and extension is impossible. The forearm is pronated. More or less complete flexion of the carpus and metacarpus upon the forearm exists, with projection of the ulna and of the radius.

Finally, the shoulder is sometimes rigid and the upper limb is fixed against the chest wall.

When we call to mind how subject the interossei muscles are to atrophy, it is not

surprising that they should play a significant *rôle* in the production of the hand deformities just specified. For these little muscles flex the first phalanges on the metacarpals, and extend the second phalanges upon the first, and so, when their spasmodic contractions are strong they give rise to examples of the first type, but when weak to those of the second type. A similar description, *mutatis mutandis*, would serve for the distortions of the lower limbs. As might be expected the less the development of osteophytes the greater will be the muscular distortions. Although it has now been proved that these distortions are due to spasmodic muscular contractions, different opinions have been offered as to their causation. Trastour, for instance, maintained that they were the result of attitudes instinctively taken by patients suffering from this disease.

Later Skin Changes.—I have already mentioned the earlier nutritional changes in the skin, but others occur at a later stage of the affection. There is often a slow perversion of nutrition, during which the skin becomes red, thin and glazed, and is then said to be glossy (Paget), or it becomes simply shiny without change of colour. There may be wasting of the subcutaneous tissues also, so that the ends of the fingers become pointed; and trophic ulcers were seen on the fingers in one

case (Hadden). The hair and the nails may be interfered with in their growth, and the latter become brittle and ridged longitudinally.

The occurrence of fibrous nodules among the muscles of the arms and forearms, as mentioned by Dr. Hilton Fagge, must be extremely rare. In case No. V., three such nodules were to be felt.

Visceral Lesions.—Although such a high authority as Professor Charcot maintains that cardiac affections are sometimes developed in the course of idiopathic polyarthritic osteo-arthritis; in this country, at least, it is extremely difficult to trace any cardiac lesion to osteo-arthritis.

The majority of English writers do not mention them as occurring, and Sir Alfred Garrod writes[1]: "I have never met with an instance in which I could trace the occurrence of pericarditis or endocarditis to rheumatoid arthritic disease, and I am of opinion that the absence of cardiac inflammation is one of the best tests for distinguishing this malady from genuine rheumatism." However this may be, there is no doubt in Case No. IV., the patient, a lady, seen by Sir Alfred Garrod, contracted pericarditis (diagnosis confirmed by Dr. Ringer) on her return from Aix-les-Bains. Another curious phenomenon this patient exhibits whenever she falls a little below her

[1] *Loc. cit.*

usual state of health, is a consolidation of the base of the left lung, sometimes the right also, accompanied by intense pain, but with no febrile disturbance, the whole condition clearing up in three or four days.

Generally speaking in cases in which cardiac disease is associated with osteo-arthritis, there is a history of an antecedent attack of acute rheumatism. Again, as children are so subject to cardiac lesions in acute rheumatism, we might expect to find the heart involved when they suffer from osteo-arthritis, but such is not the case. With regard to other visceral diseases such as phthisis, bronchitis, interstitial nephritis, &c., they are probably only associated with osteo-arthritis as intercurrent maladies.

Blood.—Similar to that of simple anæmia; there being a deficiency of red corpuscles and of hæmoglobin.

The *urine* may be normal or may show great variation in the quantity of urea and uric acid secreted, or may even temporarily contain sugar (Money). A reduction in the quantity of phosphates has been pointed out by Drachmann.

Complications.—There is no doubt but that certain skin affections occur in a large number of cases, and Sir Alfred Garrod[1] points out that psoriasis is very commonly seen at the

[1] *Loc. cit.*

same time that the joints are involved, and, further, that it may either precede or follow the onset of the articular lesions, and that sometimes the two alternate with each other.

Eczema and prurigo may also occasionally occur. With respect to affections of the eyes such as conjunctivitis, sclerotitis and iritis, opinions differ as to whether they are really complications of osteo-arthritis. Sir Alfred Garrod[1] says that all three are frequently combined, and believes that, when not associated with gonorrhœal arthritis, they are of the nature of the disease under consideration. If we look upon these inflammatory conditions as vaso-motor disturbances there is no difficulty in connecting them with osteo-arthritis.

Diagnosis.—In its fully developed state poly-arthritic osteo-arthritis is not as a rule difficult to diagnose, especially when the smaller joints are the first to be invaded, but it is very important to the sufferers from this malady, particularly so far as relief or recovery is concerned, that this disease should be recognized in its early premonitary stage, before any objective sign is to be seen in the articulations. It is necessary, therefore, to search for some of the more important early symptoms which taken together rarely leave any doubt as to the nature of the disease. If, for instance, an

[1] *Loc. cit.*

individual should present the appearance of more or less anæmia, complain of feeling tired and of having no energy, and of pains in various parts, some referred to the joints, and some to the muscles (especially on the inner side of wrist or ball of thumb), and of numbness and tingling in the extremities, and of a crackling sensation, and perhaps some stiffness in the joints on movement, the whole often accompanied, in young subjects at least, by a rapid pulse rate with high tension, and possibly some form of pigmentation, there would be little difficulty in giving the name of osteo arthritis to this group of symptoms.

There may be, however, only two or three of these early signs exhibited, and then great care is needed in examining into the whole history of the patient, especially as to heredity. The sex, too, and to a certain extent the age of the subject, will assist one in forming an opinion. A not uncommon and important early guide in the disease of the cervical vertebræ is stiffness of the neck, accompanied perhaps with tenderness over the spines of the vertebræ, care being taken to exclude that due to muscle. But there is one early symptom complained of in many cases, namely, stiffness of the jaw, especially on first exercising it after a night's rest, that will at once, even standing alone, direct our attention to osteo-arthritis, particularly if we are careful to eliminate other

common causes of stiffness of the jaw. When conjoined with any other early sign, the diagnosis is assured.

It may be difficult to differentiate an acute attack of osteo-arthritis from an attack of acute or even sub-acute rheumatism, but this differentiation can generally be effected by noting the principal points which distinguish it from the latter disease; positively, by the fact that the articular swellings (of the larger joints at least) are more circumscribed, by the special susceptibility of the smaller peripheral joints to become involved, and by the progressive character and great obstinacy of the symptoms; negatively, by the absence of tonsillitis, of cardiac lesions, and of profuse acid sweats. From an acute attack of gout, poly-arthritic osteo-arthritis may be separated by the length of the paroxysm, by the want of periodicity, and oftentimes by the large and small joints being indiscriminately invaded in its development, and by there being no particular susceptibility to the invasion of the metatarso-phalangeal joint of the great toes, although it must be remembered that these joints are also frequently involved in osteo-arthritis. From chronic gout it may be diagnosed by the absence of deposits of urates in the joints, ears, &c.; by not generally having dyspeptic symptoms as a concomitant; by occurring at any age; by attacking the delicate; and by a special predilection for the female sex.

