Acute Rheumatism

Its Aetiology and Affinities

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1896.
Preface.

During the last four years I have attended about 200 cases of Acute Rheumatism. This has enabled me to get a fair knowledge of the disease from the clinical standpoint, and the history and environments of these cases led me to enquire more deeply into the aetiology of this important disease. Practical work enlarged one's knowledge of the phases of Acute Rheumatism, and of the numerous affections which are allied to and associated with it. They led me to consider an infective origin as most probable, and the result of my investigation and study in this direction I now beg to present to my examiners, petitioning their kindly consideration.

I have taken the liberty throughout this thesis of using the contraction "A.R." for Acute Rheumatism, as saving much time and space.

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April 1896.
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The term Rheumatism is one of the oldest in medical science and is used in its writings from the time of Hippocrates. It included in its earliest applications, as its etymology suggests, a group of diseases characterised at least by fleeting symptoms, and ascribed to acid humours. As first used it was simply a synonym for catarrh. Baillon or Balbonius, who wrote in 1642, distinguished between catarrh, a term which he applied to affections of the mucous membranes, and Rheumatism: the disease of joints; and also between this latter and guitta or gout.

The conception of Rheumatism became modified in some countries so as to include the idea of its production by external cold. The undoubted form of it was painful, and hence if cold were the cause, or pain a marked
Symptom of a disease Rheumatism and Rheumatic were terms applied to it—a loose diation not yet departed.

The distinction between Rheumatism and gout and Fällon’s views were not generally accepted, and it is only in the writings of Sydenham (1670) that we find their essential differences once more clearly stated. Cullen described the free acid sweating, and mentions that the larger joints specially tend to be affected, and that suppuration does not take place. Neither Sydenham nor he had any doubt that the seat of the inflammatory changes was the articular structures themselves. Hargarth in 1805 added that the muscles may also be affected.

French writers of this period considered gout to be the joint affection proper, Rheumatism having its seat near to and between the joints, the articular localisation being more apparent than peal. Its causal, or concomitant relations to heart
affections have been recognized as the study of the disease grew — points which will be entered upon in various parts of this thesis.

It is necessary to contract the boundary or province of the word Rheumatism or Acute Rheumatism, which this treatise discusses, by taking Acute articular Rheumatism as the standard Rheumatic affection and refusing to recognize as Rheumatism any morbid processes which are not met with in such obvious association and connection with acute articular attacks that they can be regarded as manifestations of one and the same disease.

Gradually our idea of this affection has been built up, defined and limited. I will throughout this thesis use the term Acute Rheumatism as that which is most common in speech and literature, though Specific Rheumatism might for many reasons be adopted.

Acute Rheumatism is a disease characterised by pain,
swelling and inflammation of the joints, preferably the larger ones, usually of a migratory character; accompanied by great constitutional disturbance, fever and profuse sweating (your swelling); generally yielding rapidly to treatment by salicylates; and frequently attended by inflammation of the peri-, endo-, and myo-cardium; more rarely by pleurisy and by violent head symptoms. These phenomena may vary in degree and association. In children the arthritis and constitutional disturbance are frequently less marked.

Dr. Farr as Registrar-General, included Acute Rheumatism among the gynmotic diseases; but, at his death, it was relegated to the class of constitutional disease.

Many factors have to be considered in discussing the etiology of Acute Rheumatism, and I will do so under the following lines.

The factors, such as we know them, in the causation of this important
Disease may be

I. Intrinsic or personal factors
   1. Extrinsic which includes
      a. Conditions of Environment
      b. An active infective agent.

The first two may be regarded as predisposing and the last the exciting cause.

Furthermore—

I. Personal factors—age, sex, constitution and temperament, heredity (nervous and chemical theories discussed here) previous disease, injury, fatigue, chill, occupation, diet and race.

II. Conditions of Environment—

   Geography and geology of the disease, climate, season weather, air and earth temperature, rainfall, ground water and storm centres.

III. The active infective agent—

   Evidence derived from
   a. Epidemiology—epidemic prevalence, infection, miasm
   b. Clinical history, analogies and treatment
   c. Bacteriology.
I. Personal Factors

Age—

Acute Rheumatism is preferably a disease of youth. Different statisticians have compiled different age tables, placing 16 to 20, or 20 to 30, as the periods of greatest liability. In 115 cases of first attacks of A.R. of which I have records 12 occurred in patients under 10, 32 between 10 and 19, 40 between 20 and 29, 19 between 30 and 40. But if we include irregular and atypical forms of A.R. the largest proportion of cases falls between 10 and 20.

This point of its occurrence—a constitutional disorder—in early life favours an infective theory for judging by analogy and speculating as to the cause of A.R. we would expect this age incidence if the disease be an infective one.

Sex—

Acute Rheumatism, when we consider a large number of cases from different sources, is much more frequent in men than in women.
Thus of statistics I have collected 8180 cases occurred in men, and 5769 in women or nearly 70% in the former. In private practice however it has been my experience to have about 3 times as many female patients as male with A.R. The conditions of environment will largely control this distribution. Men are usually under circumstances of exposure, fatigue so more than women. In part account for the greater number of female patients I have had by local residence in this area (West Ham sanitary district) in which diphtheria and other diseases due to defective sanitation are so rife.

In children, Cheadle, Garrod and Goodhart agree that acute Articular Rheumatism itself and other phases of the disease are more common in girls than boys, and also heart affections due to it. Hirsch gives boys under 15 the preference. There is probably a greater tissue metabolism in girls than boys.
hence a less resisting power, or greater predisposition for such a disease as A.R.

**Constitution and Temperament.**

There is a particular type of patient in whom we frequently see A.R. with a constitution somewhat resembling the sanguine, and with a tendency to faulty alimentary chemistry. It is a mixed constitution with frequently the nervous or bilious element also to be noted. I have found this point of much use in rapid diagnosis and in insurance work to in an exceedingly large club and insurance practice in Derbyshire. Notwithstanding the excellent arguments brought forward by Dr. Pye Smith (Lucileian Lectures 1892) against the too ready preconception of a Rheumatic diathesis, in practice we find that from the constitution and build of a patient we can foretell truly that he is a likely subject for A.R. Not only is there a constitution in which A.R. manifests itself but it may be varied so that,
as in other diseases (tubercle) we may get particular phases - joint affections, heart or nerve diseases.

Some have argued that A.R. may be like syphilis which may lie dormant and particular states of health & weather do bring it out.

A point I would add which would favour Dr. King's Uric Acid theory (discussed later) is that I have frequently noted nephrolithiasis in the relatives of those subject to A.R. The see a distinct tendency, or absence of it, for other diseases of an infective origin as Hay Fever, Scarlet Fever, Diphtheria, Erysipelas, and Tubercle. So that we need only regard this constitution as a predisposing factor in Acute Rheumatism.

It is an important element which facts of heredity still further corroborate.

**Heredity**

Not only is there a special constitution predisposing to A.R., but this is also transmitted to the offspring.
Various statisticians have found an inherited tendency in 20 to 30% of the patients. Dr. Cheadle has stated (Harveian Lectures) that the frequency of A.R. is five times greater in the children of Rheumatic parents than in others.

In my records of 115 cases of first attacks of A.R., 36 or about 32%, one or both parents had had the disease previously. In additional 6 cases a brother or sister had suffered.

In 5 of these 36 both parents had had A.R., in 9 father only, in 22 mother only.

From my own cases and still more from literature do I note that the heredity of A.R. is principally from the mother's side. It is what we would expect.

A.R. affects those in whom there is a very considerable nervous element (Duckworth) and the inheritance of nervous disease, or nervous constitution comes largely from the mother's side.

Much more than from the consideration of numbers is the fact of
heredity corroborated in individual cases. We see whole families almost who suffer from AR having a Rheumatic parent;
— thus one family of six whose mother has had AR; 4 of the dark type and Rheumatic constitution all have had AR. 2 pair ones like their father under similar conditions of environment have avoided it.

Nervous & Chemical Theories.

Cullen’s Theory — Cullen looked upon AR as a reactionary inflammation after the joint structures had been injured by cold or the general fever being a result of this.

The Nervous Theory

In 1831 Dr. Mitchell an American physician expressed the view that AR was primarily a lesion of the spinal cord. His theory has at least the value of drawing attention to articular disease in central neurities,
caustics, Hutchinson, Buzzard and
Donkin have all been at times advocates of the nervous theory. Buzzard I should judge has now altered his views, and seems to have joined the concourse in favour of organisms, for in his inaugural address to the Clinical Society (in 1895) he favoured an infective theory of diseases and mentioned epidemics of A.R., chorea &c.

