

THE VALUE OF SULPHUR BATHS IN RHEUMATISM.

T H E S I S

Submitted for the M.D. Glasgow

by

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THE VALUE OF SULPHUR BATHS IN RHEUMATISM

1. I N T R O D U C T I O N .

Rheumatism and the conditions allied with it have for many years been amongst the most perplexing problems which Medical Practitioners have had to face, and anything that would help to a truer understanding of these diseases has been eagerly welcomed by all members of the profession. A considerable amount of research work has already been done but a great field is yet waiting to be explored.

As mentioned in the Report by the British Medical Association Committee appointed to enquire into the Causation and Treatment of Arthritis and Allied Conditions given in the British Medical Journal of 17th June, 1933,<sup>1</sup> it was found impossible in the present state of knowledge to make an aetiological classification. The Committee adopted as the most practical solution a clinical grouping though this is admittedly unsatisfactory in some respects.

The following is the clinical grouping adopted:-

#### SYNONYMS

Rheumatoid Arthritis	Chronic polyarthritis (continental nomenclature)	Primary: cause unknown; this as knowledge increases may merge into
	Atrophic (Goldthwait)	
	Proliferative (Nichols and Richardson) (American nomenclature)	Secondary: associated with focal or general infection

SYNONYMS

Chronic Villous Arthritis	---	Mainly occurring in women at or about the climacteric
Osteo- arthritis	Hypertrophic (Goldthwait) Degenerative (Nichols and Richardson)	Primary: no definite association with infection  Secondary: associated with infection
Spondylitis	, Ankylopoietica	Arthritis of spinal joints, with bony ankylosis, spreading centrifugally to adjacent large joints
	Osteo-arthritis	Osteo-arthritis of the spine (the labourer's spine)
Fibrositis	Intramuscular and fascial Periarticular Bursal and teno-synovial Subcutaneous (panniculitis) Perineuritic	

Spa Physicians are aware that some of their professional brethren are a little sceptical about the efficacy of bath treatments, and it is probably not realised what profound effects such a simple procedure as a warm immersion may exert on the bodily functions, and especially upon the circulation.

The essential feature of treatment of rheumatic diseases at Spas is the administration, internally and externally, of the fresh natural waters at or near their source./

source. Many forms of Physiotherapy are employed in the treatment of rheumatism, but it must be recognised that these are merely auxiliary treatments and that the basis of Spa treatment is the bathing in and drinking of the waters.

Hydrotherapy is one of the oldest known forms of treatment, and it was the discovery that natural waters in certain localities had a marked beneficial effect that led to the formation of Spas.

The cure in Spas is attempted in a number of ways. The following are some of the aims of the treatments:-

- (1) The removal of waste products due to faulty metabolism, or infective processes, through the bowels, kidneys or skin.
- (2) The acceleration of the interchanges between blood and tissue fluids by stimulating the circulation of blood and lymph.
- (3) Improving metabolism so as to secure increased resistance to infection.

Generally/

Generally speaking Spa treatment may be said to be of three types :-

- (1) Anabolic. In this the aim is to build up the system by increasing the intake, or by promoting assimilation, and by avoiding the production of excessive output.
- (2) Katabolic. In this treatment the essential feature is to stimulate the metabolic processes leading to greater elimination of waste products.
- (3) Metabolic, where the metabolism is not necessarily deficient or excessive but is faulty and requires alterative treatment.

The term ' Mineral Waters ' is applied to those waters which are used in the treatment of disease either internally or externally or in the form of baths, on account of the saline or gaseous substances which they contain, or on account of their elevated temperature.

The science of the origin of these waters and of the causes to which they owe their chemical composition and temperature is usually called Balneology, or in a wider sense Hydrology. The act of using them in the treatment of disease is Balneotherapy.

The principal constituents of mineral waters are water, sodium, magnesium and lime, combined with hydrochloric sulphuric, carbonic and hydrosulphuric acid. Other substances often present are arsenic, lithium/



lithium, potassium, barium, bromine and iodine.

Silica and various organic matters, traces of copper, strontium, cobalt, nickel and other metals have been detected. Free sulphuretted hydrogen in some of the sulphate iron waters. Principal gases are oxygen, nitrogen, carbonic acid gas and sulphuretted hydrogen. Argon and helium occur in various thermal and thermal sulphur waters. These substances are derived partly from the surface soil, partly from the rocky strata through which the water deposited from the atmosphere has passed. The difference between the various mineral waters are due to the differences in the superficial soil and the rocks through which the water has passed.

Spa Physicians have done a great deal of research work as to the possibilities of Balneotherapy, but all these have not yet been investigated thoroughly - notably the treatment by sulphur baths of patients suffering from rheumatism.

Sulphur baths may be divided into two types - saline and alkaline, and it is the former with which I wish specially to deal.

Saline waters are included in those in which sulphates/

sulphates and chlorides are in greatest quantity, and in accordance with the presence of the predominant salt, the class is subdivided into sulphated and muriated, in which the sulphates and chlorides are present in almost equal quantity. The sulphates may be sodium sulphate or iron sulphate, calcium, potassium, or a combination of any two or three of these salts, and thus we may have a sodic, calcic and chalybeate sulphated saline spring, or sodic, calcic, sodic magnesian, calcic chalybeate etc.

In most of the classifications as already outlined the word "saline" is in the ordinary or common non-scientific sense to designate waters in which common salt is the predominating ingredient, and this leads to confusion of terms. The use of saline in this sense is still further objectionable as any chemical salt in the water entitles it to be called saline. It is therefore preferable to separate those waters containing the chlorides from those characterised by the presence of sulphates, preferring rather a subdivision of the words sodic, calcic, chalybeate, etc.

From the beginning of February, 1932 until the end of March 1933, I was Resident Medical Officer at the Royal/

Royal Bath Hospital, Harrogate, which, with the Convalescent Home attached to it, contains 150 beds, mostly devoted to cases of rheumatism. There is attached to this Hospital a very fine laboratory where all kinds of research work can be carried out.

After a short time of residence I became greatly interested in all that was being done for the alleviation and cure of rheumatic affections. Naturally I gave a good deal of thought to the subject and gradually I began to formulate certain theories which I have attempted to work out.

One aspect of Spa treatment which specially interested me was that of Sulphur Baths. It was surprising that many patients when questioned about this treatment stated definitely that they felt better after a sulphur bath, while others maintained that they felt no benefit. I decided to examine the blood before and after a sulphur bath as I had come to the conclusion that this would reveal the reason why benefit was obtained.

I was allowed to choose any patient I wished to carry out investigation and no restrictions were placed on me in this work. This was carried out on one/

hundred patients.

I hope as a result of this work that I have something of real value to add to the study of sulphur baths, and that I shall be able to prove the therapeutic effect or at least one of the main changes which a sulphur bath produces on a patient suffering from rheumatism - namely, a change in the blood after immersion in a saline sulphur bath.

## 2. H I S T O R I C A L

The Greeks appear to have been the first to use mineral waters as a remedy for disease. For this we have the testimony of Aristotle and the Pre-Homeric myth that Hercules had imparted power to the warm springs by bathing in them. Most of the thermal baths in which Greece is so rich were, in fact, sacred to Hercules and numerous "Herculean Baths" existed of old in all parts of Greece, Sicily and Italy. Hercules was likewise believed to be the originator of the douche and some ancient coins were found near Himeron in Sicily and he is represented in a tub or bath with his broad chest exposed to a jet of water coming from the mouth of a lion.

The oldest Greek Physicians had great faith in the curative powers of mineral waters and when temples were erected to the God of Medicine, the Priests of Aesculapius took care that these should be in close proximity to mineral springs. Places of this kind were not only destined for worship but also for the use of sick, and were connected with medical schools, theatres and other places of amusement for convalescents, many/

many of which might have rivalled the contrivances which are used at the present time. The most remarkable of these was the sacred grove of Aesculapius near Nauplia, which was the constant resort of the sick and feeble from all parts of Greece, it being the place of birth of Aesculapius and therefore reported to possess special curative powers. Pausanias relates that a great many columns existed in the enclosure upon which were inscribed the names of those who had been cured there, as well as the nature of their maladies. Of the many edifices which existed in the grove there are still to be seen the remains in which, according to Dodwell who visited it in the early part of the 19th century, there were fifty four pink marble seats in good preservation and which were evidently contrived with the view of accommodating a gathering of convalescents. According to M. Landerer who made an analysis of the Mineral waters of Nauplia, they contain chiefly chloride of sodium, carbonate of lime and carbonic acid.

Philostratus, speaking of Agamemnon's bath, near Smyrna, relates that at the time when the Greek army under Agamemnon was ravaging Caius, a sanguinary battle ensued, in which many Greeks were killed and wounded; /





water; the spring of Alysson, near Nonaeris, which was specific for hydrophobia.

Herodotus mentions a spring in the country of the Ichthysphagi or fish eaters, the water of which made the skin shine as if polished, and at the same time imparted to the bathers a perfume as of violets. This water was one of such low specific gravity that pieces of wood and other light bodies did not float in it but immediately sunk to the bottom; it was also supposed to possess invigorating and life-prolonging powers, so that those who frequently bathed in it lived to 120 years of age.

Perhaps it was such and similar fables relating to the extraordinary effects of mineral springs which made the medical profession of Greece averse to the therapeutical use of the waters. Hippocrates in his work "de aeribus, aquis et regionibus S. Coeis" says that the saliva is made hard and dry by waters and generally speaking they are unwholesome, although there might be a few constitutions and diseases in which they could do good. Springs which came from rocks were indigestible, and the same was the case with thermal waters which contained iron, copper, silver

silver and sulphur. These heated the system and dried up the juices; they did not easily pass out of the system and caused constipation. Those who stated that saline waters readily passed with the faeces and even excited the bowel spoke in ignorance, for the waters mentioned had the opposite effect.

Hippocrates and his immediate followers were the first to attempt a classification of mineral springs according to their chemical composition. They classified five different kinds of waters according to their contents, sulphur, alumina, bitumen, nitre or saline. Mixed waters acted according to the peculiarities of the most prominent ingredient contained in them.

Herodotus wrote a treatise on the Natural Remedies for Health and Disease, which unfortunately is lost. He gave special rules for the therapeutical use of the mineral waters, especially as to the time for which baths should be continued.

The Jews in Palestine also made use of cold and hot mineral springs at a remote period for the cure of disease. Nothing of the kind, it is true, is mentioned in the Old Testament; we only hear in Genesis that Anah, son of Zibeon, the Hivite, the father/

father of Esau's wife, while feeding asses in the desert discovered there some springs; and in the second book of Kings, a well at Jericho is mentioned "where water was naught and the ground barren" but which was made wholesome by the Prophet Elisha throwing salt into it. From the New Testament, however, we learn that thermal waters were extensively used by the Jews before Christ; and that "a great multitude of impotent folk, of blind, halt and withered, lay in the porches of the pool of Bethesda" (which in Hebrew means House of Mercy or charity) "by the Sheep Market at Jerusalem waiting for the moving of the water," and that "whosoever first after the troubling of the water stepped in was made whole of whatsoever disease he had". This water contained salines and irons; it was of a reddish brown colour, no doubt due to a sediment of orlin; sulphur was also found in the mud which may account for the curative effect fully apparent when the water was stirred up.

The most important springs of Palestine however were those of Tiberius (now Tebarrah) near the lake of Genezareth, of which we find mention in the writings of Strabo, Pliny and Josephus. This lake is 10 miles long/

long and has on account of its picturesque situation been compared by modern travellers to Lake Lemman. Both at the eastern extremity of the lake and towards the south there are sulphurous thermal springs of a temperature varying from 86 to 130 degrees F. They contain sulphuretted hydrogen, sulphate of soda and iron, and were chiefly used in painful swellings, rheumatic gout, palsy etc. A portico of granite and Egyptian marble which led from the town to the waters was erected by the Romans. This is now deserted and destroyed but the springs themselves are even at the present time visited by patients coming not only from the neighbourhood but from all parts of the country.

Another famous bath existed in the neighbourhood of the Dead Sea, in the ancient country of Edomitus, which was known to the Greeks and Romans under the name of Calirhoë (Beautiful Spring). This place is mentioned by Josephus, who when speaking of Herod's sickness says "he not only hoped for restoration but thought of the means to bring it about". He caused himself to be carried across the Jordan and used the warm waters of Calirrhoë. The same spring is spoken of by Pliny who says that at this place there existed a warm spring of great virtue in restoring health.

The most extensive use of mineral waters was, however, made not only in Italy and Greece but in most parts of the old world at the time of the Roman Emperors . Very old contrivances for bathing may be found in Ischia, in the Lipari Isles, and in Syracuse. At first the Romans only bathed in cold water and Hannibal was blamed by them for resting too long "in fomentis Campaniae virium alias indomitum enervantibus". On the conquest of Greece, however, the Romans became acquainted with warm bathing which they soon learned to appreciate.

One of the first who erected thermal baths in Rome was Scipio Africanus. The fashion soon spread and at the time of Columella and Ammianus Marcellinus there was scarcely a village in Italy without bath establishments. More attention was at the same time directed to natural hot springs, a great number of which were then found in all parts of Italy. Bajai, Puteoli, Stabia and Cumae, became the most fashionable bathing places.

A reaction took place at the time of Augustus who was cured of a fever by Antonius Musa by hydropathic treatment. As a result cold water baths became the rage and even newly born infants were immersed in it,

a custom which still existed at the time of Galenius by whom it was severely censured. When, however, Marcellius, son of Octavia, suddenly died after taking a cold bath, the predilection for cold water baths very much abated and under the reign of Nero hot baths were again generally preferred.

In the course of their warlike expeditions to other parts of Europe, and to Asia and Africa, the Roman Generals stationed their troops where they encountered hot springs which had almost become a necessity for them, and large and comfortable bathing establishments were erected at many places.

The Romans discovered a great many of the most important thermal baths of France, England, Germany, Spain, Portugal, Belgium, Transylvania and even Africa. Amongst those most used by them I merely mention Aix in Savoy (Acqui in Montferrat) (Acqui Stabiellae) Baden in Switzerland (Thermore Aurihae) Baden near Vienna (Acqui Noricae) Bath (Acqui Calidae Sudatae Solis) Wiesbaden (Aqua Mattiaca) Aix-la-Chapelle (Aquis Granum s Aquae Grannanes) Spa in Belgium (Aqua ad Civitatem Tryrian) and many others.

M. Tristram in his work on the great Sahara informs/

informs us that on the eastern extremity of the desert, in the oasis of ElKantara there exists the ruins of a Roman town and thermal baths, near a natural basin which receives the contents of a hot spring and which had no doubt decided the selection of the site.