Prognosis.—The earlier the disease is diagnosed the better will be the prognosis. Joints which are swollen and painful, and of which the nutrition has not been too much interfered with, may by appropriate treatment resume their natural contour and painless condition of health. Even when the cartilages are destroyed and the articular heads of the bones laid bare, the disease may be arrested, but not before great crippling has become manifest. In speaking of the occasional disappearance of deformities, Professor Charcot[1] says:—"We have ourselves observed facts of this kind which are unfortunately very rare. Thus in the case of a woman at first attacked with sub-acute rheumatism affecting the shoulders and the metacarpo-phalangeal joints, the spasmodic retraction of the fingers showed itself three months after the commencement of the malady; the consecutive distortion persisted for a whole year, then the patient was cured."

There are cases, however, in which the disease ceases to show itself without any medical interference whatever. On the other hand it is more generally slowly progressive, attacking joint after joint, irrespective of treatment, and lasting over a period of ten, twenty, or even thirty years. The prognosis is graver the younger the sufferer, but the affection itself does not directly cause death, this being

[1] *Loc. cit.*, p. 210.

due to some intercurrent malady, such as phthisis, kidney disease, bed-sores, or cerebral hæmorrhage, the first two of these diseases being a common cause of death in osteo-arthritis. It seems also that the exhaustion caused by pain may be a factor in bringing the sufferings to an end.

Heberden's Nodes.—I must here say a little concerning these nodes, which represent the most trivial and the most chronic form of idiopathic polyarthritic osteo-arthritis. They are usually limited to the terminal phalangeal joints of the fingers, the thumbs generally escaping. When, however, as occasionally happens, the second phalangeal joints are involved, the thumbs are often affected. One or two of the fingers on each hand only may be invaded, and the little finger is not uncommonly first affected. Some observers affirm that they have never seen these nodes on the toes, but it does not at all follow that they are not to be found there, and there is every reason to believe that they must exist in this situation also. Although, as above stated, these nodes are frequently limited to the third joints of the fingers, they are often seen to be associated with generalised lesions of other joints, which may precede or follow their development. They may also be associated with the lesion of a single large joint, such as the hip, &c. Individuals above fifty years of age

are most liable to be attacked, although the nodes have been noticed before forty, and several female members of the same family are frequently affected with them. The following passage taken from the 28th chapter of Heberden's "Commentaries," contains the first allusion to these small nodular outgrowths under the name "Digitorum Nodi." He asks:—"What are those little hard knobs, about the size of a small pea, which are frequently seen upon the fingers, particularly a little below the top, near the joint? They have no connection with the gout, being found in persons who never had it; they continue for life; and being hardly ever attended with pain, or disposed to become sore, are rather unsightly than inconvenient, though they must be some little hindrance to the free use of the fingers." They are chiefly bony outgrowths and are formed by the addition of osseous matter to the nodules that always exist on the dorsal surface of the phalangeal joints, one on each side. They are further made up of small protrusions of the synovial membrane, which may exist as diminutive cyst-like excrescences on the apex of each node. The contiguous articulations always exhibit the morbid changes found in osteo-arthritis. In some cases in which the joint lesions have been extreme, and the articular phalangeal heads have become enlarged, there may be radial deflection

here as in other cases. In the early stages of the disease there is pain, greatest at the beginning, before the nodes make their appearance. These pains, however, cease later on, but there is always more or less tenderness to pressure upon the swollen joints as long as the disease remains active. The slowly increasing enlargement of the articular heads of the phalanges greatly limits the movements of the joints, so that in time they may become quite fixed.

Various opinions have been held from time to time, since Heberden wrote, as to whether the nodes described by him are truly osteo-arthritic or gouty. We have seen that he distinctly stated that they were not of a gouty nature. Sir Alfred Garrod observes that he has but seldom met with them in patients suffering from true gout. Dr. A. E. Garrod,[1] whilst expressing his belief in the view that they have no necessary connection with gout, adds that he has himself seen such nodes in cases in which there were clear histories of gout, but of no other articular affection. This, however, on the hypothesis assumed in these pages proves nothing. Charcot is much more emphatic in his denial of all connection with gout. From the large number of investigations he made at the Salpêtrière, he was persuaded that the malady occurred in many

[1] *Loc. cit.*, p. 226.

individuals who had never suffered from gout, and that the morbid changes found in the joints were those of osteo-arthritis. But it is only fair to remember that a form of lipping occurs in many cases of gout, which when complete presents the appearance of true exostoses.

Dr. Begbie, on the other hand, believed that the nodules were either connected with gout or at least met with in subjects having a gouty diathesis. Sir Dyce Duckworth goes even further when he insists that they are of a truly gouty nature in many cases, and demonstrates also that the morbid changes found in the joints by Charcot are often of a really gouty nature. There seems to be no doubt that cases of true gout are sometimes looked upon as examples of the disease under consideration; but this is not at all surprising, when we consider that it requires great care to differentiate the lipping and the formation of exostoses which occur in gout, from a similar condition present in osteo-arthritis. The fact, too, that generalised osteo-arthritis may be associated with these nodes, is much more suggestive of that disease than of true gout. Again it seems possible from cases that have been reported, that osteo-arthritis may become engrafted on gouty joints and *vice versâ*. Dr. Emil Pfeiffer[1] believes the condition above described to

1 "Lancet," vol. i., p. 819, 1891.

be quite as typical of true gout as any attack of that disease manifesting itself in the ball of the great toe, and adds :—"The most conclusive reason which leads me to consider the disease as being of an entirely gouty nature is furnished by chemical examination of the urine." The following is a description of his test for gout :[1]—"Collect the whole of a twenty-four hours urine of a person, during the interval between the attacks or when the individual expresses himself as feeling well, and from the whole quantity take three portions of 100 c.cm. each. Acidulate 100 c.cm. with a tenth part of strong hydrochloric acid, specific gravity 1·12. Pass the second 100 c.cm. through a filter, on which is placed 0·5 grm. of chemically pure uric acid, and then acidulate with a tenth part of the hydrochloric acid. Pass the third 100 c.cm. through a filter on which place 0·2 grm. of the uric acid, and then acidulate in the same way as before. Allow the three portions to remain undisturbed for forty-eight hours ; collect on separate filters, and weigh any uric acid that may have been deposited."