Their views together would explain A.R. as a disease of the hypothetical joint centre in the medulla, the sweating being due to the approximated sweat centre being affected also. But we do not find in other diseases of the medulla, inflammatory, neoplastic, or haemorrhagic in origin that peri-and endocarditis, and those symptoms which are classed as Rheumatic (acute), result from the process, and at least a neuro-chemical theory will serve as a wider and more convenient explanation. The researches of Chareot and Buzzard are important in reference to this subject.
The Lactic Acid Theory

The theory assigning to Lactic Acid the cause of A.R. is one that has found much favour. Originally propounded by Prout, it found a strong advocate in Fuller—that chill caused a retention of sweat containing the acid.

The evidence of its presence is to be obtained from the sweat and blood. Saure holds to have detected it in the sweat; but Salamon states positively that it is not present. The sweat of patients suffering from A.R. has a sour acid smell (of Lactic Acid), but it is not always excessively acid in reaction. It becomes more acid after exertion for a short time, a point which I have tested many times. It may be acid also in pneumonia & cold

In the blood being a powerful acid, Lactic Acid cannot exist as such; nor can it be held that the initial chill causes retention or
production of such a large amount as to cause an illness of five weeks or longer, so that some influences must be at work to account for its continued or repeated presence.

Salomon failed entirely to detect it in the blood of A.P. patients, while he did find it in those suffering from leucoerythemia.

The value of Richardson's synthetical experiments on dogs is diminished by the facts that 1st you get endocardial changes in them as a common occurrence. 2nd they were done in pre-antiseptic days, and endocarditis with peritonitis might be in part septicaemia. 3rd Professor Macfayden states that he has never seen a disease corresponding to A.P. among animals.

Foster's clinical evidence is another point in confirmation of this theory, but Harkin (Dublin Journal of Med. Science 1881 p. 312) has suggested that the arthritis which followed in these diabetic patients was gouty, as the small joints only were affected and
These two diseases are frequently associated. When we consider the number of people liable to A.P. it is strange that this synthetical evidence does not crop up oftener. Frequently large doses of lactic acid must be taken in sour milk. My friend Dr. A. Wilson of Leytonstone and myself regularly administer Lactic Acid (not to gouty or diabetic patients) but have not yet had any case of arthritis.

Sarcodactinic Acid is not chemically identical with Lactic Acid but their percentage composition and rational formulae are similar.

**Neuro-Chemical Theory.**

This theory of Dr. Latham (Croonian Lectures 1886) is another explanation of the formation and action of Lactic Acid. The internal hyperemia produced by chill induces increased metabolism and the oxygen present not being sufficient the lactic and glycotic acids pass into the circulation unoxidised. From the glycocine, uric acid
is formed which being a vasomotor stimulant proves a natural therapeutic agent. The presence of Lactic Acid distinguishes for A.R. in place of gout. But excess of uric acid will paralyse the vasomotor centre, inducing fresh hyperaemia and so the process continues. Lactic Acid will at the same time act as a diaphoretic. Uric Acid Latham designates as the essential poison. Excess of it is formed in quinsy, and, on a weakened nervous system, may end in A.R.

To the shifting character of the lesions he refers the continued acid of Uric Acid on the complex vasomotor centre, fresh hyperaemia leading of course to a fresh supply of the poison. While the explanation is much more complete than that of Prout and Fuller, the presence of Lactic Acid with Uric Acid being negative destroys the value of it. In the Lancet (1893 p. 1616) a case is quoted on
the authority of Fourrier, where consters on each occasion provoked an attack of A.R. and this seemingly supports the medullary origin of it.

**Uric Acid Theory**

advocated principally by Dr. Haig (Med. Chir. Trans. vol 73) is based largely on the effect of Salicylates and diet. He holds 1st "the essential feature of A.R. is the result of the precipitation or concentration of all, or nearly all, the uric acid in the body in the tissues and fluids of the joints. 2nd that the concentration is due as in gout to a high and rising acidity of the blood 3rd that the completeness of concentration accounts for the absence of uric acid from the blood."

Dr. Haig has shown that the efficiency of the Salicyiu bodies is in proportion to the excretion of Uric Acid which goes on during their administration. Salicylate of Soda has thirteen times the power, in this direction of Salicine, Salol has three times.
The pure neutral phosphate of soda (\( \text{Na}_2 \text{PO}_4 \)) is more efficient than the commercial product which also contains metaphosphate (\( \text{Na}_4 \text{PO}_4 \)) which latter may even cause joint pains. Uric Acid we are accustomed to associate with diseases in later life, or dietetic diseases, and AR is most prevalent in youth or early manhood.

Dr. Raige's theory does not account for the constant production of the poison as does Latham's; and we have no evidence of uric acid or urates in or around the joints in this disease. Again it is difficult to explain a particular form of Rheumatism under these theories. In support of the relation of uric acid to AR I mentioned that I had frequently seen Nephrolithiasis in members of Rheumatic families - 8 or 10 times recently - the personal constitutional factor plays an important part in the causation of this disease and deficient elimination of uric acid may be a complement to the condition.
Friedlander’s Theory.

Friedlander classes A.R. along with Balkan paralysis, ophthalmic joints &c as essentially a lesion of the medulla. He accounts for the joint, cardiac and other complications by disease of the closely connected centres and due to a micro-organism; and the inflammation and rise of temperature is accidental when present being secondary to the trophic disturbances of the serous membranes of the joints, heart &c.

Previous Disease: Chill, Fatigue, &c.

Acute Rheumatism is specially liable to occur during the course of, or some time after certain diseases. Notably: Scarlet Fever, Diphtheria, Measles, Typhoid, Typhus, Tonsilitis, Influenza, gonorrhoea, mumps, lactation anaemia (if A.R. be not often its cause) alcoholism - although statistics vary on the point - accidents, injuries and fright seem to predispose to or excite the fever at times. A line whose vitality is
lowered by injury or chill is often first affected. In a case of Typhoid with Pyaemia I attended, a previously strained joint was for several days the only one affected.

Prof. Sir J Grainger Stewart has mentioned cases where the chilled joint is first affected, the disease afterwards becoming general, and he draws the important conclusion of early treatment. A hemiplegic limb is often the one first attacked.

Among all those under discussion the factor of Chill receives the first place in general opinion; and but for the knowledge of Bacteria as a cause of disease we would probably rest content in the etiology of A.R. by assigning Chill the exciting cause in the majority of cases. It is a cause so easy to find; but recent discoveries as in relation to the cause of Syph, pneumonia, mammary abscess and many pyogenic diseases have depreciated it from its true-honoured position.
It is still under discussion if cold by its effect on the skin can affect an organ deeply situated. We apply it to the head, chest and abdomen without the subjacent viscera becoming inflamed. As a constant factor in the diseases of different seasons varied results must be ascribed to it, as for example "colds" in winter, diarrhoea in summer. But these occur in their season with a constancy that suggests a real specific infection and not to do with the temperament of the patient. Chill may act however by depressing the system or as Prout holds by causing the retention of lactic acid in the sweat, or in the way that Latham suggests. Mauhe found (B. W. Bovce 1886) that the organisms he connected with AP grew better on an acid medium, in fact induced lactic acid fermentation in milk and it is conceivable that the diminished alkalinity of the blood may favour the virus.
Surgeon Parke in his interesting book "Experiences in Equatorial Africa" (page 382) states emphatically that everyone, black or white, who stands in a draught for an exceedingly short time, is almost certain to be attacked by fever. He frequently draws attention to the fact of relapses whilst his troops were marching down hill, but that under the stimulus of hill climbing when the body temperature was kept up they had a freedom from malaria.

In an excellent monograph on Cholera by Jaeger in 1842 he showed that the miasmatic contagious bacteria of Cholera required in addition a toxin, autotoxin or leucomaine for their development in the body; so granted that there is a virus of A.R. and that it lives a saprophytic life, the sarcolectic acid we can readily suppose chill to produce in excess will on these premises be the assistant required for the parasitic life of the microbe. Chill must in our present knowledge of the disease be
regarded as an important factor. Cold alone does not seem to cause A.R., but rapid variations of temperature to which our physiology can not react. This in itself swells the list of sickness of all kinds; when it has been duly weighed and compared it may only be a predisposing instead of an exciting cause. Often the chill described must be regarded as the initial rigor.

Lërbert gives chill as the causes in 50% of the Cases of A.R., Mirsch in 24%, and in the Collective Investigation Committee Reports exposure to wet and cold obtained in 55-86%.

Coupled with over-fatigue it becomes a much more prominent factor.