Pliny mentions a very large number of mineral springs in all parts of Europe. He speaks especially of the waters of Bajai which were so hot that they were used for healing; cold baths of the Springs of Puteoli which were believed to be a specific remedy for diseases of the eye; of the sulphurous waters of Albula near Rome and of the hot Springs of Mattiaci (Wiesbaden) which cured rheumatism.

Galenus gave as little attention to mineral waters as Hippocrates had done. Although there were several springs famous for their curative powers near his native city of Pergunnus and he must have been acquainted with a large number of them in Italy, Greece, Macedonia etc., he only mentions Albula near Rome, which according to him may be useful in diarrhoea. He scarcely ever advised bathing in mineral waters, which he believed dangerous on account of foreign ingredients contained in them. He said they were heating and exsiccating and/

and either contracted the vessels or irritated the skin by their acidity. Most followers of Galenus repeated the doctrines of the Master and only a few of them held original ideas on the subject. Amongst the latter was Caelius Aurelianus who practised at the end of the second Century and who recommended mineral baths in a number of diseases. Patients suffering from paralysis of apoplexy were sent by him to the thermal baths of Padua and Sienna. He prescribed the alkaline and saline waters of Ischia.

Autythus, a Physician of the Third Century, stated that the curative effects of the mineral water baths were much greater than those of ordinary baths. He found that nitrous and muriated baths were good for rheumatic affections, sulphurous springs calmed the irritation of nerves and dissolved obstruction but at the same time weakened the digestion.

With the decadence of the Roman Empire, the use of mineral springs also diminished. The Buildings were left impaired or were destroyed by the invading Barbarians. The vapour baths in the neighbourhood of Naples were special favourites with the people, to the great annoyance it is said of the doctors who were mortified/



mortified to see the mineral baths and springs of Bajai preferred to their prescriptions. The disuse of mineral water baths was still further accelerated by the priests who denounced the warm baths as sinful. Augustine in his "Rules" only permitted bathing once per month and Hieronymus entirely forbade it for the adults.

The Germans appear to have been from time immemorial much in the habit of bathing in their numerous rivers and lakes. Charlemagne did much towards rendering the use of thermal baths fashionable in Germany. He was very fond of the hot sulphurous Springs of Aix-la-Chapelle, and Eginhardt relates that sometimes more than one hundred people bathed in them at the same time.

It was, however, especially at the time of the Crusade when the Western nations became acquainted with the habits of the East that the use of the warm baths became general. Where Roman buildings still existed these were resorted to: new places were only erected at such parts as were patronised by Crown heads.

In Spain thermal baths flourished under the Empire of the Moors who like the Romans everywhere erected magnificent buildings for the convenience of patients, and these were recommended by Rhasis, Avicenna, Abulases, Abulcasis, /

Abulcasis, eminent Arabian Physicians.

During the Middle Ages mineral baths were little in evidence and scarcely can be said to have existed, nor were there any theories of their nature and action.

With the Renaissance of the Sciences an extensive literature on this subject sprung up, the founder of which was the learned Monk Clement of Gratz (1495). Conclusions were drawn by him from their taste. If the taste was saline it was thought to come from the sea; if it had a pungent taste, brass and copper must be the cause; if fatty, sulphur.

After some time, however, rude chemical experiments on the composition of the springs were made. The water was allowed to evaporate and the deposit which remained was subjected to the action of fire. Thermometers being unknown at that time the temperature was determined by the impression made by the water on the hand.

The importance of mineral waters as curative agents in those times can scarcely be too highly estimated if we consider the state of medicine at this time and that mineral baths and waters were without exception the most effective and safest means of/

of curing disease.

The use of thermal baths became more popular than ever with good results and Hoffman<sup>2</sup>, who was Physician to the Elector of Brandenburg, said of the springs and baths of Wambunn, "I have myself seen men and women who had lost the use of their limbs carried to those waters and after a number of baths begin to walk with a stick and even at last able to do so without any support". In the Sixteenth Century the Doctors of Breslau advised their patients suffering from sciatica to use these waters. This they did with good results.

The history of baths and a more accurate knowledge of their composition is identical with that of chemistry. At this time (1648) alkalis and fixed air was discovered by Van Helmont. One year later a number of chemical reagents were discovered by the Hon. Robert Boyle.<sup>3</sup>

At the same time Dominique Duclos<sup>21</sup>, Physician to Louis XIV made the first analysis of the more important mineral waters of France, In 1698 there was published an important work which was written with the purpose of recommending the waters of Buxton. It gave a very accurate description of different effects produced by warm and cold baths and recommended the reintroduction/

reintroduction of the latter as used by the natives for hardening and invigorating the body and preventing rickets and eruptions of the skin, and for use in rheumatism and other complaints. It thus was the means of reviving their use in England.

Signor Todara of Naples induced the Italians to employ cold water baths for the prevention and treatment of disease.

It is rather a peculiar fact that in the works of Sydenhem no mention is made of the use of baths and especially mineral water baths.

At the commencement of the Eighteenth Century Hoffmann<sup>4</sup>, one of the most eminent Physicians of his time, added greatly to our knowledge of baths. He improved the method of analysing the waters, and he combated the erroneous opinion which was then prevalent that mineral waters were acidulous. He analysed chiefly the waters of Carlsbad, Enos Sedlitz, Aix-la-Chapelle, etc.

In this country the sulphur wells of Harrogate were first discovered in the Sixteenth Century by William Slingsly while those of Strathpeffer became known by Dr. Morrison in 1899. Dr. Morrison was an Aberdeenshire/

Aberdeenshire Physician who was treated and cured of a chronic rheumatic affection by means of the sulphur baths and he therefore brought the virtues of Strathpeffer to the notice of the medical profession.

Althaus<sup>5</sup> in the Nineteenth Century on writing of sulphur baths stated that it was very difficult to explain the action of this bath and that although the special therapeutic value was altogether called in question yet examination taught him that the stronger waters did indubitably exercise some therapeutic effect. He was unable to state what it was.

As Spas developed hospitals were built where treatment could be given and investigations made by the local doctors. These hospitals are all for the treatment of rheumatism.

The Royal Mineral Hospital at Bath was founded in 1738.

The Devonshire Hospital, Buxton, was founded in 1738.

The Royal Bath Hospital, Harrogate, was founded in 1824 and rebuilt in 1888.

The Spa Hospitals have done great work but up to 20 years ago the practice was limited to the use of/c

of mineral waters of the particular Spa. Since then they have become very popular. Although with the aid of laboratories much research work has been carried out on the action of mineral water applied externally on rheumatism, it is surprising how little has actually been done. This is especially so in sulphur baths as is evidenced by the scanty literature on the subject.

Bain & Edgecombe<sup>6</sup> speak of having examined the blood after a thermal Sulphur Bath at a temperature of 98 for twenty minutes on four successive days and no marked change was found.

W. Grunow (Wildbad)<sup>7</sup> describes changes in the blood during treatment with the thermal baths at Wildbad; he states that after a thermal bath there is a brief rise in the leucocytes but this is followed by stages of reaction with fall in leucocyte count. A post reaction may often be observed following bath treatment. In mild cases it may even appear during the time this is marked by a rise in leucocytes.

Mayer Bisch<sup>8</sup> experimented by injecting sulphur 2-3mg. to a normal joint and states that a polymorphonuclear leucocytosis of the blood was produced.

Dr./

Dr. Weiss-Ostborn<sup>9</sup> found by a colorimetric method that the excretion of sulphur was increased by 30-40% in 90% patients after sulphur baths and that basal metabolism of the bathers was increased by 40%. showing a prolonged effect on oxidation processes, though the temperature of the baths was practically that of the body.

Richart,<sup>10</sup> in an article written in 1932, speaks of the reaction of sulphur baths and their therapeutic effect and discusses whether or not the reaction is desirable.

Little attention has been paid to the subject on the Continent of late years.

Experiments have been carried out with the use of artificial sulphur iodine preparation. Langer<sup>11</sup> experimented with combined effects of sulphur baths and injections of vaccineurin in therapy of sciatica, in 1932.

An article was written on the effects of sulphur in baths in 1928 by Kionka<sup>12</sup> and on the Biologic curative power of sulphur baths by Schmidt<sup>13</sup> in 1930.

3. R A T I O N A L E of B A L N E O T H E R A P Y.



Water, when brought into contact with the normal surface of the body acts (1) through temperature; (2) pressure; (3) duration; also mechanically and chemically.

The changes in innervation can be shown by hot, warm, tepid, cool and cold water as well as by electricity, mechanically and chemically. These consist in inhibition, increase, reduction, modification or destruction of the nervous system at the point of application or in motor and sensory paths. These are all conducted, reflected, and joined with the nervous system.

Not only do we increase, diminish, modify the perceptive process of the sensory nerve endings at the point of application by their mechanical or chemical stimulation but we accelerate, intensify, modify or inhibit conduction in the nerve channels. Also through the medium of the conducting paths within central organs quantitative and qualitative changes of innervation are induced. Again through the efferent and reflex nerve paths they influence the peripheral organs. As the nervous system incites, stimulates, inhibits, and regulates all the functions of organs through an influence/

influence exerted upon the nervous system, it will be possible to make an impression upon the functions of all organs through their influence.

It is known that mechanical and chemical agencies applied to the skin act as irritants and the significance of the stimuli with regard to vital processes may be considered as also known. Withholding of the irritation may give rise to enfeeblement and to lessening of function and of structure. While the application of irritation, so long as it is adequate, stimulates and strengthens; if applied in excess, it injures.

The value of stimuli for the relief of nutritive disorders may be shown by the following example.

If an undersensitive or oversensitive piece of skin be exposed to a transitory thermic or to a mechanical irritation, such as contact with a piece of ice or with hot air or friction, or hot or cold water, the sensibility of the skin will have undergone a change. The stimulation has modified the innervation and if properly applied has corrected the existing derangement of innervation.

An example of the remote effect of peripheral irritation is shown by the restoration of a person who/

who has fainted by throwing water on the face. This causes a conveyance from the point of irritation of the sensory termination to Medulla Oblongata, also cerebral hemispheres.

Primarily they act by stimulation and depression; the systematic repetition of which induces a cumulative effect in the desired direction and thus makes it from a temporary into a permanent result. The nerve cell exposed to thermic irritation requires, for example, nutritive material in accordance with its increased or decreased activity. Thus circulative, metabolic, digestive and other nutritive processes are stimulated or depressed.

The comprehension of thermic, chemical and of mechanical effects is simplified by the fact that together with nerve stimulation, inhibitory and stimulatory impulses are conveyed to the corresponding vascular areas causing either increase or diminution in the supply of nutritive material.

For many years great stress was laid when estimating the value of mineral baths on the fact that the constituents of these were capable of exerting a direct influence by absorption into the blood. This particular emphasis/

emphasis has now been forced into the background.

The question as to whether the uninjured skin is capable of absorbing the substances dissolved in the water has been decided in the negative. The results apparently showing that the weight of an individual is increased after a bath and that this was due to absorption have not been confirmed. And so it is with the statement that the increase in the amount of urine secreted after a bath was due to absorption and that after simple muriated baths there is an increase in urinary chlorides indicating a diffusion of the salt of the bath.

The positive results which were obtained after bathing in a bath of Iodine or Seaweed cannot be relied on as the experimenters either forgot or did not realise that the volatility of the iodine was capable of being inhaled and did not exclude this fact.

When Röhrig did some work on the iodine bath he protected the prepuce by means of rubber against it coming in contact with the water and similarly with the umbilical fold and anal orifice by means of a coating of fat. Respiration was carried out through a tube terminating in a corridor. He remained in a bath of Potassium/

Potassium Iodide for three quarters of an hour but no iodine was found in his urine. It should also be stated that the temperature of the bath was 95°F.

Kletzinsky, Lehmann, Thomson, Rubateau, Ritter, experimented with baths containing such soluble substances as Potassium ferrocyanide, ferrous sulphate and ferrous carbonate. Their results were all negative. Wilhemia alone obtained positive results.

It has to be admitted that substances which are capable of injuring the horny layer of the skin, such as mercuric chloride, arsenic, salicylic acid, salol when they are added to a bath, are absorbed. Ethereal solutions such as atropin, cocaine, veratrin and aconitine are according to the experiments of R. Winternitz<sup>15</sup> absorbed by the skin. However he found it impossible to demonstrate the direct entrance of these substances into the skin from watery solutions.

It must therefore from the above be considered proved that the skin is not permeable to water and the various chemicals dissolved in it, even after prolonged baths, and also that absorption of substances in mineral baths does not take place through the skin.

It/

It has been proved however that the skin of the bather is permeable to volatile constituents and gases of mineral baths, such as  $\text{CO}_2$  and  $\text{H}_2\text{S}$ .

Anterrieth placed animals in bags which were filled with  $\text{H}_2\text{S}$ , the head alone excepted and found that death took place in 10 to 20 minutes, thus proving that this gas is absorbed through the skin.

This applies also to the absorption from the water of the bath of volatile and ethereal substances that permeate the epidermis and exert a certain irritative effect upon the peripheral nerve filaments in the skin. Serrag and Bremont found that the absorption of watery solutions in a fine spray took place. Röhrig and Juhl found that not only alcoholic but also watery solutions of potassium ferrocyanide, tannic solution and potassium iodide were capable of penetrating the body through the skin. A result that was questioned by Fleischer, Riseer, Levin and du Mesnel. Much seems to depend on the force with which the finely divided particles of water and saline matter come against the skin as to the amount of absorption which will take place.

Promotion of absorption can be made possible.

The/

The selum of the hair follicles, secretion of sweat glands and the scales of the epidermis form a fatty layer which must be removed in order that proper absorption can take place. This may be done by washing the body before entering a bath. Also if the temperature of the water is increased and the skin vigorously rubbed, it causes a fullness of the cutaneous capillary vessels of the skin so that greater contact takes place between the blood and the fluid which is imbibed by the epidermis. Apart from absorption in the mineral bath it should be remembered that there may be an effect from the contact obtained between the skin and the water, depending entirely upon the concentration of the bath and upon the quality of saline matter in the solution.

In accordance with the physical laws of endosmosis and exosmosis, diffusion should take place as the skin of the individual separates two saline solutions of different concentration, on the one hand, the water of the bath; on the other hand, blood serum. But if the skin prevented such diffusion there will still be the result of the approximation of the separated fluids of the mineral bath/

bath and the blood serum. The blood passes rapidly towards the surface of the body, and thus becomes the seat of increased movement of the fluid. The quantitative relation of the solids dissolved in the water of the bath is of importance in connection with the above, without even giving a thought to the process of absorption. In other words the more concentrated the mineral bath the greater will be the said effects shown.