Dr. Pfeiffer shows, by treating the urine of healthy persons, or of persons not suffering from gout, in this way, that in children, women, and old men the quantities of uric acid thrown down are as a rule equal, whilst

[1] "Lancet," vol. i., p. 1, 1891.

in young or middle aged men the portion passed through uric acid, yields a much smaller quantity of uric acid than the portion which has not been passed through the uric acid filter. He further shows that in gout, when the same rules are observed, the uric acid filters abstract the whole of the uric acid. Believing as I do that Heberden's nodes are nothing more than a very chronic form of polyarthritic osteo-arthritis, I have collected the urine of several cases representing this condition, as well as the urine of one gouty male patient, and of one patient suffering from polyarthritic osteo-arthritis, and have examined them in the way suggested by Dr. Pfeiffer, closely following his directions, with the results shown in the table on the following page.

From this table it is seen that in one case there was no deposit of uric acid, and that in all the others the amount of uric acid deposited from the uric acid filters was the same in quantity as that precipitated by the hydrochloric acid alone. In the gouty case there was only a trace after filtration through the uric acid, but in the polyarthritic osteo-arthritic case there was no perceptible difference. Although many more cases would have to be examined before anyone could arrive at an absolute conclusion, still, as every case examined yielded the same result, we may fairly argue that if the test be true there are some, probably

TABLE.

Name	N.	W.	W.	E.	E.	E. H. B.	C.	M. B.
Disease	Osteo-arthritis (Heberden)	Osteo-arthritis (Heberden)	Osteo-arthritis (Heberden)	Osteo-arthritis (Heberden)	Osteo-arthritis (Heberden)	General Osteo-arthritis	Gout	Osteo-arthritis[1] (Heberden)
Date	May 19, 1891	May 23, 1891	June 2, 1891	June 3, 1891	June 12, 1891	July 7, 1891	July 7, 1891	July 21, 1891
Reaction	Acid	Acid	Acid	Acid	Acid	Acid	Slightly acid	Slightly acid
Colour	Pale Yellow	Yellow	Yellow	Yellow	Normal	Pale	Pale	Pale
Appearance	Fine deposit (urates)	Not quite clear	Flocculent	Flocculent	Flocculent	Flocculent	Not clear	Not quite clear
Specific Gravity	1023	1016	1019	1025	1016	1016	1006	1010
Albumen	None	None	None	None	None	None	Trace	None
Sugar	,,	,,	,,	,,	,,	Trace	None	,,
100 c.c. acidulated with $\frac{1}{10}$ HCl	No deposit	Slight deposit	Slight deposit	Granular crystalline deposit	Slight deposit		Slight deposit.	Slight deposit
100 c.c. filtered through 0·5 pure uric and acidulated with $\frac{1}{10}$ hydrochloric acid and allowed to remain 48 hours	,,	,,	,,	,,	,,		Only a trace	,,
100 c.c. filtered through 0·2 uric acid		,,	,,	,,	,,			
		No weighable difference	No weighable difference	No weighable difference		No perceptible difference in amount	Alcohol by Iodoform test	No weighable difference

[1] In this case there is commencing general osteo-arthritis. The metacarpo-phalangeal joints of the index finger of the left hand is enlarged and painful; both the hands are stiff, and the same oint of the index finger of right hand is tender on pressure.

very many cases, *at least of* Heberden's nodes, which cannot be referred to gout, and if there are some, it seems more reasonable to assume that all cases of Heberden's nodes, if we qualify them by the term true, are osteo-arthritic.

Secondary or irregular forms.—Polyarthritic osteo-arthritis, instead of arising in the form of an idiopathic disease, may be evoked secondarily to some other articular malady. For instance, it may follow an attack of acute rheumatism; an attack of gonorrhœal arthritis; or repeated attacks of gout. When it follows an attack or attacks of acute rheumatism, during which the patient may have contracted some cardiac lesion, &c., it unfolds itself in the following manner. Instead of resolution taking place in the ordinary way, some of the joints, particularly the small ones, remain painful, and this pain from time to time becomes more severe. Later on all other symptoms, including muscular atrophy and spasmodic contraction of muscles, commence to show themselves in the same way as in the idiopathic disorder. It seems probable that the joints which were invaded in the attack of acute rheumatism, are those first to be affected in the supervening osteo-arthritis. This is especially so with those of the hands and feet, as is well seen in Case V.

If the hypothesis as to causation assumed in these pages be allowable, it is not difficult to see that patients having suffered from acute rheumatism are brought into just such a state of health, that will, in those predisposed, induce an attack of osteo-arthritis; and we should expect to find the same joints (at first) affected in both cases, for the simple reason that the joints invaded in the antecedent acute rheumatism have already had their nutrition more or less interfered with.

The cases in which osteo-arthritis follows gonorrhœal arthritis are much less common than the preceding, from the fact that gonorrhœal arthritis is essentially a disease of men, and that it is not nearly of such frequent occurrence as acute rheumatism. Sir Alfred Garrod[1] observes: "I have known several cases exhibiting all the characters of rheumatoid arthritis, apparently arising from that form of rheumatism which is associated with urethral inflammation." Dr. A. E. Garrod[2] also says: "I have myself seen more than one case in which the typical osteo-arthritic lesions were dated from attacks of gonorrhœal arthritis." Others also, as Charcot[3] and Lorain,[4] mention cases.

Case VI. illustrates the commencement of

[1] "Gout and Rheumatic Gout," 3rd edit., 1876.
[2] P. 269. [3] *Loc. cit.*
[4] "Union Med.," 1866, xxxii., p. 617.

the malady as occurring after repeated attacks of gonorrhœal arthritis.

As to whether true osteo-arthritis develops in gouty joints, opinions vary; for, although erosion of cartilage and osteophytic outgrowths are found in joints that have been the seat of recurrent attacks of gout, it requires very close observation to distinguish between the lipping here and that occurring in osteo-arthritis.

Sir Dyce Duckworth maintains that in the majority of cases the changes found in gouty joints closely resemble, but yet are quite different from, those seen in osteo-arthritis; in fact, that they are essentially gouty. Mr. Hutchinson, on the other hand, argues that osteo-arthritis is often the result of rheumatism and gout combined in varying proportions. It should be mentioned that osteo-arthritic changes have also been noticed in the joints of those suffering from osteitis deformans. Now if we look upon all these diseases as merely so many branches of a basic arthritic diathesis, so long as the base continues to pour forth the same influence into each branch, they would retain their distinctive characters, but any modification in the base might lead to a similar modification in the branches, and in exceptional cases two of them might become associated.