An exceedingly interesting paper by Dr. Hutchinson (Quart. March 7, 1896) will help perhaps to throw much light on the subject. He finds the alkalinity of the blood reduced in muscular exertion and in anaemia. His paper supports my clinical observation. I have frequently seen A.R. occur during anaemia or anaemic conditions, but not during Chlorosis when the alkalinity of the blood is
increased. I have regarded the liability of AR, after diphtheria and some forms of tonsillitis as due to this anæmia. Fright is occasionally attributed as the exciting cause. We know how often and how easily it is ascribed to induced chorea, a disease with which AR has an affinity. But many examples are given in which an attack of AR followed fright — M.S. aged 30 was thrown over a hedge by a bull and in a day or two developed AR. Her daughter and grand-daughter are Rheumatic.

Occupation.
Those who are under exposed conditions, more especially to rapid changes of temperature, seem most liable to AR. Domestic servants, school children, coachmen, railway servants & blacksmiths, bakers, are the class of patient most commonly met with having AR. Among domestic servants the anæmia, which is so often found, must be considered as having much to do with their
liability. Servants and school children are also most exposed to defective sanitary arrangements, and are the class of patients in whom we most commonly find infective diseases—a fact that weighs against chill as the only attributable cause of A.R.

Diet and Race

The effect of diet on the course of the disease is well known. Nitrogenous foods, particularly animal, we might suppose to play a part in uric acid accumulation, and this with lactic acid also present in favour of A.R. When superadded for secretion in already highly saturated urine it will add to the mischief as it would in any acute fever when there is great tissue waste, or when the kidneys perhaps damage had special work to do. I cannot ascertain any definite point in regard to race but I have learned from the registrar of diseases among the Jews in the east end of London that A.R. is a very rare disease.
II Conditions of Environment.

Geography and Geology of the Disease

Acute Rheumatism is a ubiquitous disease. In all countries we find it; in Iceland and the Polar regions generally; in China it is not frequent, nor in Australia but I am told it is very prevalent in New Zealand. Canada has a fair amount the Southern States U.S.A. more than the Northern.

It is very prevalent among the black troops in the West Coast of Africa, who being exempt from Malaria show a higher proportion of AR than whites. Certain stations as Gibraltar in the Mediterranean and Bombay in India are notable for it. Bombay has a case rate of 66.7 per thousand as against 4 per mille in England.

From Norway, Sweden and Denmark we have the most important statistics regarding the prevalence of AR each case being notified. Dr. Newsholme.
in the Milroy Lectures 1895 gives us a most exhaustive account of the disease in these countries. He tells us that it is more prevalent in Denmark than Sweden and in Copenhagen and Christiania than in their respective countries.

He brings out the exceedingly important point that it is an Urban Disease. In regard to England Neosholles states that the West has more A.R. than the East (Glasgow more than Edinburgh) and those counties containing large manufacturing towns (with the exception of Westmorland, Cumberland and Hereford) have the largest proportion of cases. There is more in West than in East Riding. Lincoln has little though its conditions favour Malaria.

Fisch states (Tajgis Medicine vol.2 p.16) that Connawall Guernsey and Isle of Wight enjoy a degree of immunity. Neosholles statistics however do not agree with this.

Acute Rheumatisin is generally prevalent in low lying damp places. A marsh which has been drained
And thus algae done away with or diminished, may become the breeding ground of A.R.

In South West France in sandy districts near marshes it is more common than on a clay soil.

**Climate, Season and Weather**

Few diseases are so related in the public mind as A.R. in regard to weather. The subtle effects of weather in various ways in a matter of universal experience. Kirsch states that A.R. is almost confined to the Temperate Zones, but later statistics prove this to be incorrect.

Newsholme has shown the great amount in India as compared with England. Such weather and climate conditions - dampness and changeability - as would lead to "chill" are favourable to A.R. The Seasonal Incidence of A.R. is a very important point. Newsholme in the Milnroy Lectures enters very fully into it. It is an autumnal and winter disease which favours its
classification among the zymotic diseases. Most of these of the grazer class, particularly if associated with defective sanitation, occur in this season of the year. In London and England generally from the statistics I can gather July and August are the months freest from the disease; November and December show the maximum rate; in Norway and Sweden December and January; in Germany and Helsingfors April; and August and September are given as the minimum case period. Besnier at Paris gives July as the favourite month.  

Influence of Air and Earth Temperature

Neesholme states in the Milroy Lectures that in such years as 1856-69, 74-75, 84, 87, 93, where the mean temperature was above the average A.R. was more prevalent; and the equally important inverse that when the mean temperature was lower as in 1879 the amount of A.R. was diminished.
And he further adds the valuable observation that particularly when the soil temperature was raised epidemics of Rheumatic Fever occurred.

With regard to Humidity and Barometric Pressure no conclusion as to the causal relationship can be found, and personal experience leaves us very puzzled as to what is "Rheumatic Weather." We visit patients on certain days and find that they act as weather indicators or prophets, and cannot help but conclude that certain states of barometric pressure and humidity influence at least the nervous symptomatic part of Rheumatic and febrile affections.

The Influence of Rainfall.

This is a factor of great importance and a correct appreciation of it leads to ultimate issues. Unfortunately it is still "sub judice" and opinions regarding the prevalence of AR and the extent of rainfall are still at
variance. Edleplan at Kiel.

Hirsch at Wurzburg, in substance agree that A.R. is prevalent with a diminished mean rainfall.

Gallott gives the greatest increase in the wet damp weather of Autumn.

Dr. Nasoholme enters very fully into this point. He concludes that heavy rainfall is usually coincident with a diminished prevalence of A.R., and a lessened rainfall with an increased amount. He shows that in such dry years as 1861-62-63 there was an epidemic of A.R., which fell to a minimum in 1867 after the increased rain of 1865—The epidemic in fact took time to die out. — 1868, 73, 74, 81, 84, 87, 90, 93 all dry years were marked by a rise in the number of cases.

Observations too on the number of rainy days bear out the point. With few wet days we have epidemic years.

This leads me naturally to expect an increased prevalence where wet and dry seasons alternate regularly, and thus
in India other conditions I suppose being possible, at Madras, Nagpur (66.7 cases per thousand of people), Allahabad and Sind the rate of Rheumatic Fever is much higher than it is in England (3.5 per thousand in London) where such weather is exceptional. This is an important consideration. I would urge that it points to a telluric origin of the Rheumatic poison.

The Influence of Ground Water.

This is the complement to our study of rainfall, a most valuable one and will serve to explain the discrepancy—the lagging curve of A.R. From Newsholmes records taken at Brighton I epitomise that A.R. was in excess from 6 to 73 1/2 in 1875, 87, 88, 90, 92, when the ground water was lowest, also in 1891 a wet year, but one of low level. Secondly that A.R. was diminished from 6 to 29 % when the ground water was highest, except in 1877 which was a year of great fluctuation.
With great fluctuation there is an increased amount of AR, and vice versa. These two facts must be considered together, and added to the study of such factors as rainfall and geology.

Necholue says that "it may be surmised that the time of year at which the tide of ground water turns has some influence."

Statistics from the Croydon and London wells give similar results.

In conclusion, if there be a specific virus causing Acute Rheumatism, it must have its habitat in the soil, warm dry porous soil be conditions favourable to its growth and increase. Low ground water alone may not cause an epidemic of AR; it not accompanied by the required conditions of temperature though an increase of the disease never results from high ground water.

**Storm Centres**

Dr. Lewis of Philadelphia (Med News
Philadelphia [Vol. 9, p. 574] found that the curves of chorea and A.R. showed a regular variation with that of the approach of storm centres within 400 miles of the city; the curve of A.R. following one month later than that of chorea; these curves increased with the number of storm centres.

The value of this observation is lessened by the fact that no large area containing a convenient number of storm centres was included; but a fairly similar correspondence of curves is obtained in smaller areas.

It is not an improbable relationship however, when we consider how much the personal nervous element plays in the making of this disease.

III The Active Infective Agent

Evidence derived from Epidemiology

I have discussed the personal factors and the effect of environment in the causation of A.R.

Their importance has been dwelt upon in turn as predisposing elements in the aetiology of this disease. Evidence of a further
nature is to be gathered in the subjects now to be entered upon, which will point to a true exciting cause of AR. Pringle, Stoll and Mertens (Metosholine, Milroy lectures) have described as what they regarded as epidemics of Rheumatic Fever during the last century. Doubt has however been thrown on the correctness of diagnosis of the last two observers.

De la Harpe, Herbert and others mention its epidemic prevalence in the middle of this century. Lange at Copenhagen and Longstaff in this country have drawn attention to times of great increased prevalence.