Other Factors:-

The chemical nature of the dissolved salts appears of itself to possess a certain activity. The chemical stimulation of the skin is the most important thing that the action of the mineral baths do. This stimulation partly due to the gaseous and partly to the saline contents of the mineral baths is in itself a relatively feeble action, but the continuous and accumulating sensory irritation affects an extensive cutaneous area.

This really results in the ordinary influence of warm water baths upon the circulation of the blood, and through reflex influences upon the centres regulating the action of the heart as well as upon the nervous/



nervous system in general being all materially increased. This tactile irritation Weber<sup>14</sup> attributes to a peculiar quality so operating that the various mineral waters through the irritation excited by their contained gases and salts effect in a different manner the reflex influences upon the circulation and innervation.

The investigations of Grutzner, Heidenham, Röhrig and Nauman who have shown that the various kinds of irritation exert very widely differing influence upon the arterial blood pressure supports this view. Liétrich in his experimental work on rabbits came to the conclusion that the animal skin reacts differently in manner and degree in accordance with the slightest difference in the chemical constitution of fluids to which it is exposed.

Another point relative to the chemical irritation of mineral baths appearing of significance is that the CO<sub>2</sub> which is found in these baths excites the chemical stimulation of the heat nerves, as a result of which an increased appreciation of heat is felt by the person in the bath. Thus baths which contain CO<sub>2</sub> may be taken at a lower temperature than baths of ordinary hot water. Because of the presence of gas and saline matters, /

matters, the mineral baths exert a more energetic after-effect upon the dilation of the capillary vessels of the skin. The gases and salts of mineral baths appear to possess a vasodilator influence. This I was able to prove myself.

Under a small patch of skin of a number of patients was injected pituitary extract so as to cause a constriction of the blood vessels of the skin. This was shown by the patch of skin becoming white. When these patients were subjected to a saline sulphur bath for twenty minutes it was noticed that at the end of this time the wheal had disappeared. Whereas with an ordinary hot water bath it took almost one and a half hours. After every mineral bath, moreover, there remains upon the skin for a considerable period of time finely divided particles. Therefore as a result of the adhesive properties of saline substances it stands to reason that there must be a great degree of cutaneous irritation for some considerable time after a person has bathed in a saline mineral bath, even although the bath contains but a small quantity of saline matter. Metabolism is also influenced as the result of the chemical irritation of the skin by/

by the mineral bath by reflex augmentation of the metabolic process. It increases the oxidation in proportion to the amount of the irritation of the saline constituents of the mineral bath upon the skin.

The respiratory gaseous interchange in Mineral baths rich in saline material is greater than in baths of ordinary hot water at the same temperature.

Various investigations have also shown the influence upon the quantity of normal urinary constituents and particularly that by various mineral baths.

As a result of the chemical irritation of the mineral baths upon sensory nerves, sensations of the skin, from a slight prickly feeling to that of burning occur.

The general redness of the skin of the parts which are exposed to the influence of the bath occurs. Also further contraction of the unstriated muscular tissue of the small arteries of the skin.

Amongst the constituents of a mineral bath which are capable of skin irritation are  $\text{CO}_2$ ,  $\text{H}_2\text{S}$ , volatile organic acids such as formic, malic, then sodium/

sodium chloride and calcium.

This chemical irritation of the skin also is known to be the cause of the so-called bath exanthemata - cutaneous eruptions etc. - and these were seen very often at one time after courses with mineral baths, and to which the high temperature and the duration of the bath helped. The erythemata, exzemas, and furuncles that occur, which were at one time held to be an indication of the curative effect are now considered by many to be the opposite for they indicate too active irritation of the skin and consequent atonic or paralytic dilation of the vessels.

A peculiar electric irritation is also thought to be a very important factor in the efficacy of mineral baths. This view has been held since Scoutellen remembering that mineral baths applied to the surface of the human body caused a much stronger circuit in the latter than in ordinary water, considered the electric current as the principal irritative source for the peripheral cutaneous nerves. Further work has shown a greater electric conducting power for certain mineral waters. Among the gases contained in mineral waters  $\text{CO}_2$  and  $\text{H}_2\text{S}$ , cause in general greater/

greater deflection of the multiplier; Distilled water with ozone and  $O_2$  less deflection.

The view which Renz expressed with reference to thermal baths that a water that has been exposed to the high atmospheric pressure of the incandescent heat of the interior of the earth presents an arrangement of its molecules different from that of an artificial water has been very much debated. So have the experiments by Scholz according to which the heat capacity of natural thermal water is far greater than that of artificially heated water. Certain kinds of mineral baths, particularly moor baths, afford a ready means for conveying to the body considerable degrees of heat and by elevation of the temperature of the body the irritative phenomena can be more readily induced on the part of the nervous system than through baths with ordinary water.

In the same way the mechanical irritation of certain mineral baths such as mud, moor, and baths with  $CO_2$  and  $H_2S$  will be far greater than those obtained from the ordinary waters.

The substances in the water of the mineral bath influence the bather through a channel other than the skin/

skin - inhalation by the respiratory organs of the evaporated gaseous substances when they show activity. In association with this all the gases and substances convertible by means of their chemical construction into gases, contained in the water of the bath, diffuse into the surrounding atmosphere whence they enter the respiratory organs.

4. METHODS of APPLICATION.

The baths used for the experiments were of the porcelain type. In each bath there was approximately 31 gallons of mild saline sulphur<sup>water</sup> and to this was added about 26 gallons of ordinary hot water in order to bring the bath to the requisite temperature. This is the only way in which the sulphur bath is brought to the correct temperature at the Bath Hospital. This has marked disadvantages because if care is not taken, more water than sulphur is used.

Samples of the water were submitted to examination before and after use. It was found that the count varied slightly from day to day, but a typical example of the count proved to be as follows :-

Sodium	109.0	parts per 100000
Potassium	2.05	
Ammonium	.17	
Lithium	trace	
Magnesium	2.90	
Calcium	7.26	
Iron	0.03	
Aluminium	trace	
Manganese	.015	
Chloride	163.0	
Bromide	trace	
Silicate	.72	
Sulphate	4.33	
Carbonate	22.0	
Sulphur (as sulphide)	1.47	
	<hr/>	
	312.95	
	<hr/>	

It is interesting to note that when I continued the experiments at the beginning of 1933 the results were/



were not satisfactory. An increase in the polymorphonuclear leucocytes was got but it was not so marked as up to the end of the year 1932.

Samples of the sulphur water from the springs and also from the baths were sent by me to Mr. Woodmensey, M.Sc., A.I.C., Hon. Consulting Chemist, Royal Bath Hospital, Harrogate. Taken over a period of three weeks his chemical analysis showed that the chemical constituents of the sulphur water were gradually decreasing. During this time there had been much rain. The Springs were examined by the Engineer of the Hospital who stated that surface water was getting into them. This matter was immediately taken up by the Medical Staff and the Springs re-lined.

During this period most of the work was carried on at the Royal Baths.

When the re-lining of the Springs had been completed the experiments at the Royal Bath Hospital were again carried out with satisfactory results.

At the Royal Baths in addition to the method before described two other methods are used, videlicet :-

(1) That/

(1) That in which the bath consists of saline sulphur undiluted and heated with steam. This bath is known as the thermal sulphur bath.

(2) That which is heated by admixture of Alkaline sulphur water which has previously been heated. This is termed the Saline Sulphur bath.

During the experiments the temperature of the baths in 84 cases was kept rigidly at 100°F. and in 26 cases at 98°F.

The Thomas Zeiss method of counting leucocytes was adopted in 90 cases and in 10 cases the Fuchs - Rosenthal Counting Chamber. The blood was withdrawn from a puncture in the lobe of the ear, without squeezing, into a Thomas Zeiss pipette.

The dilution was 1.100. At least 80 fields were counted and the diluting fluid was Toisson's fluid.

This consists of :-

Methyl violet	0.025 gramm
Sodium chloride	1.0
Sodium sulphate	8.0
Neutral glycerine	30.0
Distilled water	160.

The/

The pipette was well shaken and three separate chambers were filled and counted. The average of the three results was taken.

Hassellach and Hazerdahl (1908)<sup>16</sup> and Ellemen and Erlandsen (1911)<sup>17</sup> have both shown that changes of posture cause a variation in the leucocyte count. Recently Garway (1929) found that a recumbent position with complete physical and mental relaxation reduced the leucocyte count to a minimum which in the subjects investigated lay between 9000-6000 per c.m. More recently still there is the work of Harold Eric Martin (1933) who found -

- (1) that the counts were steadiest and at a minimum when the patient's condition approximates most nearly to that of absolute physiological rest
- (2) that the counts rise with increase in the mental and physical activity of the subject.
- (3) that the counts tend to rise in the later afternoon, this being regarded as the period of greatest activity.

It/

It was therefore deemed advisable to keep the patients recumbent and in a condition of absolute rest for at least one hour before and during the course of the experiment. Most of the work was done in the mornings.

The patients had a light breakfast at 7.45 a.m. At 8.30 a.m. they entered the cooling room of the bath house and reclined on a couch until 9.30 a.m. A white cell count and differential were then done. The patient was then put in the sulphur bath where he lay for 20 minutes. At the end of this time he was taken out of the bath and a blood count again done. The patient was now wrapped in towels and carried to his couch. There he rested and cooled for one hour. At the end of this time a final white cell count was done.

The/

The material for the experiments was more than ample and of necessity some choice had to be made, though the cases were not specially selected. I decided to examine 100 cases and most of them had just been admitted to the Hospital.

They had therefore no other treatment before being subjected to the experiment.

The ages of the patients used ranged from 17 to 60 years, the average age being 40 years. 78 of the total number were males and 12 females.

78  
12  
90

It will be noticed that the males are very much in the majority as they were easier to work with.

Of the 100 cases -

5	suffered from rheumatoid arthritis
1	chronic rheumatism
17	infective arthritis
43	fibrositis
7	osteo arthritis
1	tubercular arthritis
1	hyperplasia
2	villous arthritis
3	muscular rheumatism
2	neuritis
6	sciatica
2	intermediate arthritis
3	subacute rheumatism
1	sinusitis
2	skin diseases
1	spastic paraplegia
1	synovitis
1	convalescent rheumatism
1	neurasthenia
<u>100</u>	

To/

To facilitate the analysis of this investigation it became necessary to try to arrange the cases of rheumatism investigated under some classification which would be readily recognised. For this purpose a classification was adopted which had been used by G.L. Kerr Pringle,<sup>20</sup> M.C., M.D. Edin., of which the groups and subgroups are as follows :-

#### Classification of Arthritis

1. Infective - (a) arthritis associated with specific organisms (gonococcus, tubercle, streptococcus, malaria etc.) (b) arthritis of unknown origin; (c) arthritis in association with zymotic disease (scarlet fever, measles, etc.); (d) septic arthritis; (e) rheumatic fever.
2. Metabolic - (a) Gout; (b) arthritis associated with deficiency of endocrine glands; (c) scurvy, haemophilia.
3. Neurotrophic - Tabes, syringomyelia.
4. Traumatic - Injury (dislocation, loose bodies, sprains) (b) static (villous arthritis of Goldthwait, arthritis associated with flat-foot, coxa vara, knock-knee).
5. Degenerative - (a) Senile osteoarthritis (morbus coxae senilis, Heberden's nodes); (b) a sequela of traumatic, infective and metabolic arthritis.
6. Toxic. - Anaphylaxis, horse serum etc.
7. Periarticular Fibrositis - Jaccoud's chronic fibrous rheumatism, chronic articular rheumatism.

#### Explanatory Notes on Classification.

The term "associated with" is used in the infective group, as it is recognised that the presence of an infective/

infective focus or foci is not conclusive proof that it is the only casual factor in the disease.

## CYTOLOGICAL EXAMINATION OF BLOOD

		<u>Normals</u>
W.B.C.	= White Cells, thousand per c.mm	5 - 10
B.P.	= Blood Pressure	
Temp.	= Temperature	

### Differentiation of 300 Leucocytes.

		<u>Per Cent.</u>	<u>Normals</u>
P.	= Polynuclear Neutrophils		55 - 75
L.	= Lymphocytes		15 - 35
H.	= Large Hyalines		0 - 8
E.	= Eosinophils		0 - 5
M.	= Mast Cells		0 - 3



NORMAL WHITE BLOOD CELL COUNTS SHOWING DEFINITE  
RE-ACTION TO SULPHUR BATHS.

NORMAL WHITE BLOOD CELL COUNTS SHOWING DEFINITE  
REACTION TO SULPHUR BATHS

and

COMPARISON WITH VARIOUS OTHER TYPES OF BATHS

Rheumatoid Arthritis

Age of Patient 47

PATIENT No. 4274.

	Before Bath	After Bath	After 1 Hour	After 2 Hours
W.B.C.	8.4	8.8	10.8	10.4
P.	45	48	54	
L.	52	50	44	
H.	3	2	2	
E.	-	-	-	
M.	-	-	-	
Temp.	100.4	101.2	100.6	

Sulphur Bath. Temp. 102°

Infective Arthritis

Age of Patient 36.

PATIENT No. 8266

	Before Bath	After Bath	After 1 Hour
W.B.C.	8.8	8.4	10.4
P.	52	67	69
L.	46	31	30
H.	2	2	1
E.	-	-	-
M.	-	-	-

At Royal Baths

Chloride Content of Bath 166.8

Fibrositis

Age of Patient 49.

PATIENT No. 8908.

	Before Bath	After Bath	1 Hour After	2 Hours After
W.B.C.	9.6	13.6	<u>17.6</u>	12.4
P.	60	69	74	
L.	38	29	25	
H.	2	2	1	
E.	-	-	-	
M.	-	-	-	

Sulphur Bath Temp. 102°

Duration 20 minutes.

Patient's temperature at 1 hour after - 100.8 (Rectal)

Kept in sheets and not allowed out.

Infective Arthritis

Age of Patient 52.

PATIENT No. 9670

	Before Bath	After Bath	After 1 Hour
W.B.C.	6.8	8.6	10.6
P.	52	56	67
L.	46	42	32
H.	2	2	1
E.	-	-	-
M.	-	-	-

Osteo-Arthritis

Age of Patient 51.

PATIENT No.10557

	Before Bath	After Bath	1 Hour After
W.B.C.	8.4	10.2	10.8
P.	56	59	59
L.	42	39	40
H.	2	2	1
E.	-	-	-
M.	-	-	-

Sulphur Bath. Temp. 102°

Duration 20 minutes.

Infective Arthritis

Age of Patient 59

PATIENT No. 10565.