Localised osteo-arthritis.—This form of the disease is usually confined to a single large

joint, at any rate for some time. It differs from the polyarticular variety in generally budding forth in advanced life, and in being much more common in the male sex. The joints too in immediate proximity to the trunk are most liable to be affected, *i.e.*, the hip and the shoulder, the former being the special joint of predilection, and the disease as occurring in this joint was christened by Dr. Adams "malum coxæ senile," but this he afterwards exchanged for that of chronic rheumatic arthritis, when he found that it arose in middle life also. Further, although in exceptional cases the hip or shoulder on the opposite side may become affected, there is usually an absence of symmetry. Should, however, the disease become general, as it may, a similar symmetrical arrangement of articular lesions is noticed to that which is observed in the generalised form. This single joint form frequently takes its commencement from an injury, not only to the joint which becomes invaded, but also to the structures in the vicinity. In the aged, as already stated, a very trivial injury is enough to set up the malady (diathesis probably then acquired).

Some authorities, however, as Dr. Pye-Smith, look upon the condition started by the injury, as of the nature of a senile change.

The morbid changes here found are in every respect identical with those seen in the poly-

arthritic form of the disease, but the clinical features present some differences, and prior to Adams and his fellow labourers they were usually misinterpreted and supposed to indicate fracture. As in generalised osteo-arthritis, one of the first symptoms complained of is pain. Taking the hip-joint as an example, there is deep-seated pain of a gnawing character in the joint and also pain referred to the knee. There is more or less rigidity which increases as the malady advances, and greatly interferes with the movements of the joint, so that the sufferer may be unable to rotate the affected limb or to cross it over the other without assistance. The pain also slowly becomes intensified, but as this is not greatly aggravated by pressure on the acetabulum the patient can generally hobble about. In the later stages of the affection there is grating of the denuded bony surfaces, and later still[1] great shortening of the limb, owing to absorption of the head of the femur and flattening of the acetabulum. The whole limb and foot may be greatly everted. There is much atrophy, as in the polyarthritic form, of the muscles concerned in the movement of the diseased joint, such as the gluteal muscles of the affected side: and other muscles in the vicinity, as those of the thigh, may atrophy to some extent. The reflexes of the limb are

[1] Adams, p. 50.

exaggerated, and the knee-jerk of the unimpaired side may also be increased. The same group of symptoms, *mutatis mutandis*, will answer for other large joints, such as the shoulder or the knee.

Synovial tumours of considerable size are occasionally observed at some distance from the affected joint, and having no obvious relation to it. Of these Mr. Morrant Baker says:[1] —"The synovial fluid on reaching a certain amount of tension by accumulation within the joints, finds its way out in the direction of least resistance, either by the channel by which some normal bursa communicates with a joint, or, in the absence of any such channel, by forming first a hernia of the synovial membrane. In both cases should the tension continue or increase, the fluid at length escapes from the sac, and its boundaries are formed only by the muscles and other tissues between and among which it accumulates."

A disease that may be confused with osteo-arthritis of the hip-joint is sciatica, but it can generally be distinguished from the arthritic affection by the difference in the distribution of the pain, and by there being no interference with the motion of the articulation.

[1] "St. Barth. Hosp. Rep.," 1885-1887.

CHAPTER VI.

Treatment.

In former times the treatment of this malady received little attention. Haygarth[1] himself apologises for the scantiness of information he can give as to treatment, and says:—"As far as my experience extends much benefit was derived from the warm bath and a stream of warm water with repeated application of leeches on the diseased joints. In several very bad cases these remedies afforded manifest relief."

Depletion also seems to have been practised, but with obvious disadvantage to the patient. It is essential that the treatment adopted in this disease should be directed to the improvement of the general health, and to be of real service must be commenced as early in the affection as possible. The importance of this has been especially referred to of late years by Sir Alfred Garrod, Drs. A. E. Garrod, Spender, and others.

Diet.—Sir Benjamin Brodie was of opinion that the patient should be placed on a very spare diet, eating only moderately of animal

[1] On "Nodosity of Joints."

food, avoiding fruit, acids, raw vegetables and sugar, and taking little or no alcohol.

At the present day, however, it is universally recognised that osteo-arthritis being a disease of lowered vitality requires a nutritious diet with a moderate amount of alcohol with the food. Sir Alfred Garrod[1] says :—"I consider it of the utmost importance throughout the whole course of the disease to support the system and to allow the patient as nourishing a diet as he is capable of digesting. Meat should form a considerable portion of the diet, and when it cannot be taken as ordinarily cooked, it is of advantage to have it in the form of potted meat or panada, taking care that the whole of the juice of the meat be introduced." There is no doubt also that a glass of stout, port, or Burgundy prescribed with meals greatly assists assimilation.

In cases in which digestion is impaired stomachic tonics may be required.

In acute cases the diet should be light and easy of assimilation.

Drugs.—In acute cases the remedies prescribed should be those calculated to relieve the febrile state, such as salicine or an effervescing quinine mixture. In the chronic form of osteo-arthritis the drugs most serviceable are iodides, free iodine, arsenic, guaiacum, cod-liver oil, actæa racemosa and fraxinus ex-

[1] *Loc. cit.*

celsior. Charcot, Trousseau and others, following Lasègue, speak well of tincture of iodine in five to fifteen minim doses taken with food. Iodide of potassium has been extensively employed in this country, especially by Fuller, who found it of great benefit in many cases where pains in the joints were worse at night. Iodide of potassium is best given in small doses some two or three hours after food for short periods. Dr. Fuller also speaks highly of the syrup of the iodide of iron, which has more or less of late years, especially through the teaching of Sir Alfred Garrod, superseded iodide of potassium. In the early stages of this disease, and often in advanced ones, great benefit is derived from this drug. It may have to be given for one or two months at a time before material improvement is noticed in the joints, although the pains may often rapidly be relieved by its agency, and its administration should be continued for several months with only occasional suspension. Iodide of iron may also be given in the form of a pill when patients tire of the syrup. In many early cases this treatment alone either effects a permanent arrest of the disease, or at least produces marked improvement. Another highly valuable drug in the treatment of this malady is arsenic, first used in the treatment of osteo-arthritis by Dr. Jenkinson of Manchester in 1809. Dr. Fuller

recommends this drug and mentions the kind of case which is likely to benefit by its administration. He writes[1]:—"The patients referred to suffer greatly from cold, and rarely if ever perspire, however warmly they may be clad, however active the exercise they take and however great the heat to which they are subjected. Such cases are always more than usually obstinate and therefore intractable to ordinary remedies." Sir Alfred Garrod greatly extols arsenic, particularly the arseniates, given in combination with iodide of iron. Professor Charcot was of opinion that arsenic was uncertain in its action in osteo-arthritis. Dr. Hilton Fagge says that it sometimes does great good, and that it must be given in small doses and persevered with for a considerable period. He points out, however, that it is often absolutely ineffectual. Dr. Pye-Smith[2] says:—"Given in full doses I have found it the most efficient drug in this disease, although no doubt cases occur in which it is useless." Baths also consisting of arseniate of soda and bicarbonate of soda on alternate days have been strongly recommended by Monsieur Noël Gueneau de Mussy.[3]

[1] *Loc. cit.*, p. 362

[2] Fagge's "Principles and Practice of Medicine," vol. ii., p. 559.