Dr. Metosholine gives a most exhaustive account of the numbers of cases in the London, provincial and many important foreign hospitals. He pronounces conclusively that 1st There have been times when the amount of AR was so increased that it can be spoken of as epidemic. 2nd That these epidemics may be explosive, i.e. lasting 2 or 3 years.
or protracted. — principally when statistics over a whole country or large centres of population are considered. 3rd There are centre favourite years for epidemics — 1835-36, 59, 64, 65, 68, 71, 74, 76, 84, 85, 88, 93. 4th There is no regular periodicity of epidemics, nor do the explosive and protracted forms alternate always, but several of the former may intervene between protracted epidemics.

The statistics from Scandinavia are the most valuable; there, where each case of A.P. is reported, we can note the gradual spread from the large towns to the general Northern Country. Drs. Muckle of Halifax has put epidemics in his own practice on record, and most practitioners have noted times of special frequency of A.P. amongst their patients.

This fact of epidemic prevalence erases the theories which depend upon purely personal causes of A.P. Whatever be the chemical materia morbi Sake Acid, Wine Acid, or some as yet undiscovered or unaccepted
Virus we cannot regard this great increased prevalence as a matter of chance, or that A.R. is a purely nervous disease or one due to defective diet. Chill might swell the list perceptibly by frequent accidental cases, but that the amount of A.R. should for some long period be nearly doubled, that this epidemic were should travel points to some other and general cause. It may be endemic or may become epidemic.

Another fact strongly in favour of there being a specific living virus at work is the varying types of the epidemics, varying as other infectious diseases do.

Lange's statistics show that not only did the amount of Acute Rheumatism vary, but also its severity. That when the number of cases was actually diminished, those of pericarditis, pleurisy, and the general fatality were increased. Reports in this country agree on this point, and here again epidemics of A.R. correspond in type to what we often see in other infection.
fever.— Scarlet Fever.

The chorea curve follows that of A.R. and doubtless other diseases now recognized as rheumatic would help to swell the list, and we would find the above statements further emphasized and corroborated.

Miasma.

Sander (1809) considered Acute Rheumatism as “anague in desquise”. MacLagan (Rheumatism 1897) who supports a miasmatic theory, urges that both A.R. andague occur in low damp districts; do not attack all alike; have an indefinite period of incubation; vary in type; are not directly infectious and yield to similar drugs. Pechtolon (Garrod, Treatise on Rheumatism) adds that the severity of A.R. increases as we approach the equator, but the reverse holds good with regard to the frequency. Butague and A.R. seem to substitute one another both in regard to pace and locality. Felchamp has shown this substitution well at Amsterdam.
Where with an increase in the amount of A.R. there is a diminution ofague.

The clinical phenomena of the two diseases do not agree however. Malaria has no complications such as are regularly identified with A.R.; there substitution or the replacement of aigue by A.R. in a drained marsh to all points to an essential dissimilarity in the two diseases. A.R. may be of a miasmatic or telluric origin. And further evidence may justify us in supposing that like cholera and typhoid it may be a miasmatic-contagious disease.

Frouseau (Clinical Medicine) mentions that A.R. is prevalent along with erepsipelas, and it has also been noted along with scarletina and meperal fever.

**Evidence of Infection**

Adolphsen, Felbinger, Friedlander, and Mantle have all reported instances of houses in which several cases of A.R. have appeared.
in a short interval.

Pedle's report quoted in the Milroy lectures are exceedingly interesting. Not only do we see this house distribution but we may occasionally note that A.R. favours certain streets or sanitary areas.

This is much more common than has been thought, and recently several such cases have been reported in London societies.

Mantle (P.M. Adoree 1886) quoted examples where several attacks of rheumatic fever occurred in one house, seemingly denoting not only the presence of an infective virus, but also that the disease was infectious.

In the B.M. Journal (1873 vol 2, p. 960) he relates cases of infectious sore throat, some of a scarlatinal, others of a pseudo-diphtheritic type in which there was swelling of the joints.

A murmur followed the tonsillitis in some instances, and chorea in others.

Dr. Mantle regarded these attacks as due to deficient sanitary
arrangements. In infective pneumonia we have another example of a "filth" disease attacked to a house and at times presumably infections.

It has been my fortune in practice at Leyton to meet with four well marked instances of "Rheumatic Houses". In one house in a period of two and a half years I have attended five cases of Acute Rheumatism (children) four of diphtheria, one of pleurisy (father) six of follicular tonsillitis, three of scarlet fever. The mother of the children had had A.R. in youth, but they had not suffered from any of these affections previously to living in this house and district (which they have now wisely left).

Case 2. — In one year there have been two cases of A.R., three of tonsillitis (two of the patients also having a scarlatiniform rash, one also erythema marginatum); and three cases of diphtheria.

Case 3. — In eighteen months three cases of A.R., one of subacute, one
of Chorea. In this case a sister was attacked with the fever about a week after the first patient—mother and sister have had neural colic and mother A.R. twice before this history.

Case 4.—In three months four cases of tonsillitis, one of A.R. with endo and pericarditis, one of subacute rheumatism, with goitre (no oedema) and endocarditis. These cases I cannot regard as accidental or as mere coincidences. Excluding the case of goitre, and subacute rheumatism in eight of them it was the first attack of acute rheumatic arthritis.

Cases 3 and 4 not only pointed to the presence of an infective virus, but also to a direct infection which Case 2 bore out in a still more remarkable manner and I will recite the circumstances briefly.

Mother had diphtheria. Six months after had Tonsillitis, scarlatiniform rash and Erythema Marginatum. Baby sleeping with her followed with tonsillitis and rash in four days. Both recovered.
Four months after servant had diphtheria, Mother followed with it a week later never having been servant. Baby follicular tonsillitis and bronchitis in three days. Ten days later Aunt in the house had A.R. with presystolic aortic and mitral murmurs. Grandmother sleeping with Aunt in a week developed A.R. in knees and ankles which I treated energetically and stopped.

Case 4 also led one to suspect a direct infection. Mother had follicular tonsillitis. Daughter followed with it. In a month Mother appeared with tonsillitis again. A fortnight later the daughter had A.R. peri- and endocarditis resulting. During her illness a sister often waiting on her took goitre, endocarditis then sub acute rheumatism and later tonsillitis.

Case No 1 bore out the points of constitutional tendency well.

Every member of the family who had Acute Rheumatism was dark.

Two fair members had follicular tonsillitis and one of them diphtheria.
twice but no arthritis. Father who had pleurisy was fair also. This close association of Diphtheria and A.R. leads me to incline not only to the idea of there being a specific virus at work but also that A.R. may be a disease connected with defective sanitation. A wider recognition of these particular forms of A.R. and its affinities will help us very materially to trace this point: that there is a very great probability of the existence of a specific virus.

Dr. Dalton (B.M.J. 1889 vol. 1. p. 472) mentions six or eight cases of Acute Rheumaticism, Tonsillitis and Diphtheria all occurring in houses with defective drainage.

The idea now gains ground that A.R. may at times be a Silver gas disease.

My friend Dr. Humphrey of Hampstead related at the Anteerior Society (1895) three instances of this presumable infection.

Case 1. Early in December 1889 in one house girl had tonsillitis on
Dec 18 child began with AR and endocarditis; on Jan 3, 1890 Mother began with AR and endocarditis.

Case 2. End of September 1895 daughter had purpura, AR, and endocarditis. Oct 8, sister had tonsillitis. Nov 3 Mother had tonsillitis (followed by cervical abscess).

Case 3. In Nov 1891 Mother had AR. Jan 1892 daughter had AR, endocarditis and erythema.

Three weeks later a visitor had subacute Rheumatism. In May another visitor had pharyngitis, servant subacute Rheumatism.

At end of same year another servant had AR, and three weeks later Mother appeared with herpes of posterior auricular nerve. In 1893 she had endocarditis and cerebral embolism.

Dr. Shadwell (Amer. Jour. of Hyg., 1893) reported a case in which wife was confined in a bed in which husband had had AR three weeks before, and she herself developed the disease.

Pocock and Schaefer (Garrod's treatise on Rheumatism, p. 46) related instances
in which women suffering from A.R. have given birth to children who have almost immediately developed symptoms of the disease. Epidemics of A.R. Dr. Mantle has noted sometimes go hand in hand with scarlet fever and tonsillitis; and not only so, but during such times there is an increased prevalence of arthritic complications in these latter diseases.

As our knowledge of A.R. is enlarged and the various phases of it understood, I think that further evidence of infection will be forthcoming that the Rheumatic series may be traced through a household one member having tonsillitis, another A.R. another erythema, another possibly chorea, and that we may be able to hunt out a source of infection from one of them, the special form of the disease being determined by the patient's health temperament etc.

It is particularly when tonsillitis is present that evidence of infection crops up. Granted that A.R. is
a specific infective disease, two sources of infection may be obtained: to explain these series of illnesses I have related.