	Before Bath	After Bath	1 Hour After
W.B.C.	7.6	10.0	10.4
P.	55	67	79
L.	41	32	20
H.	4	1	1
E.	-	-	-
M.	-	-	-

Sulphur Bath. Temp. 102°

Duration 20 minutes.



PATIENT No. 10586.

	Before Bath	After Bath	After 1 Hour	After 2 Hours	After 24 Hours
W.B.C	8.8	9.6	14.0	9.2	
P.	63	68	74	58	
L.	33	32	25	39	
H.	2	0	1	2	
E.	2	0	0	1	
M.	0	0	0	0	
B.P.	146/78				
Temp.	97.2	98.2	97.2		

Sulphur Bath. Temp. 100°

Duration 20 minutes.

PATIENT No. 11004.

	Before Bath	After Bath	After 1 Hour	After 2 Hours	After 24 Hours.
W.B.C.	6.8	9.6	10.8	7.6	
P.	43	43	54	49	
L.	54	55	45	47	
H.	3	2	1	1	
E.	0	0	0	1	
M.	0	0	0	0	
B.P.	128/78	128/78			
Temp.	98°F.	98.8	98°F.		

Sulphur Bath. Temp. 102°

Duration 20 minutes.

PATIENT No. 11301.

	Before Bath	After Bath	After 1 Hour	After 2 Hours	After 24 Hours
W.B.C.	9.2	10.0	14.4	9.8	
P.	67	71	76	69	
L.	32	28	22	29	
H.	1	1	2	2	
E.	0	0	0	0	
B.P.	130/65	125/60	-	-	
Temp.	96.4	98.4	97	-	

Sulphur Bath. Temp. 100°

Duration 20 minutes.

. PATIENT No. 11395

	Before Bath	After Bath	After 1 Hour	After 2 Hours	After 24 Hours
W.B.C.	7.6	11.2	12.	10.	
P.	54	58	64	62	
L.	45	36	34	35	
H.	1	2	2	2	
E.	0	4	0	1	
M.	0	0	0	0	
B.P.	130/68	130/65	-	-	
Temp.	97.2	98.6	-	-	

Sulphur Bath. Temp. 100°

Duration 20 minutes.

Fibrositis

Age of Patient 29

PATIENT No. 11198.

	Before Bath	After Bath	After 1 Hour
W.B.C.	10.8	11.0	12.8
P.	58	61	69
L.	41	36	30
H.	1	3	1
E.	-	-	-
M.	-	-	-

At Royal Baths.

Temp. 103°

Chloride Content

Tubercular Arthritis

Age of Patient 48.

PATIENT NO. 12110.

	Before Bath	After Bath	After 1 Hour
W.B.C.	10.0	13.4	14.4
P.	65	58	67
L.	33	41	32
H.	2	1	1
E.	-	-	-
M.	-	-	-
Temp.	99	101	100.4

At Royal Baths.

Temp. 103°

Chloride Content 206.

PATIENT No. 12486.

	Before Bath.	After Bath	1 Hour After	24 Hours After
W.B.C.	8.0	11.6	14.0	8.4
P.	64.0	74.0	78.0	61.0
L.	33.0	24.0	20.0	37.0
H.	2.0	2.0	2.0	2.0
E.	-	-	-	-
M.	1.0	-	-	-
B.P.	140/70	120/70	-	-
Temp.	96.4	98.4	98	

Sulphur Bath. Temp. 100°

Duration 20 Minutes.

PATIENT No. 12510.

	Before Bath	After Bath	After 1 Hour	After 2 Hours	After 24 Hours
W.B.C.	8.4	9.2	13.6	9.6	
P.	61	60	74	70	
L.	36	38	25	27	
H.	3	2	1	3	
E.	0	0	0	0	
M.	0	0	0	0	
B.P.	130/65	130/78	120/70		
Temp.	98.4	99.			

Sulphur Bath. Temp. 100°  
Duration 20 minutes.



Spastic Paraplegia

PATIENT No. 12533

	Before Bath	After Bath	1 Hour after	24 Hours after
W.B.C.	5.2	6.4	8.8	
P.	69	64	74	
L.	30	35	25	
H.	1	1	1	
E.	-	-	-	
M.	-	-	-	
B.P.	110/90	110/90	100/90	
Temp.		-	-	

Sulphur Bath.

Temp. 100°

Duration 20 minutes.

PATIENT No. 12576.

	Before Bath	After Bath	1 Hour After	24 Hours after
W.B.C.	9.2	6.0	11.2	9.6
P.	51.0	56.0	61.0	54.0
L.	46.0	43.0	35.0	34.0
H.	3.0	1.0	3.0	10.0
E.	-	-	-	2.0
M.	-	-	1.0	-
B.P.	-	-	-	-
Temp.	-	-	-	-

Sulphur Bath. Temp. 100°  
Duration 20 minutes.

PATIENT No. 12579.

	Before Bath	After Bath	After 1 hour	After 2 Hours	After 24 Hours
W.B.C.	6.4	7.2	13.4	10.0	
P.	58.0	60.0	64.0	63.0	
L.	40.0	39.0	35.0	35.0	
H.	2.0	1.0	1.0	2.0	
E.	-	-	-	-	
M.	-	-	-	-	
B.P.	106/66	98/66	106/66		
Temp.	97.4	98.2	99.0		

Sulphur Bath. Temp. 100°  
Duration 20 minutes.

PATIENT No. 12591.

	Before Bath	After Bath	1 Hour after	24 Hours after
W.B.C.	9.6	10.0	18.4	14.2
P.	70.0	78.0	81.0	75.0
L.	28.0	21.0	18.0	24.0
H.	2.0	1.0	1.0	1.0
E.	-	-	-	-
M.	-	-	-	-
B.P.				
Temp.				

Sulphur Bath. Temp. 100°  
Duration 20 minutes.

PATIENT No.12613.

	Before Bath	After Bath	After 1 Hour	After 2 Hours	After 24 Hours
W.B.C.	9.0	9.8	11.2	10.4	9.2
P.	55	43	68	69	
L.	42	56	30	30	
H.	3	1	2	1	
E.	0	0	0	0	
M.	0	0	0	0	
B.P.	150/75	150/75	150/75		
Temp.	97.2	98	-		

Sulphur Bath. Temp. 100°  
Duration 20 minutes.

PATIENT No. 12616.

	Before Bath	After Bath	1 Hour after	24 hours after
W.B.C.	6.0	7.8	9.8	6.8
P.	67	59	69	55
L.	31	40	30	42
H.	2	1	1	2
E.	0	0	0	0
M.	0	0	0	1
B.P.	130/80	130/80	126/70	-
Temp.	98.2	99	-	-

Sulphur Bath. Temp. 100°  
Duration 20 minutes.

PATIENT No. 12630.

	Before Bath	After Bath	After 1 Hour	After 2 Hours	After 24 Hours
W.B.C.	8.0	12.4	15.2	12.4	
P.	69	68	78	68	
L.	29	31	19	29	
E.	2	1	3	3	
M.	0	0	0	0	
H.	0	0	0	0	
B.P.	126/110	140/110	-		
Temp.		99.			

Sulphur Bath. Temp. 102°  
Duration 20 minutes.

PATIENT No. 12644.

	Before Bath	After Bath	After 1 Hour	After 2 Hours	After 24 Hours
W.B.C.	9.2	10.8	14.8	12.0	
P.	75	80	89	73	
L.	25	19	10	24	
H.	0	1	1	3	
E.	0	0	0	0	
M.	0	0	0	0	
B.P.	110/70	110/65	-	-	
Temp.	98	101	101	-	

Sulphur Bath. Temp. 100°  
Duration 20 minutes.



PATIENT No. 12659.

	Before Bath	After Bath	After 1 Hour	After 2 Hours	After 24 Hours.
W.B.C.	8.8	13.6	13.2	10.4	
P.	60	69	66	64	
L.	39	30	32	34	
H.	1	1	2	1	
E.				1	
M.				0	
B.P.	140/76	106/84			
Temp.	97.8	99.8	99.8		

Sulphur Bath. Temp. 100°  
Duration 20 minutes.

PATIENT No. 12687.

	Before Bath	After Bath	After 1 Hour	After 2 Hours	After 24 Hours
W.B.C.	8.8	11.2	13.6	8.6	
P.	65	68	74	67	
L.	32	29	24	32	
H.	3	3	2	1	
E.	0	0	0	0	
M.	0	0	0	0	
B.P.	120/68	115/60	-	-	
Temp.	95.4	97.6	-	-	

Sulphur Bath. Temp. 100°

Duration 20 minutes.

PATIENT No. 12707.

	Before Bath	After Bath	After 1 Hour	After 2 Hours	After 24 Hours
W.B.C.	8.0	8.8	14.4	9.6	
P.	50	55	58	56	
L.	49	42	40	42	
H.	1	3	2	2	
E.	0	0	0	0	
B.P.	140/72	133/70	-	-	
Temp.	99.2	99.8			

Sulphur Bath.

Temp. 100°

Duration 20 minutes.

Fibrositis

Age of Patient 36.

PATIENT No. 12815.

	Before Bath	After Bath	1 Hour After
W.B.C.	10.0	12.8	12.0
P.	66	69	69
L.	32	31	31
H.	2	-	-
E.	-	-	-
M.	-	-	-

Sulphur Bath. Temp. 102°  
Duration 20 minutes.

Rheumatoid Arthritis (Focal)

Age of Patient 51.

PATIENT No. 12859.

	Before Bath	After Bath	1 Hour After
W.B.C.	8.0	7.8	10.4
P.	58	61	66
L.	40	38	32
H.	2	1	2
E.	-	-	-
M.	-	-	-
Temp.	98.2	100.2	99.8

Sulphur Bath. Temp. 102°

Duration 20 minutes.

Hyperpiesia

Age of Patient 54.

PATIENT No. 12895.

	Before Bath	After Bath	1 Hour After	2 Hours After
W.B.C.	8.0	8.8	14.8	8.8
P.	60	64	65	61
L.	37	35	32	38
H.	3	1	3	1
E.	-	-	-	-
M.	-	-	-	-
Temp.	96.8		100.8	

Sulphur Bath.

Temp. 102°

Duration 20 minutes.

Osteo-Arthritis Spine

Age of Patient 36.

PATIENT No. 12903.

	Before Bath	After Bath	1 Hour After
W.B.C.	8.4	8.8	11.8
P.	56	58	62
L.	42	39	36
E.	-	-	-
M.	-	-	-

Sulphur Bath. Temp. 102°  
Duration 20 minutes.

Villous Arthritis

Age of Patient 42

PATIENT No. 12938.

	Before Bath	After Bath	1 Hour After
W.B.C.	8.8	9.6	13.2
P.	64	67	72
L.	33	31	27
H.	3	2	1
E.	-	-	-
M.	-	-	-

Sulphur Bath. Temp. 102°  
Duration 20 minutes.



Fibrositis

Age of Patient 51.

PATIENT No. 12943.

	Before Bath	After Bath	1 Hour After
W.B.C.	9.2	10.4	13.6
P.	55	63	68
L.	44	36	30
H.	1	1	2
E.	-	-	-
M.	-	-	-
Temp.			

Sulphur Bath. Temp. 102°  
Duration 20 minutes.

Muscular Rheumatism

Age of Patient 59.

PATIENT No. 12950.

	Before Bath	After Bath	1 Hour After
W.B.C.	6.0	8.8	11.6
P.	62	65	70
L.	36	33	29
H.	2	2	1
E.	-	-	-
M.	-	-	-

Sulphur Bath. Temp. 102°  
Duration 20 minutes.

Fibrositis

Age of Patient 32

PATIENT No. 12989.

	Before Bath	After Bath	1 Hour After
W.B.C.	8.4	7.8	11.4
P.	55	64	68
L.	44	34	30
H.	1	2	2
E.	-	-	-
M.	-	-	-
Temp.	99.8	100.4	100.2

Sulphur Bath. Temp. 102°  
Duration 20 minutes.

Fibrositis

Age of Patient 28

PATIENT No. 13004.

	Before Bath	After Bath	1 Hour After
W.B.C.	6.8	11.0	14.8
P.	71	63	69
L. .	26	36	31
H.	3	1	-
E.	-	-	-
M.	-	-	-
Temp.	99.4	102.2	100.8

Sulphur Bath. Temp. 102°  
Duration 20 minutes.

Fibrositis

Age of Patient 47.

PATIENT No. 13019.

	Before Bath	After Bath	1 Hour After
W.B.C.	12.8	15.2	16.8
P.	68	60	80
L.	29	38	19
H.	3	2	1
E.	-	-	-
M.	-	-	-
Temp.	99	100.4	100

Sulphur Bath. Temp. 102°

Duration 20 minutes.

Early Arthritis  
Ovarian Tumour

Age of Patient 36

PATIENT No. 13027.

	Before Bath	After Bath	After 1 Hour
W.B.C.	4.8	9.6	9.2
P.	67	67	67
L.	31	32	30
H.	2	1	3
E.	-	-	-
M.	-	-	-

Sulphur Bath. Temp. 102°

Fibrositis

Age of Patient 52

PATIENT No. 13028.

	Before Bath	After Bath	After 1 Hour
W.B.C.	10.6	12.9	12.4
P.	42	55	60
L.	56	43	38
H.	1	1	1
E.	1	1	1
M.	-	-	-

Sulphur Bath. Temp. 102°

Neuritis

Age of Patient 21.

PATIENT No. 13030.

	Before Bath	After Bath	After 1 Hour	After 2 Hours
W.B.C.	9.8	7.0	15.0	14.6
P.	56	69	69	
L.	43	29	31	
H.	1	2	-	
E.	-	-	-	
M.	-	-	-	
Temp.	100.2	103.5	99.8	

Sulphur Bath. Temp. 102°



Fibrositis

Age of Patient 56

PATIENT No. 13031.

	Before Bath	After Bath	After 1 Hour
W.B.C.	8.4	10.0	11.8
P.	56	58	57
L.	43	40	42
H.	1	2	1
E.	-	-	-
M.	-	-	-
Temp.	98.2	100	100

At Royal Baths.

Sulphur Bath. Temp 102°

Infective Arthritis

Age of Patient 58

PATIENT No. 13043

	Before Bath	After Bath	After 1 Hour
W.B.C.	9.6	17.0	13.7
P.	56	63	67
L.	43	36	33
H.	1	1	0
E.	-	-	-
M.	-	-	-

At Royal Baths.

Sulphur Bath. Temp. 102°

W.B.C.                      7.8                      6.4                      9.6

At. Royal Bath Hospital.

Infective Arthritis

Age of Patient 34.