[3] Dr. A. E. Garrod's "Treatise of Rheumatism and Rheumatoid Arthritis," p. 295.

Of all drugs used in the treatment of this disease, there is little doubt that cod-liver oil ranks as one of the most valuable. It should be taken for a lengthened period and in fairly large doses. Of other drugs used in the treatment of this affection colchicum and the alkalies were formerly given, and Dr. Fuller recommended that they should be administered to the robust; he also highly praised an infusion of the leaves of fraxinus excelsior. Dr. Ringer[1] in speaking of actæa racemosa says that in his hands it has produced very satisfactory results, that it is very useful in those cases in which the pain is more severe at night, and particularly when the disease is associated with any uterine disturbance. Tonics, such as quinine, strychnia and nux vomica may be prescribed with benefit in some cases. Ichthyol has recently been lauded by Lorenz as of great service in the treatment of osteo-arthritis, but others have found it useless. In the case of painful muscular cramps Dr. A. E. Garrod has found hyoscyamus of great utility in the relief of the pain. In some cases I myself have given antipyrin in ten grain doses, combined with a stimulant, and the result has been a speedy cessation of the pain. It is necessary, if the patient suffer from constipation, that the action of the bowels be carefully regulated.

1 "Handbook of Therapeutics," 1878, p. 415.

Should any of the assigned causes of this disease exist treatment should be directed to their removal. Great care should be bestowed on the clothing of patients. Thick woollen underclothing should be worn in winter and thin woollen underclothing in summer, over the whole body. If possible, all cares and anxieties should be removed, and a warm, dry habitation should be chosen. Change of climate, as will be shown, is a very important factor in the treatment of this affection.

Local Treatment of the Joints.—When the joints are painful or swollen they may be either painted over with tincture of iodine, strapped with plaster, or rubbed with belladonna liniment. Sir Alfred Garrod speaks highly of the use of a liniment of cantharides, and says it is more convenient than an ordinary blister. He also highly recommends the joints to be rubbed with iodide of cadmium ointment night and morning. Trousseau advocates the burying of the affected joints in hot sand, at as high a temperature as can be borne, three times a day, for an hour or so at a time. The patients should use their joints only to such an extent as will not cause them to become more painful on the following day.

Electrical treatment.—Remak was the first to introduce electricity into the treatment of

osteo-arthritis. Since Remak's time, others, as Boudet, Lacaze-Dori, Althaus and Steavenson have written of its efficacy. It often produces considerable benefit in cases in which drugs have entirely failed; it relieves pain, lessens or causes the disappearance of the deformities, aids the absorption of the nodosities, and restores the wasted muscles to their normal bul.. and tone. The continuous current is generally the best, and has been applied in various ways by different investigators. By some, as Lacaze-Dori, the positive pole is placed in the cervico-dorsal region of the spine for disease of the upper extremities, and in the dorso-lumbar region for disease of the lower, the extremities themselves being immersed in a porcelain basin full of water, to which a little salt has been added, and having a temperature equal to that of the body, the negative pole being then plunged into the water. The intensity of the current should be about 15 to 20 milliampères. The applications should be made every day for the first month, and be continued for from ten to fifteen minutes each time. Remak and Meyer advised that the continuous current should be applied to the sympathetic nerve. Others simply apply a narrow terminal, connected with the positive pole below each of the affected joints in turn, and a sponge connected with the negative pole higher up the limb, or

closer to the spine. The late Dr. Steavenson strongly recommended the continuous electric current bath in the treatment of osteo-arthritis. He stated that the baths would not cure inveterate cases, but would arrest the progress of the disease and somewhat reduce the pain and swelling of the joints, and otherwise produce some improvement in the general symptoms. In the "Lancet" for March 28th, 1891, he gave a very concise account of the bath and how it should be used.

Thermal Treatment.—In the treatment of osteo-arthritis some authorities have recommended the cold shower bath or douche; and others, in some cases, have found the vapour bath of great service, if not too frequently employed. Dr. Wright, of Birmingham, pointed out that the warm bath, rendered alkaline by the addition of bicarbonate of soda or potash, was of benefit in cases in which ordinary treatment had failed. Ferruginous waters are often of great use where there is much anæmia. Ordinary salt or sea-water baths are of value in some cases; and from my own experience, I feel sure that great benefit is frequently derived from mild Turkish baths taken with all necessary care.

Among places to which patients may be sent for treatment by baths and douches, may be mentioned Harrogate, Buxton, Tunbridge Wells, and Bath; but with regard to

the last named place great discrimination in cases is required, although it is only fair to mention that the Aix treatment can be most efficiently carried out here, and that its newly-opened establishment contains the most perfect arrangements to this end. Dr. Spender, in a paper to the "Lancet," 1889, observes :— "Most good is to be expected from our thermal waters when there is an antecedent history of rheumatism or gout. In other cases, when osteo-arthritis is distinctly a sign of local or general deterioration, internal medicinal treatment is of at least equal value."

Sir Alfred Garrod is of opinion that many cases return from Bath the worse for their sojourn there.

Abroad the most celebrated and efficient places are:—Aix-les-Bains, Aix-la-Chapelle, Barèges, Wiesbaden, Wildbad, Baden-Baden, Carlsbad, Marienbad, Schwalbach, Spa, Teplitz and Vichy. At Barèges the waters contain sulphur, and are sometimes of benefit in atonic long-standing cases, but as the warm season does not commence until about the middle of June, other places are to be preferred.

This is especially the case with Aix-les-Bains which was well known to the Romans, and is situated in a beautiful neighbourhood, and near some of the prettiest scenery in the Alps. Patients may be sent there early

in May, for the heat only continues intense from June to the middle of August when it again subsides.