First, the original cause acting at intervals - the Telluric poison or Sewer Gas evacuations. Second, an infectious patient. If the disease be contagious I must admit that evidence of this contagion should be elicited more frequently.

In a very fair number of cases now we allow its probability. It is conceivable that in Tonsilitis we have the germ on the surface in a position capable of being transmitted; but in arthritis endocarditis etc. (unless it be in the excretions) it is so buried that its direct transmission is impossible. Experimental inoculation of A.R. to so far as I am aware has not been tried. But the discharges to may re-infect the soil and the circle be completed again.

b. Evidence from Clinical Types

Analogies and Treatment

Whatever may be the view held regarding the presence of a specific virus causing A.R. from the subject preceded, when we
look at the disease from the clinical standpoint. The facts seem to point more strongly in this direction. In the first place it is notable that the cases in various epidemics vary in severity and the type of complications, as is often exemplified in scarlet fever epidemics, when there is not the largest number of cases there is often the greatest fatality.

In its clinical history A.R. corresponds in many respects to pyaemia, an organisinal disease. In scarlet fever an affection having a kinship with A.R., we are sure that we have a microbe at work.

The following points of clinical evidence favour an infective theory in acute rheumatism.

1st The general history of the case, the patient’s age, the season in which all the data we can gather in our preliminary investigation must be considered. 2nd The mode of onset of the illness, often with pimples, and general constitutional disturbance. The content of this
of course depends on the severity of the attack. The inflammation may begin in one or several joints, injury or lowered vitality of the part often determining its site.

That peri or endocarditis, as acute inflammatory lesions, may precede the joint affection, or be progressing along with it, points to some general constitutional poison.

The sore throat as in other infectious disorders often precedes the attack.

Dr. Fowler Kingston (Lancet Dec. 2nd 1880) estimated the proportion as 80%.

Dr. Whipple (B. M. J. Feb 25th 1888) placed the percentage as 24\% 12 in 655 cases investigated.

The form of sore throat is suggestive of micro-organismal invasion, being so frequently membranous, and is benefited by antiseptics such as lactic acid and Hypericum Boracic.

4th The Progress of the Illness.

The protracted temperature curve, the simultaneous visceral and joint affections, the occurrence of epistaxis, hyperpyrexia and cutaneous eruption is analogous to what occurs in
Purpura, Pyaemia, Scarlet fever etc.
Epistaxis and haemorrhage are important facts. In the absence of some obstruction to a major channel of the circulation and occurring in the course of an acute inflammatory disease (unless it be miscarious menstruation) there are most commonly due to microbes.

W. Cheyne in 1884 found organism in the vessels in idiopathic purpura and Rauhbach and Raymond Johnson (Sanco 1896 vol 1 p. 232) have discovered the capillaries blocked with streptococci or staphylococcus Aureus.

The parturient state is specially favourable for the development of AR as it is for the poison of Scarlet Fever, Pyaemia, and pyogenic diseases.

The temperature chart is worthy of study. The pyrexia does not show an absolutely regular termination by crisis or crisis on a given day, as it does in Scarlet fever, typhus, and typhoid.

This is in many cases accounted for by the occurrence of cerebro complications. This indefinite
Period of fever does not overthrow an infective theory. I would assume that the antitoxine is long in forming and is not capable of protecting for any length of time.

The local lesions are very largely instrumental in causing, or at least correlated to the rise of temperature.

In children the pyrexia is not so great usually as in adults.

It may often precede the urinary or joint affection or may be altogether disproportionate to these.

Friedlander regarded a protracted temperature curve as due to a combination with the primary attack of a cycle of relapses, and he holds that the temperature has a natural curve falling to normal in 7 to 14 days.

All infectious diseases have not a definite period of existence (pyrexia etc.). Again this subtle virus seems capable of taking on different forms of affecting different organs, and as the virus itself changes so from having a definite or rapid life history in Arthritic attacks to its slow yet tenacious and lethal form.
in Rheumatic Nodules with Endo and Peri-carditis, we need not look for a regular life duration always in the acute forms of specific rheumatism.

The virus of malaria, modified in some ways shows a similar irregularity. It may be presumed that the character of the poison and the comparative phagocytic power of the patient regulate the form and duration of Rheumatic manifestations.

5. The tendency to Relapse.

Though every care is taken to avoid a return both in regard to the personal and surrounding factors, we often see the disease relapse as does erysipelas, diphtheria, and typhoid. We have relapsing pneumonia, and occasionally a repetition of Scarlet fever.

As in diphtheria and erysipelas after one attack the patient is more prone to A.R. It seems possible in some cases that as in syphilis and malaria the poison may lie dormant and suitable conditions invigorate its toxic power.

6. That the joints, serous membranes
And endocardium to. are the seat of trouble indicates strongly the presence of a specific living virus.

In all acute inflammatory processes that affect these structures with the exception of acute rheumatism, a parasite is found and proved as the cause, or its probability admitted.

Again that A.P. occurs along with another disease as gonorrhea, conceivably as a double infection is important.

The gonococcus has been found in the affected joints.

Mantle proved the same organism that he got in A.P. This has been quoted against the value of his researches, but I think that you may have the gonococcus only, or a mixed infection of gonococcus and A.P. in other cases... A.P. may remain in one position or may affect many viscera. If uric acid or lactic acid were its cause, however, they acted on the joints or on their hypothetical trophic centre in the medulla, it is extremely improbable that the clinical phenomena should
appear with the definiteness and regularity with which they do or in the second case without some other of these closely packed centres being influenced with marked symptoms resulting - diabetes - hyperpyrexia is to be explained by an implication of the heat regulating mechanism.

It is not yet explained why it occurs in such diseases as Apoplexy and Epilepsy when we have a local disturbance. We can easily conceive that the plexus or its toxine has damaged the heat centre and it is not necessary to assume that the medulla was affected from the beginning of the arthritis.

Hyperpyrexia principally occurs in adults in the smaller epidemics of increased fatality and it is not improbable that the special selective power of the poison at such times or the increased toxemia of the adult nervous system determined this feature. Its striking toffeen unexpected onset, and the marvellous results of treatment by cold effusion, as instituted by
Wilson Fox, have given it great
prominence in this country.

The influence of the personal
equation which is undoubtedly would
dean to militate against an infective
theory. Its exact value varies
greatly, but we see it in practice as
an important element. But Scarlet
fever, hay fever, erysipelas, and apparently
Tubercle do not attack all people
alike, although they are exposed
to the infection.

Result of Treatment.

The specific power of Quinine over
malaria may be attributed to its
antiseptic or toxic effects on
Laveran's plasmodium. Side by
side with, as one of the most remark-
able triumphs of therapeutics, we
have the action of the saliein bodies
in Acute Rheumatism. These two
diseases stand related as their
remedies do historically. It is
remarkable that in the diseases for
which we possess specific therapeutic
agents (as in syphilis and malaria)
the remedies are also antiseptics.

In the internal administration of
Germicides their relation to the animal chemistry must be considered, and it is perhaps not too fond a hope that we may have some time a specific antiseptic for each infective disease. The power of the salicin bodies in urine acid secretion must be allowed. The bacteria obtained in AR are more readily destroyed outside the body by quinine than by salicin. (Wilson Edw. Med. Journal).

During the administration of this specific antiseptic in AR we have improvement in the condition of the joints along with the fall in temperature. But the salicin bodies are comparatively unable to cope with visceral lesions.

The number of cases of endocarditis has probably not been diminished nor does the drug arrest its progress. In pericarditis it decidedly in many cases acts in a remarkably curative fashion. In three cases recently I have administered it when pericarditis was the first rheumatic symptom. The friction disappeared and the arthritics which followed 6 or 8
Hours later was very evanescent. The cases of hyperpyresia are often seen, but salicylates do not control the extreme fever. Here I regard the clinical symptoms as out of all proportion to the pathological lesion, and the effect of the great rise of temperature is to destroy the whole physiology and soon make recovery impossible.

Salicylates do not act so well in the fibrinous as in the hyperaemic group of lesions and the former class often progress. Quinine has not the marvellous effect on the hyperplasirae of malaria. But even in the fibrinous lesions of specific rheumatic origin we often get a good result with the salicylates. Periosteal nodes so disappear; chorea is sometimes amenable to the antiseptic. Sodium salicylate (Mackenzie) Salopon and Therosalicylate of Soda (which I have tried recently in chorea) seem at times to maintain the reputation of the specific even in fibrinous rheumatic processes, especially if any pyrexia occurs.
Evidence derived from Bacteriology.

The final clause in favour of the inclusion of AR among the epidemic diseases is now to be sought for. Strong as is the circumstantial and deductive evidence, without the isolation of a specific virus, and the application of Koch's postulates, the question is unsettled, and our study and knowledge of the aetiology of AR incomplete. The value or correctness of bacteriological observations in AR is yet doubtful, statements are still at cross purposes.