PATIENT No. 13055.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	8.8	10.6	11.6
P.	50	53	66
L.	47	46	33
H.	3	1	1
E.	0	0	0
M.	0	0	0
Temp.	97	101	99

At Royal Baths.

Sulphur Bath. Temp. 102°

W.B.C.                      9.6                      8.0                      10.4

At Royal Bath Hospital.

Fibrositis

Age of Patient 42

PATIENT No. 13071.

	Before Bath	After Bath	After 1 Hour
W.B.C.	6.0	10.8	10.8
P.	50	56	64
L.	48	42	34
H.	2	2	1
E.	-	-	1
M.	-	-	-
Temp.	99.6	101.2	100.2

At Royal Baths.

Sulphur Bath. Temp. 102°

W.B.C.                      7.2                      7.6                      8.4

At Royal Bath Hospital.

Sciatica

Age of Patient 39.

PATIENT No. 13072.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	8.0	5.0	14.2
P.	60	58	72
L.	36	38	36
H.	4	2	2
E.	0	1	-
M.	0	1	-

At Royal Baths, Harrogate.

Strong Sulphur Bath. Temp. 102°

Sciatica

Age of Patient 32

PATIENT No. 13072.

	Before Bath	After Bath	After 1 Hour
W.B.C.	8.6	6.0	11.2
P.	57	52	62
L.	42	46	37
H.	1	2	1
E.	-	-	-
M.	-	-	-

At Royal Bath Hospital.

Fibrositis

Age of Patient 17.

PATIENT No. 13073.

	Before Bath	After Bath	After 1 Hour
W.B.C.	10.8	6.0	<u>11.8</u>
P.	60	68	<u>80</u>
L.	38	31	<u>19</u>
H.	2	1	1
E.	-	-	-
M.	-	-	-

Sulphur Bath. Temp. 102°

Intermediate Arthritis

Age of Patient 32

PATIENT No. 13082.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	10.4	10.0	14.6
P.	63	67	71
L.	36	31	28
H.	1	2	1
E.	-	-	-
M.	-	-	-

At Royal Baths. Temp. 102°

W.B.C. 9.2 7.6 11.4.

At Royal Bath Hospital.



Fibrositis

Age of Patient 44.

PATIENT No. 13083.

	Before Bath	After Bath	After 1 Hour
W.B.C.	8.0	10.4	12.6
P.	56	62	73
L.	42	37	26
H.	2	1	1
E.	-	-	-
M.	-	-	-

At Royal Baths. Temp. 102°

Fibrositis

Age of Patient 27.

PATIENT No. 12963.

	Before Bath	After Bath	1 Hour After.
W.B.C.	10.4	10.8	14.2
P.	66	68	70
L.	33	30	28
H.	1	2	2
E.	0	0	0
M.	0	0	0

Subacute Rheumatism.

Age of Patient 21.

PATIENT No. 13084.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	8.4	8.6	11.2
P.	49	66	70
L.	48	32	29
H.	3	2	1
E.	-	-	-
M.	-	-	-
Temp.	98.2	101	100.4

Sulphur Bath. Temp. 102°

Fibrositis

Age of Patient 27.

PATIENT No. 13087.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	8.0	10.0	10.8
P.	60	65	70
L.	38	34	30
H.	2	1	-
E.	-	-	-
M.	-	-	-

Sulphur Bath. Temp. 102°

Osteo Arthritis

Age of Patient 39

PATIENT No. 13099.

	Before Bath	After Bath	After 1 Hour
W.B.C.	8.4	7.6	10.8
P.	68	63	69
L.	30	36	31
H.	2	1	-
E.	-	-	-
M.	-	-	-

At Royal Baths. Temp. 104°

Sodium Chloride Content of Sulphur  
Water 166.8

Gout

Age of Patient 49.

PATIENT No. 13100.

	Before Bath	After Bath	1 Hour After
W.B.C.	7.2	10.0	11.8
P.	50	72	70
L.	47	26	28
H.	3	2	2
E.	0	0	0
M.	0	0	0

Sulphur Bath. Temp. 102°

Subacute Rheumatism

Age of Patient 35.

PATIENT No. 13101.

	Before Bath	After Bath	After 1 Hour
W.B.C.	9.0	6.4	11.2
P.	68	75	76
L.	27	24	23
H.	4	1	1
E.	1	-	-

Sulphur Bath. Temp. 102°

Osteo Arthritis

Age of Patient 43.

PATIENT No. 13105.

	Before Bath	After Bath	After 1 Hour
W.B.C.	5.6	8.2	11.6
P.	52	56	67
L.	46	42	32
H.	2	2	1
E.	-	-	-
M.	-	-	-

Strong Sulphur Bath. Temp. 102°  
At Royal Baths, Harrogate.

W.B.C.            10.4                    7.0                    10.4

Repeat Bath at Royal Bath Hospital.



Fibrositis

Age of Patient 43.

PATIENT No. 13105.

	Before Bath	After Bath	After 1 Hour
W.B.C.	8.0	10.0	10.8
P.	46	54	60
L.	52	45	40
H.	2	1	-
E.	-	-	-
M.	-	-	-

Sulphur Bath. Temp. 102°

Fibrositis

Age of Patient 36.

PATIENT No. 13106.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	9.6	19.8	15.4
P.	43	62	60
L.	56	36	38
H.	1	2	2
E.	-	-	-
M.	-	-	-

AT ROYAL BATHS.

Temp. 103°

Chloride Content.

Fibrositis

Age of Patient 36.

PATIENT No. 13106.

	Before Bath	After Bath	After 1 Hour
W.B.C.	6.4	11.0	11.6
P.	60	64	64
L.	38	34	34
H.	1	2	2
E.	1	0	0
M.	0	0	0

Sulphur Bath. Temp. 102°

Fibrositis

Age of Patient 29.

PATIENT No. 13111

	Before Bath	After Bath	After 1 Hour
W.B.C.	9.6	11.6	12.4
P.	65	54	63
L.	34	43	36
H.	1	3	1
E.	-	-	-
M.	-	-	-

Osteo Arthritis

Age of Patient 60.

PATIENT No. 13112.

	Before Bath	After Bath	After 1 Hour
W.B.C.	6.0	6.8	10.4
P.	57	56	64
L.	42	42	35
H.	1	2	1
E.	-	-	-
M.	--	-	-

At Royal Baths.

Temp. 103°

Chloride Content 188.1

Muscular Rheumatism.

Age of Patient 30

PATIENT No. 13114.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	9.6	12.4	14.2
P.	62	74	80
L.	33	20	18
H.	3	2	1
E.	2	4	1
M.	-	-	-

At Royal Baths.

Temp. 102°

Chloride Content of Bath 412

W.B.C.                      10.0                      8.6                      11.2

At Royal Bath Hospital.

Fibrositis

Age of patient 43.

PATIENT No. 13137.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	10.4	14.2	17.2
P.	68	75	76
L.	27	24	23
H.	4	1	1
E.	1	-	-

At Royal Baths.

Temp. 102°

Chloride Content of Bath 412

W.B.C.            9.6                    8.2                    11.2

At Royal Bath Hospital.

Fibrositis

Age of Patient 45

PATIENT No. 13142.

	Before Bath	After Bath	After 1 Hour
W.B.C.	8.8	9.6	16.0
P.	54	54	63
L.	43	45	35
H.	3	1	2
E.	-	-	-
M.	-	-	-



Fibrositis

Age of Patient 19

PATIENT NO. 13143.

	Before Bath	After Bath	After 1 Hour
W.B.C.	8.4	10.0	11.8
P.	57	56	64
L.	42	42	35
H.	1	2	1
E.	-	-	-
M.	-	-	-

At Royal Baths

Temp. 104°

Chloride Content 188.1

W.B.C.                      9.8                      9.2                      10.0

At Royal Bath Hospital.

Muscular Rheumatism

Age of Patient 57

PATIENT No. 13114.

	Before Bath	After Bath	After 1 Hour
W.B.C.	8.3	9.6	11.0
P.	52	53	65
L.	47	44	34
H.	1	3	1
E.	-	-	-
M.	-	-	-

At Royal Baths.

Temp. 102°

Chloride Content 290.5

W.B.C.            7.2                            5.6                            7.4

At Royal Bath Hospital.

Sciatica

Age of Patient 44.

PATIENT No. 13149.

	Before Bath	After Bath	After 1 Hour
W.B.C.	8.4	16.0	11.6
P.	65	65	69
L.	34	32	29
H.	1	3	2
E.	-	-	-
M.	-	-	-

At Royal Baths.

Temp. 103°

Chloride Content 390.5

W.B.C.                      9.6                      7.2                      10.8

At Royal Bath Hospital.

Fibrositis

Age of Patient 43

PATIENT No. 13157.

	Before Bath	After Bath	After 1 Hour
W.B.C.	8.0	7.4	11.6
P.	52	50	59
L.	44	48	39
H.	4	2	2
E.	-	-	-
M.	-	-	-

At Royal Baths.

Temp. 103°

Chloride Content

Age of Patient 40

PATIENT No.11234.

	Before Bath	After Bath	1 Hour After
W.B.C.	8.0	12.0	11.6
P.	48	60	67
L.	46	38	31
H.	6	2	2
E.	-	-	-
M.	-	-	-
Temp.	99.2	100.4	99.8

Sulphur Bath. Temp. 102°  
Duration 20 minutes.

Fibrositis

Age of Patient 36.

PATIENT No.

	Before Bath	After Bath	1 Hour After
W.B.C.	8.4	9.6	12.5
P.	54	51	63
L.	44	48	34
H.	2	1	3
E.	-	-	-
M.	-	-	-
Temp.	98.4	102.0	101.2

Sulphur Bath.

Temp. 102°

Duration 20 minutes.

C.I.

Age of Patient 23.

SINUSITIS

	Before Bath	After Bath	After 1 Hour	After 24 Hours
W.B.C.	7.2	8.4	12.8	
P.	65	68	71	
L.	32	31	27	
H.	3	1	2	
E.	0	0	0	
M.	0	0	0	

Sulphur Bath. Temp. 100°  
Duration 20 minutes.

Fibrositis

Age of Patient 21.

PATIENT No.

	Before Bath	After Bath	After 1 Hour
W.B.C.	4.4	4.8	10.8
P.	49	50	64
L.	47	47	34
H.	4	3	2
E.	-	-	-
M.	-	-	-

Sulphur Bath. Temp. 102°  
Duration 20 minutes.



PATIENT No. 12561.

	Before Bath	After Bath	After 1 Hour	After 2 Hours	After 24 Hours
W.B.C.	9.2	10.8	15.6	11.2	8.8
P.	72	72	76	78	
L.	27	26	22	22	
H.	1	2	2	0	
E.	0	0	0	0	
B.P.	142/80	136/80			
Temp.	97.6	99			

Sulphur Bath. Temp. 100°  
Duration 20 minutes.

PATIENT No. 12651.

	Before Bath	After Bath	After $\frac{1}{2}$ Hour	After 1 Hour	After $1\frac{1}{2}$ Hours	After 2 Hours	After 24 Hours
W.B.C.	9.2	10	17.2	16.4	14.8	12.4	
P.	72	77	71	75	69	68	
L.	27	31	28	24	30	29	
H.	1	2	1	1	1	3	
E.	0	0	0	0	0	0	
M.	0	0	0	0	0	0	
B.P.	123/70	108/58	-	-	-	-	
Temp.	98.2	99.8	-	-	-	-	

Strong Sulphur Bath.

Temp. 100°

Duration 20 minutes.

PATIENT No. 12646.

	Before Bath	After Bath	1 Hour After	After 2 Hours	After 24 Hours
W.B.C.	5.2	9.6	16.4	9.6	
P.	63	70	78	65	
L.	35	29	21	33	
H.	2	1	1	2	
E.	0	0	0	0	
M.	-	0	-	-	
B.P.	120/60	110/55	-	-	
Temp.	97.4	99.2	-	-	

Sulphur Bath. Temp. 100°  
Duration 20 minutes.

	Before Bath	After Bath	After $\frac{1}{2}$ Hour	After 1 Hour	After $1\frac{1}{2}$ Hours	After 2 Hours	After 24hrs.
W.B.C.	6.2	8.4	11.6	16.2	14.4	11.2	
P.	63	66	69	78	76	75	
L.	35	33	30	20	23	24	
H.	2	1	1	2	1	1	
E.	0	0	0	0	0	0	
M.	0	0	0	0	0	0	
B.P.	105/66	100/60	-	-	-	-	
Temp.	97.4	99.2	-	-	-	-	

Strong Sulphur Bath. Temp. 100°  
Duration 20 minutes.

PATIENT No. 12625.

Sulphur Bath.Temp.100°  
Duration 20 minutes

	Before Bath	After Bath	1 hour After	24 hours after
W.B.C.	8.4	10.0	15.2	9.2
P.	-	71	78	
L.	-	27	20	
H.	-	2	2	
E.	-	0	0	
M.	-	0	0	
B.P.	160/70	100/70	148/66	
Temp.	98.5	99.8	99.	

White Cells.

2 Hours after	3 hours after	4 hours after	5 hours after
15.0	12.0	11.2	9.6

With Mask

Before Bath	After Bath	1 Hour after	2 Hours after
8.4	9.6	14.8	14.2

Note. Patient left at end of fortnight. Very well - no pain or stiffness.

Infective Arthritis

Age of Patient 26

PATIENT No. 12838

Type of Bath	Before Bath	After Bath	1 Hour After
Sulphur	9.6	14.8	15.2
Sodium Chloride	9.7	7.6	9.0
Sodium Carbonate	5.2	5.6	6.4
Plain Water	7.2	6.4	7.6
Sulphur c Mask	8.4	6.8	13.4
Sodium Sulphide	7.6	6.8	8.4
Collosal Sulphur	8.8	7.2	8.4

Temperature of each bath 102°

Normal variation before bath ranges from 9.6 to 5.2 -

84.6% variation.

Infective Arthritis

Age of Patient 21.

PATIENT No. 9192.

Type of Bath	Before Bath	After Bath	1 Hour After.
Sulphur	5.2	8.0	14.3
Sodium Chloride	8.4	8.0	8.8
Sodium Carbonate	9.2	10.0	8.0
Plain Water	10.0	9.2	8.6
Sulphur c Mask	7.6	9.0	13.2

Temperature of each bath 102°

Normal variation before Baths ranges from 5.2 to 10.0 =  
92.3% variation

Fibrositis

Age of Patient 26

PATIENT No. 12782.