There are probably no other sulphur baths in which the appliances are so complete. There are massage baths, private and public, for men and women; and every kind of vapour bath, douche and inhalation chamber, with an abundant supply of hot water at a high temperature.

It has been said that the successes of Aix are the effects of the skilful application of warm water rather than of sulphur water proper. Be this as it may, there is no doubt that the treatment has produced a complete arrest of the disease in many early cases, and in more advanced examples great improvement has been sustained for a long period. Dr. A. E. Garrod thinks that those patients who have been taking iodide of iron, cod-liver oil, &c., for some time, derive the greatest benefit from the Aix treatment, also that all drug treatment should be discontinued during the baths. Three weeks is the usual time for patients to remain at Aix, and this should be followed by a trip to some dry and bracing place for a fortnight. It is advisable also for patients to return to Aix regularly for a few years. It should be mentioned that there are cases in which no improvement takes place whatever the treatment adopted.

ILLUSTRATIVE CASES.

Case I.—Mrs. B., æt. 32, married, no children, no miscarriages. It is doubtful whether her mother, who died from phthisis, suffered from osteo-arthritis. Father suffered from gout. One brother and five sisters. Mother's sister suffered from some articular affection. No history of exposure or emotional disturbance. Patient has generally enjoyed good health. For some twelve months patient has complained of a feeling of weariness, accompanied with a tired feeling and aching limbs, both on going to bed and on rising in the morning, also of a sensation of pins and needles in the extremities, and burning of the soles of the feet. About six months ago she experienced pain in her wrists, which was followed by slight swelling there, and pain and slight swelling in the finger joints and stiffness on closing the hands. She complained also of sweating of the feet and of her skin becoming darker and dry. Patient only slightly anæmic looking, sallow, dark complexion, well nourished, much freckled over face, upper chest, arms and hands. Pulse 70. Does not suffer from palpitation. No cardiac mischief. The wrist joints are very slightly swollen and tender, and the middle joints of

the fingers also. There is no apparent atrophy of the muscles. In the lower limbs the ankles are also slightly swollen and tender.

On microscopical examination of the blood of this patient I found a few red corpuscles of smaller (microcytes) size than normal. Estimation of the value of the red discs by means of the hæmocytometer and hæmochromometer, yielded the following result:—The number of red discs counted on ten squares of the hæmocytometer was found to be 375, indicating a corpuscular richness of ·75. The percentage of hæmoglobin, as measured by the hæmochromometer, was 45. Therefore the average value of the red discs was $\frac{45}{75}$ or $\frac{3}{5}$ of their normal value. The treatment adopted in this case has been the improvement of the general health by means of good nutritious food, iodide of iron and arsenic. Under this the pains and swellings have become considerably less; but the patient is very erratic and will not take drugs regularly.

Case II.—Mrs. N., æt. 49, married, lodging-house keeper. Father died from some cardiac affection. Mother suffered from some chronic articular disease. An only child. No history of exposure. Patient has not suffered from any particular illnesses. At the present time both knees are stiff and painful, and emit a crackling sound on movement.

The left knee is swollen and tender. All the terminal phalangeal joints of the fingers exhibit Heberden's nodes. Patient has a sallow complexion, is somewhat anæmic, but stout, complains much of languor, and feels tired and stiff on rising in the morning. No muscular atrophy. All the viscera appear normal. This patient's urine has been examined, and the result given in the table under Heberden's nodes. Her blood gave the following results:—With hæmocytometer 380 red discs in ten squares $= {}^{3}\frac{8}{5}{}^{0} = \cdot 76$; with hæmochromometer 55 per cent. of hæmoglobin. Therefore the average value of the red corpuscles was $\frac{55}{76}$ of their normal value. Patient has been treated with iodide of iron in syrup and solution of arseniate of soda, and has improved. The left knee is now the same size as the right.

Case III.—Miss F., æt. 57. Grandmother either suffered from osteo-arthritis or from rheumatism, probably the former. Parents apparently healthy. No tubercular history. No history of exposure or emotional disturbance. Patient an only child, was more or less weakly, but periods were normal, ceased at the age of 48, soon after which she had pain in the right elbow and hand, with tenderness and slight swelling. Three weeks later the same condition was exhibited in the left elbow and hand. For several months the affection

was confined to the above joints. The symptoms complained of, however, varied in intensity from day to day, being more marked on one side one day, and on the other side another day. After this both ankles became painful and swollen, but the knees, especially the right, did not appear to be affected till five years ago. Patient at the present time is very anæmic, has a slow and small pulse, and no cardiac lesion. She can only get about with difficulty. The movements of the cervical spine are slightly impeded, patient being unable to move her head freely, particularly to the right, in which direction she can only partially turn it. Temporo-maxillary joints not involved. The fingers of both hands are deflected to the ulnar side, and present the first variety of Charcot's type, namely, flexion, that is, all the articulations of the hands are flexed, except the terminal phalangeal joints, which are extended. The articular heads of the bones are much enlarged, especially the metacarpo-phalangeal joints of the index finger, and in many of the joints movement is extremely limited and gives rise to pain. There is much wasting of the interossei muscles, and of the thenar and hypothenar muscular eminences. The elbow joints are greatly involved, and their movement much interfered with, and the muscles of the arm and forearm are extensively atrophied. The

right knee and ankle are tender and much enlarged, emit a crackling sound and are painful on movement. The corresponding joints on the left side present the same symptoms, only in a much less degree. There is slight pain and tenderness over the hip-joints. The knee-jerk is exaggerated on the left side, and there is much atrophy of muscles. The joints of the toes are deformed, especially the metatarso-phalangeal joint of the great toe. The blood on microscopical examination showed the various sized red discs as seen in anæmic blood; but there was no separation of the hæmoglobin, nor any particular increase in the number of white corpuscles. The value of the red discs, as estimated by the hæmocytometer and hæmochromometer, was $\frac{25}{52}$ per cent. of their normal value.

The chief treatment in this advanced case has been nourishing food, drugs of all kinds being of little service. Electricity was also useless.

Case IV.—Madame S., aged 33, married, six children. Grandmother said to have suffered from some articular disease. Patient has enjoyed fairly good health, and has not been subject to damp or exposure, but has had children very rapidly. She complains of pain and stiffness of her hands and feet, and of muscular cramps of the legs and of burning

and tingling of the extremities. She is slightly anæmic, apparently well nourished, has a dark complexion, a clear and fine skin and brown eyes. The metacarpo-phalangeal joints and the middle joints of the index, second, and little finger of both hands are enlarged and tender. There is slight stiffness of the temporo-maxillary articulation. Her ankles are also slightly swollen and painful. No muscular atrophy.