It may be from the varying methods employed. Others more hopeful may enable us to get more regular results.

In reading I note one marked fact in this study.

Many of the bacteriologists have taken the blood or serum for examination or cultivation of bacteria, from the body after death. This should imagine to lessen very considerably the value of their results for many obvious reasons. The fluid
should be taken during the uncomplicated course of the disease.

Goncal, Babc, Popoff, Risch-Arshfield, Bouchard, Petrone, Saceze, Milroy lectures) have all found micro-organisms in the joints or on the cardiac valves. A. Germain found that intravenous injection of attenuated staphylococci produced joint effusion.

Leyden has obtained a diplococcus. (Milroy lectures)

A. Wilson (Edin. Med. Journal, June 1885) in a case of pericarditis with nodules, cultivated from the serum a very short bacillus looking like a diplococcus. Quinine prevented the growth of this better than sod. salicylate.

Mantle (B. Med. Assoc. meeting 1886) gets results which appear better, from the fact that he took the serum or blood during life and the history was repeated in many cases (18) of arthritis and other rheumatic diseases. He found principally a short oval bacillus (which becomes longer in acid media) and a micrococccus. When growing in Petrone beef broth they appear like the Acelous fungus; may be separate in pairs or
chains, and stain well by Baillie's, Dye or by Gravis method.

The Micrococcus he found chiefly in the acute stage of the disease and may occur in clusters.

At the College of State Medicine
101 St. Russell Street, London. I have made inoculation from the blood in my recent cases of Specific Acute Rheumatism. Pressure of work and time have prevented me doing much that I had hoped for to add to my study. My cases too in a tantalising fashion have fallen short but with more time at home I hope to add to my observations.

With the exception of a case of Rheumatic oedema I took the blood from the lobe of the ear, first thoroughly antiseppticising it. This part is more readily purified than the finger and less sensitive. I stored the blood in sterile capillary tubes and sealed them by heating. They were afterwards disinfected, broken by flame, forced and dropped into the fluid medium which was kept afterwards at blood heat.
My results were as follows.

I. 100 cc. aqua. 35, Rheumatic oedema, Arthritis later.
    Peptone beef broth - sterile.

II. 100 cc. Blood. Pericarditis, Arthritis
    Temp. 102. Acid beef broth - sterile.

III. 100 cc. Arthritis
    Temp. 102. Acid beef broth - sterile.

    Beef broth, sterile.

V. 10 cc. Serum. 98.8. Subcutaneous
    Nodules, progressive endocarditis.
    Peptone beef broth - sterile.

VI. D.M. 22. A.R. Temp. 102. Acid beef
    Broth - The broth turned cloudy
    Throughout in ten days and although
    I examined it carefully on three
    occasions I failed to discover any
    Micro-organisms.

VII. W.R. Subcutaneous nodules,
    On the 13th day I noticed a growth
    in the Peptone broth. This grew
    slowly and resembled the Actinomycetous
    fungus. The tube had no odour.
    Microscopically the growth consisted
    of micrococci; sometimes singly,
    Very frequently in pairs or massed
    together in zooglea form.
They stained well with acidine alps and by Gracie's method. They appeared more rapidly in subcultures in Acid beef broth, and even of similar macro and microscopic appearance.

I can only regard this investigation as a preliminary note, pressure of time preventing further observations for this thesis.

**Incubation Period.**

Perhaps it is premature without having absolutely demonstrated the presence of a specific living cause of AR to discuss the probable period of incubation. In many cases, however, from the appearance of causes which I have classified as personal or belonging to environment, there is a definite time before the onset of symptoms. These causes of course I would regard as predisposing, from the time at which they appear and give the presumable exciting cause the necessary help for the development of the disease; we may regard as the period of incubation.
This period, which may or may not be one of ill health, is usually 7 to 14 days. The symptoms may immediately supersede the chill or other factor and this period be considerably shortened. But we see this in cholera, typhus, & Smallpox, when under favourable circumstances the attack follows the infection almost in a few hours.

If we look upon Follicular tonsillitis as a phase of the Rheumatic state its period of incubation is 7 to 21 days. A.R. follows it very frequently and this usually about a week after.

Are we justified then in the case of two diseases so closely correlated in looking upon the second—the arthritic attack—as a relapse of the essential malady? In the cases I have mentioned, indicating a distinct infection 7 to 21 days was usually the period between the appearance of illness in the different patients.
The Affinities of Acute Rheumatism

At the beginning of this thesis I defined the province of Acute Rheumatism. The consideration of its affinities had interested me long before I studied the aetiology of A.R. itself. Certain parts of this subject are necessary for the understanding of this interesting disease, and by recognizing its various phases we appreciate its aetiology far more thoroughly.

If we consider what tissues are affected in a definite attack of A.R. in our patient we see that certain structures are damaged by the poison. Notably it selects the serous membranes of joints but any endothelial membrane may presumably be attacked by it. It also follicular connective tissue as that of the tonsil and periappendiceal appendices. Dr. R.J. Berrig investigation (M.D. Thesis 1895) throws light on the function of this intestinal tonsil.

3rd. Fibrous + connective tissue. Of the last mentioned the most interesting pathological is the neuroglia of Chorea hic as Chedle suggests, due to increased
proliferation of its cells due to the Rheumatic poison 4th Skin. We see in one patient probably during an attack of AR all these tissues affected and the question of the selective property of the virus is interesting. Is it the relative Tocemia of the porous fluids that determines the site? or the phagoctytic power of the membranes?

Together with the cases I have quoted the following will illustrate affections other than that of the joints occurring during the course of Acute Rheumatism and so associated with it as to be regarded as a continuance of one pathogenic process A. E. 25 had pneumonia followed by Arthritis Edeo and periarteritis.
Papulatum and a bullous rash (Periaphyagma).
H. S. 19. Appendicitis, Ophthalmic Goitre, Edeo Carditie. At the end of 4 years I find the pre systolic murmur persisting.
E. W. J. Chorea Edeo + Periarteritis, Arthritis.
R. G. J. Chorea, Arthritis erythema Marginatum.
S. B. 20. Sub Acute Rheumatism Goitre
without Exophthalmos, Endocarditis, Tonsillitis.
These cases illustrate well the probability
of different phases of A.R., or complication
of the arthritic attack—one continued illness.
In childhood especially this picture is
drawn out—considerable periods may
separate the appearance of these diseases
and their connection not recognized.
I have noted the history in the following
of my cases which will show the
great tendency to Specific Rheumatic
affections that these patients have.

E. M. aged now 16. In 1884 had
Rheuma nodosum Arthritis Enso and
pericarditis. January 1894. Tonsillitis
Rheuma exfoliata. Arthritis. Sister
had A.R. as well. March 1895—Rheuma
Nodosum Subcutaneous nodules Arthritis
Enso and pericarditis. August 1895—
Facial paralysis. September 1895—Chorea.
Mother had had A.R. and she and a
sister renal colic.

J. B. 22. November 24, 1894. Pericarditis
Arthritis. October 1895. Tonsillitis. Rheuma
Scarlatiniform (acid sweat) Cardiac
"breakdown". January 1896. Acute Thoraxform
Hysteria, mitral leakage.
A. F. 10. 1890. Acute Rheumatism in 1892 Chorea.
Nov 1895—Endocarditis and punctate erythematous rash.

Nov 30 Arthritis.


These cases show different phases of the rheumatic state. They are all caused by the same virus at different periods selecting a different habitat.

The possibility of causing endo and pericarditis, without a tendency to suppuration seems to be the distinguishing feature of A.R. and the advent of arthritis or heart-disease evidences the presence of the specific rheumatic poison in these cases. We see patients one illness go through several of these phases and the experience is so common that we have no doubt as to their association.

The recognition of this affinity would be most important in prognosis and treatment. A regular bacteriological examination will no doubt in the future bring out many points on the affinities of other diseases.
In a case of erysipelas in which Dr. Albert Wilson and myself made cultulations we got a bacillus which corresponded to Pfleger's influenza bacillus. During the dry spring of 1893 we made a long series of plate, stab and surface cultures from cases of influenza, "Cold," bronchitis, and two cases of pneumonia (all these appeared infectious) and in each Aspergillus glaucus was the only growth we got.

In "sympathetic sore throat" we may presume that we are dealing with an abortive case of scarlet fever. Mantle has noted the prevalence of A.R. along with this zymotic disease and even hints at their substitution or common origin.

The relation of Chorea to Acute Rheumatism is not so generally admitted and I will discuss later their affinity as I have recently had opportunity of studying a larger number of cases at Great Ormond Street Children's Hospital.