Type of Bath	Before Bath	After Bath	1 Hour After
Sulphur	8.2	8.8	12.8
Sodium Chloride	8.8	14.0	7.2
Sodium Carbonate	5.2	6.4	6.8
Plain Water	7.6	8.8	8.8
Sulphur & Mask	6.2	8.2	12.0

Temperature of each bath 102°

Normal variation before baths ranges from 8.2 to 5.2 =  
57.7% variation.

Arthritis

Age of Patient 30.

PATIENT NO. 12825.

Type of Bath	Before Bath	After Bath	1 hour After
Sulphur	7.6	9.6	11.4
Sodium Chloride	7.6	8.0	7.2
Sodium Carbonate	10.8	10.4	10.8
Plain Water	9.2	10.0	9.8
Sulphur & Mask	8.8	10.0	12.0

Temperature of each bath 102°

Normal variation before baths range from 10.8 to 7.6 =  
42% variation.



Infective Arthritis

Age of Patient 41.

PATIENT No.

Type of Bath	Before Bath	After Bath	1 Hour After
Sulphur	9.6	15.2	14.7
Sodium Carbonate	9.6	6.4	8.4
Sulphur & Mask	13.4	16.8	19.0
Sulphur	*17.4	14.0	10.8
Plain Hot Water	10.0	8.2	10.4

Temperature of each bath 102°

\* Patient had definite flare up of joints.

Normal variation before bath 9.6 to 17.4 = 81% variation.

Convalescent Rheumatism

Age of Patient 19.

PATIENT No. 12745.

Type of Bath	Before Bath	After Bath	1 Hour After
Sulphur	8.0	13.6	14.4
Sodium Carbonate	11.2	9.2	11.4
Plain Hot Water	10.0	8.2	10.4

Temperature of each bath 102°

Neuritis and Arthritis

Age of Patient

PATIENT No.12755.

Type of Bath	Before Bath	After Bath	1 Hour After
Sulphur	8.2	8.4	11.2
Sodium Chloride	9.6	8.0	8.4
Sodium Carbonate	8.8	<u>11.2</u>	9.2
Plain Hot Water	6.2	6.0	7.0

Temperature of each bath 102°

Note :-

At end of Sodium Carbonate bath patient was distressed and suffered from palpitation.

Infective Arthritis

Age of Patient 51.

PATIENT No. 12749.

Type of Bath	Before Bath	After Bath	1 Hour After
Sulphur	6.0	9.2	11.6
Collosal Sulphur	9.8	9.2	8.6
Sodium Chloride	5.2	6.0	6.4
Sodium Carbonate	7.6	7.2	7.6
Plain Hot Water	6.0	5.2	6.8

Temperature of each bath 102°

Variation before bath 6.0 to 9.8 = 63%

Age of Patient 54

PATIENT No. 12755.

	Before Bath	After Bath	1 hour After.
Sulphur	9.6	8.4	11.2
Saline	9.6	8.0	8.4
Sodium Carbonate	10.2	10.6	10.2
Plain Hot Water	8.6	7.2	8.8

Temperature of each bath 102°

Age of Patient 49

PATIENT No. 11301.

	Before Bath	After Bath	1 Hour After
Sulphur	9.2	10.0	11.4
Saline	9.2	7.2	9.6
Sodium Carbonate	7.6	8.0	8.4
Plain Hot Water	8.0	6.2	8.8

Temperature of each Bath 102°

Age of Patient 60.

PATIENT No. 12707.

	Before Bath	After Bath	1 Hour After
Sulphur	8.0	8.6	14.4
Plain Hot Water	8.0	8.8	9.6
Sodium Carbonate	8.6	8.8	9.2
Sodium Chloride	9.8	11.0	10.6

Temperature of each bath 102°

Age of Patient 20.

PATIENT No. 12644.

	Before Bath	After Bath	1 Hour After
Sulphur	9.2	10.0	14.8
Sodium Carbonate	9.2	8.8	8.0
Plain Hot Water	8.6	9.0	8.2
Sodium Chloride	7.2	7.8	8.4

Temperature of each bath 102°



## Age of Patient 56

PATIENT No. 12576

	Before Bath	After Bath	1 Hour After
Sulphur	9.2	9.0	11.2
Sodium Carbonate	9.2	9.6	9.2
Plain Hot Water	10.0	8.6	9.8
Sodium Chloride	8.4	9.0	8.8

Temperature of each bath 102°

Age of Patient 41.

PATIENT No. 12579.

	Before Bath	After Bath	1 Hour After
Sulphur	6.4	7.2	13.4
Plain Hot Water	6.4	7.6	9.2
Sodium Chloride	7.6	9.0	8.2
Sodium Carbonate	5.8	7.6	6.4

Temperature of each bath 102°

Age of Patient 31

PATIENT No.12599.

	Before Bath	After Bath	1 Hour After
Sulphur	9.6	9.6	10.4
Plain Hot Water	9.6	9.6	7.8
Sodium Carbonate	10.2	11.4	10.8
Sodium Chloride	7.6	8.8	9.2

Temperature of each bath 102°

Age of Patient 21

PATIENT No. 12591.

	Before Bath	After Bath	1 Hour After
Sulphur	9.6	10.0	18.4
Plain Hot Water	9.8	10.6	11.2
Sodium Chloride	7.0	6.4	8.6
Sodium Carbonate	9.2	9.0	10.0

Temperature of each bath 102°

Infective Arthritis

Age of Patient 42

PATIENT No.

	Before Bath	After Bath	1 Hour After
Sulphur	9.6	15.2	14.7
Harlow Car Sulphur	10.4	7.6	9.2

Temperature of each bath 102°

Normal differences before baths = 8.3%

Fibrositis

Age of Patient 49

PATIENT NO. 8908.

	Before Bath	After Bath	1 Hour After
Sulphur	9.6	13.6	17.6
Harlow Car Sulphur	12.4	11.6	10.4

Temperature of each bath 102°

Normal difference before bath = 30%

Fibrositis

Age of Patient 24

PATIENT No. 13061.

	Before Bath	After Bath	After 1 Hour
W.B.C.	9.6	13.6	10.2
P.	50	51	46
L.	47	49	51
H.	3	-	3
E.	-	-	-
M.	-	-	-

Sulphur Bath. Temp. 102°

Fibrositis

Age of Patient 49

PATIENT No. 8908.

	Before Bath	After Bath	1 Hour After
W.B.C.	12.4	11.6	10.4
Temp.	99.6	99.8	99.6
Plain Hot Water	9.8	10.0	10.6
Saline Sulphur	6.8	13.6	11.4

Harlow Car Sulphur Bath. Temp. 102°

Duration 20 minutes.



PATIENT No. 12719.

	Before Bath	After Bath	After 1 Hour	After 24 Hours
W.B.C.	9.2	9.6	10.4	
P.	72	63	74	
L.	27	34	24	
H.	1	2	2	
E.	0	0	0	
M.	0	1	0	
B.P.	120/70	116/70	-	
Temp.	97.2	99	-	

Sulphur Bath. Temp. 100°

Duration 20 minutes.

PATIENT No. 12599.

	Before Bath	After Bath	1 Hour After	24 Hours After
W.B.C.	9.6	9.6	10.4	9.2
P.	64.0	66.0	70.8	62.0
L.	34.0	31.0	28.0	37.0
H.	2.0	3.0	2.0	1.0
E.	-	-	-	-
M.	-	-	-	-
B.P.	-	-	-	-
Temp.	-	-	-	-

Sulphur Bath. Temp. 100°  
Duration 20 minutes.

Fibrositis

Age of Patient 53.

PATIENT No. 12963.

	Before Bath	After Bath	1 Hour After
W.B.C.	9.8	11.6	10.6
P.	49	62	57
L.	48	26	42
H.	2	2	1
E.	1	-	-
M.	-	-	-
Temp.	98.2	101.2	99.6

Sulphur Bath. Temp. 102°

Duration 20 minutes.

Focal Arthritis

Age of Patient 41.

PATIENT No. 12001.

	Before Bath	After Bath	1 Hour After
W.B.C.	8.8	9.2	8.4
P.	42	51	54
L.	52	43	39
H.	3	4	3
E.	2	1	3
M.	1	1	1

Infective Arthritis

Age of Patient 38

PATIENT No. 13046.

	Before Bath	After Bath	After 1 Hour
W.B.C.	7.6	7.6	8.8
P.	40	54	62
L.	54	41	33
H.	2	4	4
E.	1	1	1
M.	1	0	0
Temp.			

Fibrositis

Age of Patient 48.

PATIENT No. 13221.

	Before Bath	After Bath	After 1 Hour
W.B.C.	6.4	9.2	15.8
P.	52	68	70
L.	47	31	28
H.	1	1	2
E.	-	-	-
M.	-	-	-

Fibrositis

Age of Patient 27

PATIENT No. 13222.

	Before Bath	After Bath	After 1 Hour
W.B.C.	8.8	10.4	16.3
P.	52	63	74
L.	46	36	22
H.	2	1	2
E.	-	-	-
M.	-	-	-

NORMAL WHITE BLOOD CELL COUNT IN SODIUM  
CARBONATE AND SALINE BATHS.



Age of Patient

PATIENT No. 12685.

	Before Bath	After Bath	1 Hour After
Sodium Carbonate	8.4	10.0	9.2

Temperature of Bath 102°

Age of Patient 57.

PATIENT No. 12786.

	Before Bath	After Bath	1 Hour After
Saline	9.6	6.4	6.0

Temperature of Bath 102°

**WHITE BLOOD CELL COUNTS (NORMAL PERSONS)**

L.C.

Normal

Age 23.

	Before Bath	After Bath	1 Hour After
W.B.C.	6.8	7.2	8.7
P.	65	70	68
L.	32	28	31
H.	3	2	1
E.	-	-	-
M.	-	-	-
Temp.	99.4	101.8	100.2

Sulphur Bath. Temp. 102°

Duration 20 Minutes.

J.M.

Normal

Age 26.

	Before Bath	After Bath	1 hour After.
W.B.C.	9.6	8.1	8.4
P.	60	64	76
L.	36	32	22
H.	4	4	2
E.	-	-	-
M.	-	-	-
Temp.	99.1	101.2	100

Sulphur Bath. Temp. 102°

Duration 20 minutes.

W.D.

Normal

Age 20

	Before Bath	After Bath	1 Hour After
W.B.C.	6.8	6.0	6.6
P.	54	61	58
L.	43	37	41
H.	3	2	1
E.	-	-	-
M.	-	-	-
Temp.	99.2	101.4	100.8

Sulphur Bath. Temp. 102°

Duration 20 minutes.

J. McK.

Normal

Age 28

	Before Bath	After Bath	1 Hour After.
W.B.C.	8.4	9.6	8.0
P.	53	54	56
L.	46	44	44
H.	1	2	2
E.	-	-	-
M.	-	-	-
Temp.	99.2	100.8	99.8

Sulphur Bath. Temp. 102°

Duration 20 minutes.

Normal

Age 46.

	Before Bath	After Bath	1 Hour After.
W.B.C.	8.2	7.6	10.8
P.	60	64	64
L.	38	34	32
H.	2	2	2
E.	0	0	1
M.	0	0	1



Morris

NORMAL No. 2.

	Before Bath	After Bath	After 1 hour	After 24 hours
W.B.C.	8.0	8.0	8.8	
P.	62	69	67	
L.	36	30	31	
H.	2	1	2	
E.	0	0	0	
M.	0	0	0	

Sulphur Bath. Temp. 100°

Duration 20 minutes.

Rhodes.

Normal

Age 18.

No.13092.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	8.8	10.0	8.0
P.	67	65	64
L.	31	34	33
H.	2	1	3
E.	0	0	0
M.	0	0	0

Sulphur Bath. Temp. 102°

Normal

Age of Patient 52.

Patient No. 13155.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	9.6	9.2	9.2
P.	54	54	57
L.	43	44	42
H.	3	2	1
E.	-	-	-
M.	-	-	-

Normal

Age of Patient 50.

Patient No. 13170.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	8.8	10.0	10.0
P.	34	55	62
L.	65	44	35
H.	1	1	3
E.	-	-	-
M.	-	-	-

Neurasthenia

Age of Patient 55.

Patient No. 13127.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	9.6	9.2	8.8
P.	56	56	64
L.	43	43	34
H.	1	1	2
E.	-	-	-
M.	-	-	-

Normal

Age of Patient 52

Patient No. 13049.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	8.0	7.6	8.4
P.	54	65	69
L.	44	33	29
H.	2	2	2
E.	-	-	-
M.	-	-	-

ACTIVE INFECTIVE ARTHRITICS WITH HIGH WHITE  
BLOOD CELL COUNT SHOWING NO INCREASE.

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Spondylitis

Age of Patient 32.

Patient No. 13074.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	16.0	10.2	7.4
P.	56	64	62
L.	43	34	36
H.	1	2	2
E.	-	-	-
M.	-	-	-



Infective Arthritis

Age of Patient 30.

Patient No. 9528.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	12.0	6.4	6.4
P.	56	53	56
L.	41	46	42
H.	3	1	1
E.	-	-	1
M.	-	-	-

Arthritis of Spine

Age of Patient 56

Patient No. 13075.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	13.2	8.0	9.6
P.	50	65	63
L.	47	34	36
H.	3	1	1
E.	-	-	-
M.	-	-	-

Fibrositis

Age of Patient 20

Patient No. 13113.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	18.0	13.6	9.2
P.	77	80	74
L.	22	17	26
H.	1	3	-
E.	-	-	-
M.	-	-	-

Infective Arthritis

Age of Patient 23.

Patient No. 10121

	Before Bath	After Bath	1 Hour After.
W.B.C.	16.8	7.6	7.6
P.	48	61	68
L.	50	37	30
H.	2	2	2
E.	-	-	-
M.	-	-	-
Temp.	99	100.6	100

Sulphur Bath. Temp. 102°  
Duration 20 minutes.

Infective Arthritis

Age of Patient 31

Patient No. 13007.

	Before Bath	After Bath	1 Hour After
W.B.C.	20.4	9.6	6.0
P.	52	64	57
L.	45	32	40
H.	3	4	3
E.	-	-	-
M.	-	-	-
Temp.	98	100.8	98.2

Sulphur Bath. Temp. 102°

Duration 20 minutes.

Infective Arthritis

Age of Patient 24.

Patient No. 12147.

	Before Bath	After Bath	1 Hour After
W.B.C.	18.0	12.0	20.8
P.	72	74	75
L.	24	21	22
H.	2	2	2
E.	1	1	1
M.	1	1	1

Sulphur Bath. Temp. 102°

Duration 20 minutes.

Infective Arthritis

Patient No.

THOMPSON.

	Before Bath	After Bath	1 Hour After.
W.B.C.	17.4	14.0	10.8
P.	60	68	64
L.	32	25	32
H.	4	4	2
E.	2	2	1
M.	2	1	1

Sulphur Bath. Temp. 102°

Duration 20 minutes.