There are no visceral troubles. This attack commenced in the latter part of 1879, and early in 1880 she saw Sir Alfred Garrod, who advised that she should go to Aix-les-Bains in the following May. Before going to Aix she was treated with iodide of iron and cod-liver oil. After staying there about a month, she returned viâ Paris, where she remained for a few days, seemed to get a "chill," and arrived in London with follicular tonsillitis, and three days afterwards, before she was convalescent from the tonsillitis, she developed a typical attack of pericarditis of a very acute and severe nature. She was seen by Dr. Ringer, in consultation, who confirmed the diagnosis, and after many weeks she recovered without any noticeable adhesions remaining.

Since this time the patient has suffered from occasional attacks of osteo-arthritis, the same joints being involved, which are now, in 1891, slightly enlarged, but painless. From 1885

to 1890 the patient has suffered from several attacks of the following condition. In 1885 she seemed to get another "chill," suffered from great cardiac pain, oppression of chest and dyspnœa, and in addition, exhibited signs of pneumonia at the base of the left lung, except that there was no fever, no cough, no sputa, and little or no crepitation. The whole of the consolidation cleared up in three days to be followed by a precisely similar attack three days later. She had a like attack in the spring of 1887 which passed off just as quickly. Her last attack in 1890 closely resembled the antecedent ones, the only difference being that the consolidation was more extensive, and as this was clearing up on the third day, the right base became consolidated. The left base was apparently normal on the fifth day, and the right on the seventh.

Case V.—Mrs. E. H. B., æt. 39, a lady with very fair complexion, light golden hair, and blue eyes; who has always held a good social position, and been sheltered from care and anxiety and well nourished, married, one child, æt. 20, male. Parents dead. Father during lifetime suffered from gout, died from uræmia. Mother died at patient's birth from puerperal fever, said to have been phthisical. Has one brother, who does not suffer from gout, and one step-sister who is in apparently good

health. Patient has suffered much from tonsillitis, particularly the follicular form, and also from dysmenorrhœa and excessive leucorrhœa. In March, 1889, she had a serous effusion into left wrist-joint. This entirely disappeared, but patient has complained ever since of more or less fatigue on using her hand. On August 1st, 1890, patient had an attack of tonsillitis, which was prolonged and tedious, and accompanied with great œdema of the uvula. Just as she was recovering from this, she seemed to get a "chill," and complained of pain in her ankles, which on examination were found to be swollen and tender. On the next day, August 20th, an attack of acute rheumatism was manifest.

The temperature curve for three days varied between 102°, and 103·4°, but during the remainder of this illness, which continued for seven weeks, it only varied between 99° and 101°. The joints affected were the ankles, the knees, the elbows, the wrists, and those of the fingers. There were slight pains complained of in the hips also. There was slight sore throat on and off during most of the attack. The heart was much affected. Patient lost much flesh during her illness and became anæmic. At this time there was slight œdema of the ankles and hands. She went to St. Leonards about the middle of October still complaining of much stiffness of

the joints, especially the knees and ankles, and of pains and stiffness in the elbows, wrists and fingers. During her stay at this place I saw her and noticed that the middle phalangeal joints of the middle fingers of both hands were tender and slightly enlarged, the left slightly more advanced than the right. The left little finger was involved, the terminal phalanx being flexed on the second, and the second on the first. The metacarpo-phalangeal joint of the left index finger was also invaded, being painful and a little swollen. The wrists were stiff and painful, and the fingers deflected to the ulnar side. On the dorsum of the left hand were three bronze pigment spots of different sizes, the largest being the darkest and about three times the diameter of the smallest, which was the size of a pin's head. There was a small one on the dorsum of the right hand. Three fibrous nodules were exhibited by this patient; one among the flexor tendons of the forearm; one just below the metacarpo-phalangeal joint of the left index-finger and a little to the inner side; and one among the calf muscles of the left leg. The elbows were stiff and tender. Shoulders not affected. Neck slightly stiff, pain on turning head to either side. Some wasting of the interossei muscles, and of muscles also of the forearm. The ankles were stiff and a little swollen, and the knees

were painful and tender (emitting a crackling sound on movement), but not enlarged. The knee-jerks were equally exaggerated, and although the patient had lost so much flesh, the lower limbs had nearly regained their usual size, so that it was difficult to estimate muscular atrophy. Apparently there was none due to the secondary disease. Sweating of the left foot was complained of at this time. She also complained of neuralgia of the chest wall on the left side.

December 12th, the patient has been improving during the last thirteen days. There is not so much stiffness on attempting to walk, or on first leaving bed in the morning. The hands are about the same, excepting slight increase in atrophy of muscles of left hand, and this in spite of the fact that the patient has gained four pounds in weight during the last week. Elbows still tender. Right ankle a little swollen. The blood, as examined by the hæmocytometer and hæmochromometer, gave the following result:—In ten squares of the hæmocytometer there were counted 350 red corpuscles, showing a corpuscular richness ($\frac{350}{500}$) of only ·70; with the hæmochromometer the percentage of hæmoglobin was only 40. Therefore the average value of the red corpuscles was $\frac{40}{70}$ or $\frac{4}{7}$ of their normal value.

The treatment after the attack of acute

rheumatism was nutritious food, iodide of iron, arsenic and cod-liver oil, to the 1st of September. During the latter part of October and November electricity and mild Turkish baths were ordered with benefit. After this the patient saw Sir Alfred Garrod, who ordered her to continue the above and to go to Aix-les-Bains.

This lady did not go to Aix until August of the present year, 1891; I have seen her since her return and find her in every way improved. She has lost all stiffness and pain, and the hands have almost assumed their accustomed form. The hollows and depressions formed by the muscular wasting have all but disappeared, and there is only slight enlargement of the middle phalangeal joints of the fingers, and the metacarpo-phalangeal joint of the index finger. There is no tenderness to pressure of these joints; but the patient cannot quite close her hands with comfort. The right elbow joint shows osteophytic expansion, but all active mischief seems to have ceased.

Case VI.—Mr. E. D., æt. 28, single. Parents dead. Does not know whether either suffered from any articular affection. Can give no history of his ancestors. No history of exposure, shock or emotional disturbance. Patient has suffered from two attacks of gonorrhœal arthritis, otherwise he has enjoyed

fairly good health. Last attack of gonorrhœal rheumatism occurred in June, 1891. On apparently recovering from this, slight pain and stiffness remained in some of the joints of the hands, and also slight pain and sweating in the ankles.