Endocarditis, Pericarditis, Tonsillitis, Appendicitis, Pleurisy, Pneumonia, Bronchitis, Phlebitis (warted) Menigitis, Peritonitis, orchitis, Thyroiditis, pneumonitis.
erythema, rheumatic edema, subcutaneous nodules, periostal nodes, the arthritis of the infective fevers, inflammations of muscles, tendons and their sheaths, Iritis, Scleritis, occasionally, nephritis, insanity. All may be phases of disease due to the Rheumatic poison. Many of them are so well recognized that it is not necessary to mention them further. Of 110 cases of which I have records (first attacks) it is 48 the heart suffered as follows:
Pericarditis only, 4
Pepticus, Mitral Syphilitic, 2
Pecarditis Aortie Syphilitic, 1
Mitral Syphilitic only, 33
Mitral Preeptotic only, 0
Mitral Syphilitic, Preeptotic, 2
Mitral Syphilitic, Preeptotic Aortie Syphilitic, 2
Mitral Syphilitic, Aortie Syphilitic & Diastotic, 4
Mitral Syphilitic, Pulmonary Syphilitic, 1
Mitral Syphilitic, Aortie Syphilitic Pulmonary Syphilitic.

The case of Thyroiditis with subacute rheumatism and endocarditis is interesting. I am at present attending a case of cellulitis of the left arm in which the right lobe of the thyroid is swollen and
Tender.

Peripara is a recognized phase of A.P., and the idea has occurred to me that perhaps Rheumatism has something to do with the etiology of anterior poliomyelitis. Tonsillitis frequently precedes the paralysis. Buzzard has related epidemics of this disease (Clinical toe) which infers a general poison. It occurs in childhood when a particular focus of A.P. are the rules.

It is exceedingly unlikely that a poison such as uric acid or lactic acid would cause such varied diseases. Their presence is indeed hypothetical.

In chronic disorders such as subcutaneous nodules where we would expect evidence of them procurable, neither of these poisons is found. In rheumatic skin affections (erythema nodosum) there is no deposit.

Serous theories must be far reaching or accommodating to explain the phenomena of acute Rheumatism in its...
Various Phases. While Latham's lactic acid theory may explain arthritis and acute rheumatic conditions it fails when we come to the more chronic and localised ones. Along with uric acid acting on the medulla and paralysing the paco motor centre it may keep up the supply and protract the disease. But I cannot think that these theories will explain periosteal nodes, subcutaneous nodules, chorea with endocarditis—these insidious, yet persistent. If these poisons were the sole cause of the disease, specific rheumatic and as there is little constitutional disturbance their amount I presume to be limited, they would soon be excreted and convalesence secured. Gout and A.P. do not alternate and if uric acid be their cause we would expect their substitution to occur. The study of Acute Rheumatism and its numerous phases and affinities leads us in another direction.
leads us to look for another cause and this a living organismal one. The points in favour of this I will now indicate in the following summary.

Summary

1st. The age of the patient.
2nd. Sex, heredity, constitution, occupation, race, and diet in that they afford conditions favourable to the disease.
Their importance in this direction have entered upon, and due weight must be accorded in individual cases.

3rd. Some depressing influence as chill, fatigue, or injury or previous disease favours a bacterial invasion in this as in many other cases.

4th. The geological and geographical distribution of Acute Rheumatic Fever, its seasonal incidence, its relation to air and soil temperature to rainfall, groundwater and storm centres is in accordance with the presumption of a telluric poison.
5th. The epidemic prevalence of AR, varying in type, severity and case frequency; its urban localization and spread from centuses of population correspond to the history of microorganismal diseases.

6th. Its substitution for malaria points to some miasmatic or telluric cause. However, related etiologically these diseases are yet clinically dissimilary.

7th. Evidence has been gathered of infection in regard to houses apparently of infectiousness between patients; and it is increasingly in favour of the relation of AR to other diseases due to defective protection – Diphtheria.

8th. When we include the several phases of the rheumatic state this evidence of infectiousness will be further supported.

9th. The occurrence of AR, along with other infective diseases leads us to regard it as a probable mixed infection. Notably is this the case with gonorrhoea: here the combination is such that the specific power of
Sodium Salicylate is largely lost.

10th: The clinical phenomena of AR are of the natural order of infective diseases. The structures involved, the varying type of the pathological processes, their protraction or their relapse are analogues to those of pyaemia and other diseases due to living poisons.

11th: The disease yields to the salicylic bodies, conceivably acting as antiseptics.

12th: Micro-organisms have been found in the blood, joints, and on the heart valves by various observers. The evidence obtainable from this source is however still incomplete.

**Chorea**

I am aware of a certain appearance of presumption in approaching a question so large and so intricate as that of Chorea and its relation to Acute Rheumatism. Much has been written upon it by eminent physicians and the subject still left one of doubt.
for the student. Their connection at times, which is admitted by all, necessitates my approaching this study, and cases suggesting this connection having occurred in my practice encourages my enquiry.

Bright as early as 1802 alludes to the relationship of these affections (Guy's Hosp. L.y. J. Med.) Sedgmore in 1827 Regbie in 1847 pointed out that Chorea was apt to occur in the course of a Rheumatic attack, or in the children of Rheumatic parents.

Rabington, Hughes, Copland, Burrows, Séé, and Botrel drew attention to it; and Troussseau (Clin. Med. vol 1) mentions a case of Chorea occurring in the course of A.R.

The embolic theory of Kirkes (1863) regarded Chorea as a Secondary affection; but neither this nor imitation of the nerve endings in the pericardium as suggested by Bright will explain their relationship, for Chorea may precede the endo or peri-carditis or the two processes may be advancing together.

We may regard their relationship in several lights. That the two
diseases have a common origin which is Rheumatism. 2nd That Chorea predisposes to rheumatic affection and that the endocarditis is rheumatic. 3rd That they have no connection and that the endocarditis is not rheumatic.

Chorea is largely a disease of childhood and if we look upon A.R. as a disease presenting several different clinical types and phases in the way in which Dr. Cheadle has done in his Harveyian lectures, and which the study of its affinities warrants, we may add with him that the history of some patients childhood is one of Rheumatism. Childhood offers this opportunity for studying Rheumatism for the picture is drawn out and analysed into a variety of steps. We must take into account functional development as a predisposition.

Macleagan urged that A.R. is a disease of the motor apparatus and so Chorea is a disease of the motor centres; and Duckworth (B.M.J. Jan 3 1885) pointed out that a child with a tendency to Rheumatism
probably inherited a mobile nervous system. Cheadle has suggested that the pathology of Chorea may be that of the fibrous group of the rheumatic lesions (as against the hyperaemic). But we cannot go so far as to state that all cases of chorea are of rheumatic origin, for some have a very distinct pathology. Embolism. Hughlings Jackson has said would cause it, and Kerringham reports several cases due to this. I remember seeing a fatal Case of Chorea in Edinburgh Infirmary due to tubercular tumour of the Corpora Quadragemina. However, there is no general disease of childhood with which Chorea has such a common association as A.R. except Scarlet fever, and that in a very much less degree. Again Chorea has not much association with other neuroses. Sturges, an opponent of the Rheumatic theory, states that whooping cough is twice as common in choreic patients as in others. Fright may be the sole cause - Sturges states of two thirds of the cases (Int. Med. Congr. 1881) - or may
be only superficial and determining the site of the rheumatic lesion. As I have previously suggested that a weakened spot may be the nidus selected. In speaking of the causes of AR, I mentioned a case in which fright was the assigned cause and Dr. A. B. Ganoe has reported several such cases.

The tendency to Chorea is far greater in some Rheumatic families than in others; and a family history of chorea without Rheumatism is uncommon so that we are justified in concluding that in those families suffering from Chorea some with and some without Articular Rheumatism, that the Chorea is in each case rheumatic. Again we are justified in including all Articular forms of Rheumatism so common in childhood their association being sufficient to allow us to ascribe a Rheumatic Cause. If Chorea with Endocarditis be the whole of a Rheumatic attack it must be granted that Chorea is in some instances the sole manifestation,
The following table will help to show the influence of a rheumatic family history.

Money 214 cases 28 had rheumatic family history

Sayer 122 " 41
Herschel 75 " 25
Garrod 80 " 20
491 114
or over 23%.

In a paper published by A. E. Garrod (Med. Chir. Trans. vol. 72) containing a later study of this point he says that a family history of AR is found in 38.8% of choreic patients as against 21% in the general population.