Infective Arthritis

Age of Patient 35.

Patient No. 13141.

	Before Bath	After Bath	1 hour After	2 hours After
W.B.C.	21.2	13.6	18.0	20.4.
P.	48	61	68	52
L.	50	35	26	44
H.	2	2	4	2
E.	0	1	1	1
M.	0	1	1	1

Sulphur Bath. Temp. 102°

Duration 20 minutes.



Fibrositis

Age of Patient 26

Patient No.12737.

	Before Bath	After Bath	1 Hour After
W.B.C.	11.4	10.0	12.8
P.	69	67	75
L.	30	32	23
H.	1	1	2
E.	-	-	-
M.	-	-	-
Temp.	98.4	100.2	99.4

Sulphur Bath.

Temp. 102°

Duration 20 Minutes.

Infective Arthritis

Age of Patient

Patient No. 13083.

	Before Bath	After Bath	After 1 Hour
W.B.C.	14.0	10.4	10.4
P.	53	68	64
L.	45	30	35
H.	2	2	1
E.	0	0	0
M.	0	0	0

Sulphur Bath. Temp. 102°

Infective Arthritis

Age of Patient 21.

Patient No. 13030.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	14.0	10.8	15.6
Temp.	100	100.2	100
P.	60	64	60
L.	34	34	32
H.	4	2	4
E.	1	1	2
M.	1	1	2

Sulphur Bath. Temp. 102°

Nerves

Age of Patient 33.

Patient No. 13086.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	11.2	10.0	11.6
P.	53	69	68
L.	46	29	30
H.	1	2	2
E.	-	-	-
M.	-	-	-
Temp.	98.4	100.6	99.6

Sulphur Bath. Temp. 102°

Active Infective Arthritis

Age of Patient 31

Patient No. 13091

	Before Bath	After Bath	After 1 Hour
W.B.C.	13.6	7.0	8.0
P.	39	42	46
L.	60	56	53
H.	1	2	1
E.	0	0	0
M.	0	0	0
Temp.	99.2	100.4	99.6

Sulphur Bath. Temp. 102°

Fibrositis

Age of Patient 55.

Patient No.13067.

	Before Bath	After Bath	After 1 Hour
W.B.C.	14.0	6.8	6.2
P.	77	66	64
L.	21	23	35
H.	2	1	1
E.	-	-	-
M.	-	-	-
Temp.	98.2	100	99.4

Sulphur Bath. Temp. 102°

Infective Arthritis

Age of Patient 39.

Patient -- HOBSON.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	17	14	13
P.	45.5	44	37
L.	42.5	39	49
H.	7	10	10
E.	5	7	4

Infective Arthritis

Age of Patient 48

Patient No. 13261.

	Before Bath	After Bath	After 1 Hour.
W.B.C.	18.0	10.4	11.8
P.	57	72	72
L.	42	27	26
H.	1	1	2
E.	-	-	-
M.	-	-	-



WHITE BLOOD CELL COUNTS TAKEN HOURLY.

Time	WBC Count
8:00	10,000
9:00	12,000
10:00	15,000
11:00	18,000
12:00	20,000
1:00	22,000
2:00	25,000
3:00	28,000
4:00	30,000
5:00	32,000
6:00	35,000
7:00	38,000
8:00	40,000
9:00	42,000
10:00	45,000
11:00	48,000
12:00	50,000
1:00	52,000
2:00	55,000
3:00	58,000
4:00	60,000
5:00	62,000
6:00	65,000
7:00	68,000
8:00	70,000
9:00	72,000
10:00	75,000
11:00	78,000
12:00	80,000
1:00	82,000
2:00	85,000
3:00	88,000
4:00	90,000
5:00	92,000
6:00	95,000
7:00	98,000
8:00	100,000
9:00	102,000
10:00	105,000
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8:00	760,000
9:00	762,000
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11:00	768,000
12:00	770,000
1:00	772,000
2:00	775,000
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8:00	1090,000
9:00	1092,000
10:00	1095,000
11:00	1098,000
12:00	1100,000
1:00	1102,000
2:00	1105,000
3:00	1108,000
4:00	1110,000
5:00	1112,000
6:00	1115,000
7:00	1118,000
8:00	1120,000
9:00	1122,000
10:00	1125,000
11:00	1128,000
12:00	1130,000
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9:00	1152,000
10:00	1155,000
11:00	1158,000
12:00	1160,000
1:00	1162,000
2:00	1165,000
3:00	1168,000
4:00	1170,000
5:00	1172,000

PATIENT No. 13222.

Hourly White Cell Count Without Treatment or Exercise

9th March, 1933

Time	a.m.				Noon	p.m.			
	9	10	11	12	1	2	3	4	
W.B.C.	8.4	7.6	8.2	9.6	8.2	8.8	9.2	8.4.	

10th March, 1933

Time	a.m.				p.m.			
	9.15	10.15	11.15	12.15	2.15	3.15*	4.15	
W.B.C.	9.6	8.0	8.8.	8.4	10.0	12.0	10.8.	

\* Note. At 3.15 p.m. patient did not feel well - had dizziness and sickness. At 4.15 p.m., much better.

Hourly White Cell Count Before and After Sulphur Bath at Temp. 102° - Duration 20 Minutes.

11th March, 1933.

Time	Before Bath		After Bath				
	a.m.	10.10	10.30	11.30	p.m.	2.0	3.
W.B.C.	7.6	8.8	10.4	16.3	18.0	16.8	11.8

12th March, 1933

Time	Before Bath		After Bath					
	9.50		10.50	11.50	12.30	2.0	3.0	4.0
W.B.C.	13.0		13.6	12.5	12.0	12.0	13.6	14.4

Note. - Patient had definite flare up of joints and had a temperature of 100°

Convalescent Rheumatism.

FIBROSITIS

Age of Patient 17

PATIENT No. 13221

Hourly White Cell Count Without Treatment or Exercise

10th March, 1933.

Time	a.m. 9.15	10.15	11.15	p.m. 12.15	2.15	3.15	4.15
W.B.C.	8.4	8.0	8.0	8.8	9.8	8.8	8.6

11th March, 1933.

Time	a.m. 9.30	10.30	11.30	p.m. 12.30	2.0	3.0	4.0
W.B.C.	6.0	8.0	8.0	9.0	8.0	8.4	9.2

Hourly White Cell Count Before and After Sulphur Bath  
at Temp. 102° - Duration 20 Minutes.

13th March, 1933.

Before Bath		After Bath				
Time	a.m. 9.40	10.30	11.30	p.m. 12.30	2.0	3.0.
W.B.C.	6.4	9.2	15.8	11.0	12.0	10.5.

14th March, 1933

Before Bath		After Bath				
Time	a.m. 9.30	10.30	11.30	p.m. 12.30	2.30	3.30*
W.B.C.	8.0	10.8	13.4	10.4	10.0	14.4

\* Note. At 3.30 p.m. patient feeling excited as she had to visit the Dentist.

Fibrositis

Age of Patient —

PATIENT No. 13004

Time	White Blood Count	
7.30 a.m.	7.2	Given Sulphur Water 10 ozs.
8.	8.4	
8.30	8.0	Breakfast
9.30	11.6	Electrical treatment
10.30	10.0	Magnesia Water.
11.30	14.0	
12.30 p.m.	9.6	After this Count Lunch.
1.30	12.0	
2.30	10.8	
3.30	9.2	

	Before	After	1 Hour	2 Hours	% Rise	P.	L.
22	9.2	10.8	14.8	12.0	60.0	-	-
23	8.8	13.6	13.2	10.4	55.0	+	-
24	8.8	11.2	13.6	8.6	55.0	+	0
25	8.0	8.8	14.4	9.6	80.0	+	-
26	10.0	12.8	12.0	-	28.0	+	-
27	8.0	<u>7.6</u>	10.4	-	30.0	+	-
28	8.0	8.8	14.8	8.8	85.0	+	-
29	8.4	8.8	11.8	-	40.0	+	-
30	8.8	9.6	13.2	-	50.0	+	-
31	9.2	10.4	13.5	-	48.0	+	-
32	6.0	8.8	11.6	-	93.3	+	-
33	8.4	<u>7.8</u>	11.4	-	35.7	+	-
34	6.8	11.0	14.8	-	117.6	-	+
35	12.8	15.2	16.8	-	33.0	+	-
36	4.8	9.6	9.2	-	100.0	0	-
37	10.6	12.9	12.4	-	21.7	+	-
38	9.8	<u>7.0</u>	15.0	-	55.0	+	-
39	8.4	10.0	11.8	-	40.5	+	-
40	9.6	17.0	13.7	-	77.0	+	-
41	8.8	10.6	11.6	-	32.0	+	-
42	6.0	10.8	10.8	-	80.0	+	-
43	8.0	<u>5.0</u>	14.2	-	77.5	+	0
44	8.6	<u>6.0</u>	11.2	-	30.0	+	-
45	10.8	<u>6.0</u>	11.8	-	9.2	+	-
46	10.4	<u>10.0</u>	14.6	-	40.0	+	-

	Before	After	1 Hour	2 Hours	% Rise	P.	L.
47	8.0	10.4	12.6	-	57.5	†	-
48	10.4	10.8	14.2	-	42.0	†	-
49	8.4	8.6	11.2	-	33.3	†	-
50	8.0	10.0	10.8	-	35.0	†	-
51	8.4	<u>7.6</u>	10.8	-	28.6	†	†
52	7.2	10.0	11.8	-	64.0	†	-
53	9.0	<u>6.4.</u>	11.2	-	24.4	†	-
54	5.6	8.2	11.6	-	107.0	†	-
(Repeat 55)	10.4	<u>7.0</u>	10.4	-		†	-
55	8.0	10.0	10.8	-	35.0	†	-
56	9.6	19.8	15.4	-	106.0	†	-
57	6.4	11.0	11.6	-	81.0	†	-
58	9.6	11.6	12.4	-	30.0.	†	†
59	6.0	6.8	10.4	-	73.3	†	-
60	9.6	12.4	14.2	-	47.9	†	-
61	10.4	14.2	17.2	-	65.4	†	-
62	8.8	9.6	16.0	-	82.0	†	-
63	8.4	10.0	11.8	-	40.4	†	-
64	8.3	9.6	11.0	-	32.5	†	-
65	8.4	16.0	11.6	-	90.0	†	-
66	8.0	<u>7.4</u>	11.6	-	45.0	†	-
67	8.0	12.0	11.6	-	50.0	†	-
68	8.4	9.6	12.5	-	49.0	†	-
69	7.2	8.4	12.8	-	78.0	†	-
70	4.4	4.8	10.8	-	145.0	†	-
71	9.2	10.8	15.6	11.2	70.0	†	-
72	9.2	10.0	16.4	12.4	78.0	†	-

	Before	After	1 Hour	2 Hours	% Rise	P.	L.
72	9.2	10.0	16.4	12.4	78.0	+	-
73	5.2	9.6	16.4	9.6	215.0	+	-
(Repeat)	5.2	8.4	16.2	11.2	211.0	+	-
74	8.4	10.0	15.0	9	81.0	+	-
75	9.6	14.8	15.2	-	58.3	+	-
76	5.2	8.0	14.3	-	175.0	+	-
77	8.2	8.8	12.8	-	56.0	+	-
78	7.6	9.6	1.4	-	50.0	+	-
79	9.6	15.2	14.7	-	58.3	+	-
80	8.0	13.6	14.4	-	80.8	+	-
81	8.2	8.4	11.2	-	36.6	+	-
82	6.0	9.2	11.6	-	93.0	+	-
83	9.6	<u>8.4</u>	11.2	-	16.6	+	-
84	9.2	10.0	14.4	-	56.0	+	-
85	8.0	8.6	14.4	-	80.0	+	-
86	9.2	10.0	14.8	-	60.0	+	-
87	9.2	9.0	11.2	-	22.0	+	-
88	6.4	7.2	13.4	-	109.0	+	-
89	9.6	9.6	10.4	-	8.3	+	-
90	9.6	10.0	18.4	-	91.7	+	-
91	9.6	15.2	14.7	-	58.3	+	-
92	9.6	13.6	17.6	-	83.3	+	-
93	9.6	13.6	10.2		41.6	-	+
94	9.2	9.6	10.4		13.0	+	-
95	9.6	9.6	10.4		8.3	+	-

	Before	After	1 Hour	2 Hours	% Rise	P.	L.
96	9.8	11.6	10.6		80.3	+	-
97	8.8	9.2	8.4		4.0	-	+
98	7.6	7.6	8.8		16.0	+	-
99	6.4	9.2	15.8				
100	8.8	10.4	16.3				



HIGH INITIAL COUNTS

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HIGH INITIAL COUNTS

	Before	After	1 Hour	2 Hours	% Rise & Fall	P.	L
1	16.0	10.2	7.4	-	- 54	+	-
2	12.6	6.4	6.4	-	- 46.6	0	+
3	13.2	8.6	9.6	-	- 40.0	+	-
4	18.0	13.6	9.2	-	- 48.8	-	+
5	16.8	7.6	7.6	-	- 55.0	+	-
6	20.4	9.6	6.0	-	- 60.0	+	-
7	18.0	12.0	20.8	-	+ 16.0	+	-
8	17.4	14.0	10.8	-	- 38.0	+	-
9	21.2	13.6	18.0	20.4	- 36.0	+	-
10	11.4	10.0	12.8	-	+ 12.3	+	-
11	14.0	10.4	10.4	-	- 28.6	+	-
12	14.0	10.8	15.6	-	+ 11.4	+	-
13	11.2	10.0	11.6	-	No change	+	-
14	13.6	7.0	8.0	-	- 94.0	+	-
15	14.0	6.8	6.2	-	- 55.7	-	+
16	17.0	14.0	13.0	-	- 28.2	+	-
17	18.0	10.4	11.8	-	- 48.8	+	-

S U L P H U R      B A T H S

	Before	After	1 Hour	2 Hours	% Rise	P.	L.
1	8.4	8.8	10.8	10.4	28.5	†	—
2	8.8	8.4	10.4	-	18.2	†	—
3	9.6	13.6	17.6	12.4	83.3	†	—
4	6.8	8.6	10.6	-	56.0	†	—
5	8.4	10.2	10.8	-	28.5	†	—
6	7.6	10.0	10.4	-	37.0	†	—
7	8.8	9.6	14.0	9.2	60.0	—	†
8	6.8	9.6	10.8	7.6	44.0	†	—
9	9.2	10.0	14.4	9.8	56.5	†	—
10	7.6	11.2	12.0	10.0	58.0	†	—
11	10.8	11.0	12.8	-	18.5	†	—
12	10.0	13.4	14.4	-	44.0	†	—
13	8.0	11.6	14.0	-	75.0	†	—
14	8.4	9.2	13.6	9.6	62.0	†	—
15	5.2	6.4	8.8	-	70.0	†	—
16	9.2	6.0	11.2	9.6	21.7	†	—
17	6.4	7.2	13.4	10.0	109.4	†	—
18	9.6	10.0	18.4	-	91.6	†	—
19	9.0	9.8	11.2	10.4	24.4	†	—
20	6.0	7.8	9.8	-	63.3	†	—
21	8.0	12.4	15.2	12.4	90.0	†	—

N O R M A L S

S U L P H U R   B A T H S.