At the present time the patient is anæmic. He complains of feeling tired and of tingling and burning of the soles of the feet. The second phalangeal joint of the middle finger of the left hand is a little swollen and tender, and the metacarpo-phalangeal joint of the index finger of the same hand is also stiff and a little painful. There is slight pain in the wrist of the right hand. There are no visceral complications of any kind. The blood on examination shows much deficiency of oxygen as estimated by the deficiency of hæmoglobin. In ten squares of the hæmocytometer, there were counted 290 red discs which gives $(\frac{290}{5})$ only ·58 as the corpuscular richness. The hæmochromometer yielded only 35 per cent. of hæmoglobin, therefore, the average value of the red discs was $\frac{35}{58}$ of their normal value.

The treatment adopted has been directed to the improvement of the general health. Syrup of the iodide of iron in teaspoonful doses, combined with five minims of sol. arseniate of soda, and cod-liver oil were ordered, under which the patient has greatly improved.

Case VII.—Mr. B., aged 43, an American. Antecedents of some articular affection in mother. Patient suffered from shock and emotional disturbance as the result of heavy pecuniary losses. Does not appear anæmic; hands and wrists only affected; metacarpo-phalangeal joints of thumbs, index fingers and little fingers enlarged and painful, the thumbs especially so. Blood, as estimated by the hæmocytometer and hæmochromometer gave the average value of the red corpuscles as $\frac{59}{77}$ of their normal value. Ordered syrup of the iodide of iron and arsenic. Patient returned to America and has not consulted me since.

Case VIII.—Mrs. M. S., aged 53. Mother's sister suffered from osteo-arthritis. Mother died from phthisis. Patient slightly anæmic. Middle phalanges of middle, index and little fingers of left hand enlarged and tender. Heberden's nodes over terminal phalanges of fingers of both hands. The blood, as estimated by the hæmocytometer and hæmochromometer, gave the average value of the red corpuscles as $\frac{59}{69}$ of their normal value. Great improvement took place under syrup of iodide of iron and arsenic.

Case IX.—Mrs. M. B., aged 55. Antecedents of gout in father; three sisters, two of whom exhibit Heberden's nodes. Patient

anæmic, shows well marked Heberden's nodes over terminal phalanges of all fingers of both hands. Metacarpo-phalangeal joint of index finger of left hand enlarged, painful, and tender. Cannot close her hands with comfort. Arms and legs exhibit psoriasis patches. Patient left town, blood not examined.

Case X.—Mrs. K., aged 49, widow. Antecedents of gout in father. Patient slightly anæmic, pulse 96, full and regular, nodes on terminal joints of index fingers of both hands. Middle joint of ring finger of left hand swollen and painful. Blood, as estimated by the hæmocytometer and hæmochromometer, gave the average value of the red corpuscles as $\frac{30}{60}$ or $\frac{1}{2}$ of their normal value.

INDEX.

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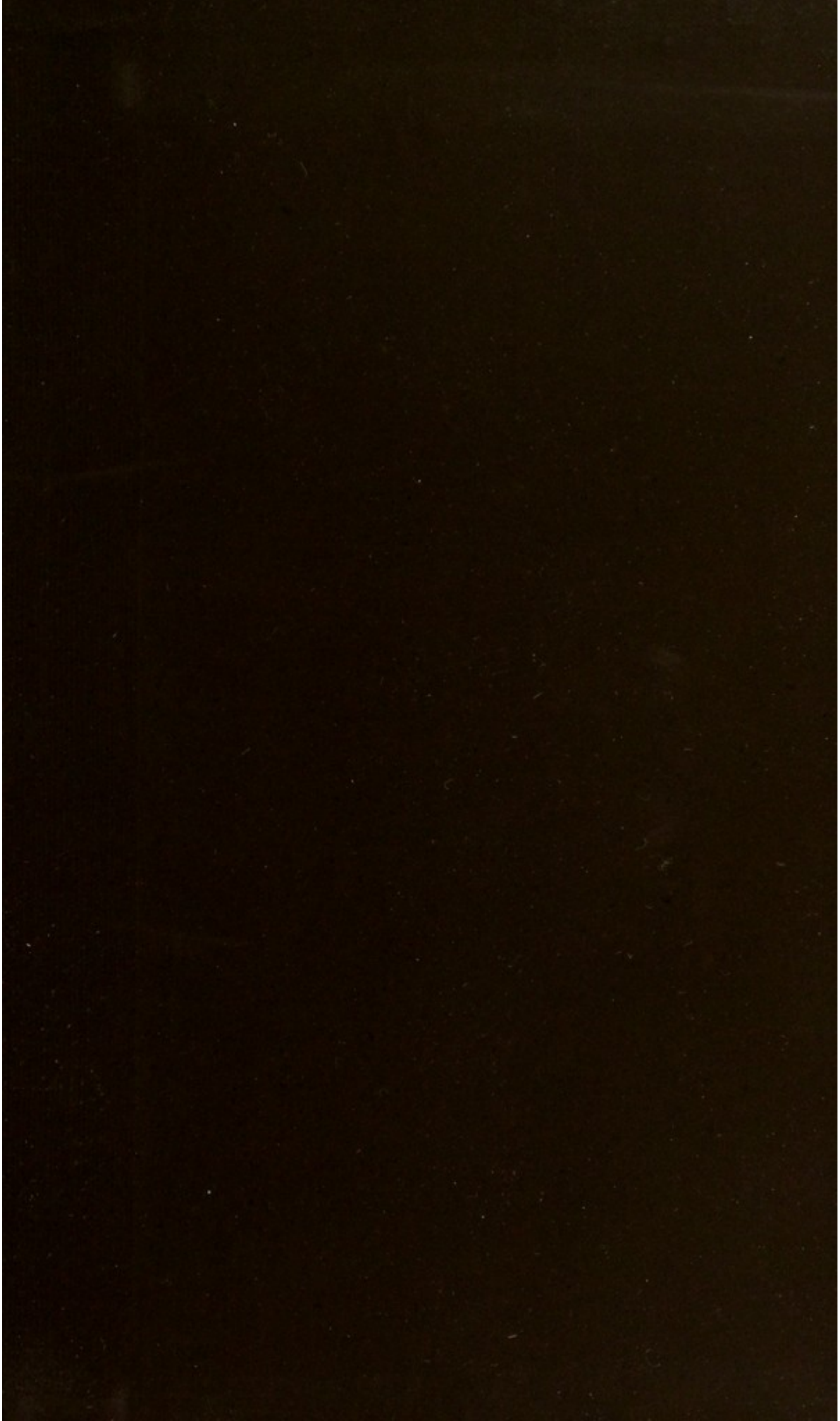

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