The age curve for the two diseases corresponds

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5 to 10</td>
<td>22</td>
<td>33</td>
<td>102</td>
<td>157</td>
</tr>
<tr>
<td>10 to 15</td>
<td>19</td>
<td>81</td>
<td>134</td>
<td>234</td>
</tr>
<tr>
<td>15 to 20</td>
<td>7</td>
<td>41</td>
<td>53</td>
<td>103</td>
</tr>
</tbody>
</table>

Girls show a greater proclivity than boys for chorea especially between 10 & 15, and also for heart disease associated with chorea and AR, and for chorea itself associated with AR.

In those cases in which it exists rheumatism usually precedes the chorea. In 9 cases out of 655 (Collect. Invest. Conf. Rep.) it followed the meningitis.
though I would imagine the proportion is much higher than this. That this order of events and age selection should occur in so many instances has its parallel in tubercular manifestations. We know that the various viscera, serous membranes, bones and joints tend to be affected with tubercle at certain different ages and this law I regard it holds good in rheumatism. The muscular system and coordinating functions are so often undergoing their greatest strain at the age of 10 to 15 or are in a similar morphological condition to the organs which tubercle attacks at its favourite ages.

The following statistics will show a personal history of Rheumatism as a factor. I propose to include "Rheumatism" and Rheumatic fever together and I am justified in doing this from the wider view. I am urging for specific rheumatic affections and also from the fact that I have frequently found organic murmurs among poor patients who deny having had "Rheumatic fever" but will own to "Rheumatism" which I presume did not therefore send them to bed.
<table>
<thead>
<tr>
<th>Observer</th>
<th>Source</th>
<th>Chorea</th>
<th>Acute Rheumatism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halstead</td>
<td>Jaggis med. vol 1</td>
<td>163</td>
<td>53</td>
</tr>
<tr>
<td>Jaggis</td>
<td>p. 755</td>
<td>150</td>
<td>42</td>
</tr>
<tr>
<td>See</td>
<td></td>
<td>128</td>
<td>61</td>
</tr>
<tr>
<td>Donkin</td>
<td></td>
<td>104</td>
<td>27</td>
</tr>
<tr>
<td>Money</td>
<td></td>
<td>214</td>
<td>36 23ar+23&quot;kh&quot;</td>
</tr>
<tr>
<td>Hughes</td>
<td></td>
<td>100</td>
<td>8</td>
</tr>
<tr>
<td>MacKenzie</td>
<td>Int. med. surg. 1881</td>
<td>172</td>
<td>75 47+28</td>
</tr>
<tr>
<td>Sturges</td>
<td></td>
<td>121</td>
<td>22 7 + 15</td>
</tr>
<tr>
<td>Bowers</td>
<td></td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Rye-Smith</td>
<td>Jaggis med</td>
<td>150</td>
<td>45 0 + 45</td>
</tr>
<tr>
<td>A.E. Parrot</td>
<td>Treatise Rheumatism</td>
<td>80</td>
<td>25 15 + 10</td>
</tr>
</tbody>
</table>

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or about 27%.

The difference of figures is partly due to opinions of specific rheumatism. Cheadle (Harveian Lectures) gives the percentage as 75 and Barlow 60%. Of 13 cases of which I have records 9 have a history of A.R. — seven before the occurrence of chorea, one during it and one after the attack. But we have additional evidence of the Rheumatic origin of the chorea from the state of the heart so frequently present. Acute Rheumatism and lepis account for nearly all the cases of
Eudocarditis and Rheumatism itself, for such a large share that we are justified, in the absence of sepsis and a few other well known Causes, in assigning to this former a given case of Eudocarditis.

The following list of Cases will illustrate the frequency of heart affection directly associated with chorea.

<table>
<thead>
<tr>
<th>Observer</th>
<th>Source</th>
<th>Cases of Chorea</th>
<th>Definite Cardiac Lesion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Money</td>
<td>Brain 1882-83</td>
<td>214</td>
<td>31</td>
</tr>
<tr>
<td>Dickinson</td>
<td>Med. Chir. Trans.</td>
<td>70</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>(Following Rheum) 1876</td>
<td>28</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>(Mental cause)</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>MacKenzie</td>
<td>Int. Med. Cong. 1881</td>
<td>164</td>
<td>89 (Brain)</td>
</tr>
<tr>
<td>Keruingham</td>
<td>Med. Chir. Trans. Vol 72</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>A. S. Garrod</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>656</td>
<td>310</td>
</tr>
</tbody>
</table>

or nearly 50% showed some heart affection. Wilks has stated and the post mortem reports of MacKenzie's Cases agree that in all fatal Cases of chorea regurgitations are found in the heart valves. In many other Convulsive disorders however, as Tetanus and Hydrophobia, a similar Condition has been reported.

Dr. MacKenzie's exhaustive study of
This point deserves a more detailed report, and I must be pardoned for quoting more fully from his admirable paper and statistics to bear out my point— the frequent association of Endocarditis with Chorea and that of Rheumatic origin.

As I have said in 89 out of his 164 cases there was a bruit. Of these Dr. MacKenzie was able to follow 33 with the result tabulated.

Cases with persistent murmur 17
With cardiac abnormality other than murmur 7
Died of heart disease 3
Died of unknown cause 3
Heart recovered to normal 3

or that in 24 cases the heart was left damaged or 31.81%.

In 9 of the other 6 there were organic murmurs while in Hospital. In 66 of the cases in which there was no A. P., a murmur was present in 31 or 46.96%.
I. Cases with distinct history of Rh. 47 - Murmur 34 or 72, 34% 
II. With history of pains probably, Rh. 28 “ 12 or 42, 85% 
III. With doubtful history of Rh. 22 “ 12 or 32, 17% 
IV. No history of Rheumatism 60 “ 31 or 46, 96% 

Again separating those of first attacks of Chorea

Class I. 22 cases, murmur present 16 or 73, 72% 
   "   23 " " " 11 or 47, 83% 
   "   14 " " " 6 or 42, 85% 
   "   43 " " " 20 or 46, 51% 

Thus a murmur occurred in about 80% when 
Rheumatism was denied. It is only that 
the murmur developed during the attack, 
all belonging to Class IV. In the 
others it was present presumably early 
in the attack.

Chorea per se has not been shown to produce a murmur at all 
frequently and as the Rh of 
no influence likely to produce 
heart disease in such proportion 
as it occurred in Classes III and IV. 
Rheumatism must have obtained 
in a considerable number of 
these cases and no history of 
it elicited.

Scarlet fever, Smallpox to was 
distributed, Dr. Mackenzie mentions, 
equally among both classes of cases 
and so is a factor in allegiance.
The initial value in all except one case was the one affected. In 60% (and possibly over 80%) the lesion persisted. The form of heart disease is that found in connection with acute rheumatism.

Pericarditis is occasionally met with but with by no means the frequency that it is when the motor apparatus is affected.

Subcutaneous nodules and several other rheumatic manifestations have been noted in connection with chorea and C.R. Stratton has mentioned pseudo-diphtheritic or follicular tonsillitis as preceding the nervous disorder.

As I have before stated that if chorea with endocarditis be the whole of a rheumatic attack as endocarditis alone may be it must be granted that chorea may in some instances be the sole manifestation.

Dr. Lewis of Philadelphia (Med. News House 1886 vol 19) has shown the remarkable relationship of the prevalence of chorea and AR and that the yearly
Curves resemble each other. The Chorea curve following one month later than the curve for A.R. Statistics at St. George's Hospital show a similar relationship.

The sex and age curves, the preponderance with a personal and family history of A.R. the constitutional similarity of the patients suffering and last but not least the analysed picture which individual clinical examples afford, shows us the very close relationship if not the exact essential aetiology of Chorea and Acute Rheumatism.

Scientifically irregular as it may be therapeutics sometimes enable us in our clinical work in diagnosis. The absorbent and alternative effects of Potassium Iodide and Mercury are so near specific in syphilis that it is a common course to make a diagnosis from the results of treatment.

The salicylates hold a peculiar reputation in Acute Rheumatism. They benefit specially the hyperaemic lesions but their employment in Chorea has been disappointing.
Dr. Mackenzie (B.M.J. 1887 vol. 1. p. 436) has recorded eight cases in which satisfactory results have been obtained from the administration of salicylate of soda. Salophen has been accredited with good results. Recently I have used this salicylate of soda in two cases and it has proved beneficial.


My friend D. Woods of Toxteth House has recently shown six cases at the St. Andrew's Society cured by hypnotic suggestion. From these and several other cases he tells me he gets equal results whether the patient is rheumatic or not—so that this method of treatment does not help in the etiology of Chorea.

Pressure of time compels me to
leave general problems still in embryo. I am conscious of many defects in this study but my work, such as it is, I beg to present to my examiners petitioning their kindly consideration, and hoping that perhaps by concentration of my train of investigation I may at least have improved my general knowledge and perhaps added to the study of the etiology of Acute Rheumatism.

John H. Lyman, M.D. 