N O R M A L S.

	Before	After	1 Hour	<sup>%</sup> Rise & Fall	P.	L.
1	6.8	7.2	8.7	+ 28	+	-
2	9.6	8.1	8.4	- 13.5	+	-
3	6.8	6.0	6.6	No change	+	-
4	8.4	9.6	8.0	+ 14.3	+	-
5	8.2	7.6	10.8	+ 31.7		
6	8.0	8.0	8.8	+ 10.0	+	-
7	8.8	10.0	8.0	+ 13.8	-	+
8	9.6	9.2	9.2	No change	+	-
9	8.8	10.0	10.0	+ 13.8	+	-
10	9.6	9.2	8.8	- 12.6	+	-
11	8.0	7.6	8.4	+ 10.0	+	-

FIBROSITIS.

PATIENT No. 12625.

Date of Admission 7/9/32  
 Date of Discharge 21/9/32 (at own request).  
 Age. 57 years.  
 Married.  
 Occupation. Fitter.

History of Illness. Three years ago he had pain in muscles of back. When he bent down he had difficulty in straightening himself because of pain and stiffness. Since then he had had periodical attacks. In June 1932 he got a slight chill and then got pain and stiffness in feet, knees, intercostal muscles, and back of neck.

Previous illnesses. Pleurisy, Bronchitis, Nephritis.

Examination. Pain in intercostal muscles. Pain and stiffness in muscles of back.

Treatment. Leucodescent lamp to back and chest followed by massage. Alternate days.  
 Sulphur bath - alternate days.  
 He was given a saline sulphur bath at temperature of 100°F. for 20 minutes. Instead of stopping taking his blood count at the end of one hour it was carried on for five hours and during this period he rested and was given no food. This experiment was carried out in order that the duration of the leucocytosis could be seen. The experiment was stopped at 5 p.m. as it was thought that the patient was beginning to show signs of fatigue.

	<u>Before Bath</u>	<u>After Bath</u>	<u>1 Hour After</u>	<u>2 hours after</u>	<u>3 hrs</u>
W.B.C.	8.4	10.0	15.2	15.0	12.0
		<u>4 Hours after</u>	<u>5 Hours after</u>		
		11.2	9.6		
Patient's Temperature	<u>Before</u>	<u>After</u>	<u>1 Hour after</u>		
	98.6°F.	99.8°F.	99°F.		

At the end of the bath he was sweating profusely and temperature was slightly increased. At the end of the hour it had fallen and he felt quite cool.

Two days later he was given a further saline bath at the same temperature and duration of time but instead of breathing the air from the bath house and the gases from the bath he breathed air from outside by means of an apparatus consisting of a mask to which was attached a long rubber tube.

Result.

	<u>Before</u>	<u>After</u>	<u>1 Hour after</u>	<u>2 Hours after</u>
W.B.C.	8.4	9.6	14.8	14.2

At the end of a fortnight he went home at his own request as he felt so well, and did not require further treatment.

RHEUMATOID ARTHRITIS.

Patient No. 13187.

Date of Admission 2/8/32

Date of Discharge 5/9/32

Occupation. Tailor.

Age. 27 years.

History of Illness. In September, 1929, patient developed pain in soles of feet. Next got pain in ankles and knees followed by swelling and stiffness. Gradually all the joints of his arms became similarly affected. He was in bed ten weeks at this time. He lost stiffness and pain in joints through time and had no more trouble until February, 1932 when he felt cold and shivery. Following this all his joints became involved with pain, swelling and stiffness.

Previous Illnesses. None.

Examination. Ankles swollen and painful on movement. Mid phalangeal joints of fingers swollen and stiff - typically spindle shaped. Shoulders stiff and marked creaking present. Patient easily perspires especially hands and feet. Marked tenderness over metatarsal joints of feet.

Treatment. Sulphur Bath - Temperature 102°F - 20 minutes duration. Alternate days. Berthollet to upper and lower extremities - alternate days.

Experimental Sulphur Bath. Temperature 102°F - 20 minutes.

	<u>Before</u>	<u>After</u>	<u>After 1 hour</u>
W.B.C.	7.2	7.8	8.8
Temp.	99°F	101°F	100.8°F

One hour after his bath patient was still sweating profusely but there was very little change in his white cell count.

On Discharge there was no marked improvement.



FIBROSITIS.

Patient No. 11301.

Date of Admission 21/9/32.  
Date of Discharge 19/10/32.  
Occupation. Gardener.  
Age. 48 years.

History of Illness. In September 1914 he commenced having pain in knees, feet, shoulder, hands and lumbar region of back. He was in bed six weeks. Three months later felt quite well again. He has however been getting periodical attacks of slight pain and occasional swelling in hands and feet. In February, 1932, he got much worse and pain in hands shoulders and neck became continuous.

Previous Illnesses. Quinsy 1930.

Examination. Pain and stiffness in hands, shoulders and lumbar region of back.

Treatment. Vichy - Alternate days - 20 minutes duration. Sulphur Bath - Temperature 102°F. - 20 minutes duration - Alternate days. Paraffin wax to hands - alternate days.

Experimental Bath. Sulphur Bath - Temperature 100°F. - 20 minutes.

Result:

	<u>Before</u>	<u>After</u>	<u>After 1 hour</u>	<u>After 2 Hours</u>
W.B.C.	9.2	10.0	11.4	9.8
Temp.	96.4°F	98.4°F	97°F	

Discharged much improved.

INFECTIVE ARTHRITIS (D)

Patient No. 10586.

Date of Admission 21/9/32.  
Date of Discharge 19/10/32.  
Occupation. Miner.  
Age. 49 years.

History of Illness. He developed pain in right thigh and leg on 25th August, 1930. Left foot also became affected. He gradually became worse and all his joints were swollen and stiff. He was admitted to the Royal Infirmary, Newcastle, where he remained for three months. In May, 1932, he got a cold and following this all his joints became stiff, painful and swollen and he was in bed for one month. Patient now feels much better but still complains of pain chiefly in left foot and right heel.

Previous Illnesses. None.

Examination. Pain and stiffness in left foot.  
Pain and tenderness in ball of right heel. No swelling present.

Faeces.

Colour - normal.	Consistence - semi solid
Reaction - Alkaline	Mucus †
Blood - Nil	Puss - nil

Strep Faecalis. (c) 80. B. Coli. 20

Treatment. Sulphur Bath - Temperature 102°F. - 20 minutes.  
Alternate days. Berthollet to right knee and feet followed by massage to ankles and feet.

Experimental Sulphur Bath - Temperature 100°F. - 20 minutes.

	<u>Before</u>	<u>After</u>	<u>After 1 hour</u>	<u>After 2 hours</u>
W.B.C.	8.8	9.6	14.0	9.2
Temp.	97.2°F	98.2°F	97.2°F	

Condition on Discharge, much improved.

Patient No. 12,204

Date of Admission 2/6/32  
Date of Discharge 20/6/32  
Occupation. Tailor.  
Age. 27 years.

History of Illness. In September, 1929, patient developed pain in soles of feet. He had no sore throat or influenza before it. Next pain went into ankles, knees and gradually all his joints. In bed six weeks. Better until February, 1932, when he got cold and then got pain again in all his joints. Also became stiff. In bed eight weeks.

He has been able to go about lately but after two or three hours his knees become very stiff again. He is all right when he gets up in the morning but after walking for some time and then sitting down again his knees quickly become painful and stiff. Once he has walked a few steps again the stiffness wears off and he is able to walk quite freely.

Examination. Fluid present in knees joints. Tightening of hamstring muscles. Fingers - mid phalangeal joints spindle shaped. Shoulders painful and stiff.

Treatment. Sulphur Bath - Temperature 102°F - 20 minutes.  
duration - Alternate days.  
Vichy - 20 minutes. Alternate days.

Result of Experimental Bath at Temperature of 102°F - 20 minutes.

	<u>Before</u>	<u>After</u>	<u>After 1 hour</u>
W.B.C.	12.0	6.4	6.4

On Discharge, very little improved.

Gonorrhoeal Arthritis.

Patient No. 12103.

Date of Admission 5/5/32.  
Date of Discharge 9/6/32.  
Occupation. Waste Dealer.  
Age. 51 years.

History of Illness. In December, 1931, patient had an attack of gonorrhoea. On 8th January, 1932, he developed pain in right ankle and swelling of right foot. Pain left there and went into right shoulder, then into hands, and lately both feet have become involved. On 2nd May, 1932, wrists and knees flared up. Has lost weight.

Previous Illnesses. None.

Examination. Metacarpal joints swollen. Muscles of hands very much wasted. Mid phalangeal joints spindle-shaped. Movements poor. Knees, fluid present. Very painful on movement. Feet - flat-footed with feet very swollen. Patient is extremely emaciated and weak.

Treatment. Sulphur Bath - Temperature 102°F - 20 minutes duration, on the days not having Protein shock or massage. Every fifth day given Protein shock commencing with 50 millions T.A.B. and increasing the dose by double each time.

Experimental Sulphur Bath - 102°F. - 20 minutes duration.

	<u>Before</u>	<u>After</u>	<u>After 1 hour</u>
W.B.C.	12.0	6.4	6.4

Sulphur baths had to be stopped as they were causing great stiffening of the joints.

Discharged. - No improvement.

Spondylitis.

Patient No. 13074.

Date of Admission 12/5/32.  
Date of Discharge 9/6/32.  
Occupation. Blacksmith.  
Age. 32 years.

History of Illness. In 1916 while in Army patient suddenly developed pain in left hip joint. Each year in the winter always had periodical attack of pain in this joint. The pain was never too acute to prevent him from carrying out his work. In June, 1930, he began to get pain at foot of his spine and gradually it got so bad that he was unable to bend his back. Later shoulders became very painful and movements limited. He then got pain and stiffness of his jaws. Finally all joints became affected. His condition has become worse as the result of getting his teeth out.

Previous Illnesses. None.

Examination. Boardlike rigidity of lumbar region of back. Shoulders painful and unable to put hands above his head. Fingers - middle phalangeal joints spindle-shaped.

Xray. Evidence of Arthritic changes at the articulations between first and second lumbar vertebrae with small spondylitic outgrowths. Sacro-iliac Joints. - These were rather blurred and ill defined. These appearances are due to chronic inflammatory changes. Hips. - Right, normal. Left showed a little patch of rarefaction in the upper part of acetabulum. Cartilage, normal.

Treatment. Sulphur bath - Temperature 102°F - 20 minutes duration. Protein shock (T.A.B.) commencing with 50 millions and doubling the dose every five days. The day after injection given 40 minutes massage.

The day after admission given an experimental bath at temperature 102°F for 20 minutes.

	<u>Before</u>	<u>After</u>	<u>1 hour After</u>
W.B.C.	16.0	10.2	7.4

On discharge movements of the various joints increased. No improvement.

Tubercular Arthritis.

Patient No. 12,110.

Date of Admission 6/5/32.  
Date of Discharge 26/5/32.  
Occupation. Plas/5/3r.  
Age. 48 years. 6/5/

History of Illness. In June 1931, patient began to have pain in feet. The pain has become much worse and prevents him from walking much. Two months later pain and swelling commenced in his hands and left shoulder.

Previous Illnesses. None.

Examination. Pain and stiffness on movements of shoulders. Knuckles very swollen. Creaking in knee joints. Both ankles stiff. Unable to flex left elbow.

Xray of left elbow. Shows evidence of practically complete disorganisation of the joint with ankylosis.

Treatment. Sulphur Bath - Temperature 100°F for 20 minutes. Paraffin Wax to hands and feet allowed by massage.

Experimental Bath. - Saline sulphur at temperature of 103° for 20 minutes.

	<u>Before</u>	<u>After</u>	<u>After 1 hour</u>
W.B.C.	10.0	13.4	14.4
Temp.	99°F	101°F	100.4°F

Patient was discharged with less stiffness and pain in shoulders and knees. Ankles still remained stiff.

FIBROSITIS.

Patient No. 12486.

Date of Admission 10/8/32.

Date of Discharge 7/9/32.

Occupation. Miner.

Age. 55 years.

History of Illness. When fifteen years of age had acute rheumatism. Had pain and stiffness in all his joints and was for six weeks. Since then whenever the weather was damp he had aches and stiffness mostly in shoulders and elbows. In February, 1932, he was working in a pit up to the knees in water. The pain gradually came into shoulders, elbows, ankles and knees. Later the muscles became stiff.

Previous illnesses. Typhoid Fever 20 years ago.

Examination. Movements of shoulders, elbows, ankles and knees painful and stiff.

Treatment. Sulphur Bath - Temperature 100° - 20 minutes duration. Alternate days. Vichy. Alternate days.

Given experimental saline sulphur bath at 100° for 20 minutes.

	<u>Before</u>	<u>After</u>	<u>After 1 hour</u>
W.B.C.	8.0	11.6	14.0
Temp.	96.4°F	98.4°F	98°F

There was no marked increase of temperature although patient had a severe sweat.

Discharged much improved.

RHEUMATOID ARTHRITIS.

Patient No. 12579.

Date of Admission 30/8/32.

Date of Discharge 20/9/32.

Occupation. Engineer.

Age. 41 years.

History of Illness. In November 1921, patient suddenly developed pain and stiffness in his shoulders, ankles, and knees. He felt quite well previously to this illness. He was six weeks in bed. Since then he has had periodical attacks affecting different joints. In April, 1932, his right knee became painful and occasionally gave way under him. Patient then noticed that this knee was swollen. One week later his shoulders, ankles and feet became painful and stiff.

Previous Illnesses. None.

Examination. Right knee painful and swollen - fluid obviously present. Ankles painful and stiff in movement. Shoulder joints - movement good, but painful on abduction.

Treatment. Sulphur Bath - Temperature 102° - duration 20 minutes alternate days. Diathermy to the right knee - 20 minutes - alternate days.

Experimental Bath - Temperature 100° Duration 20 minutes.

	<u>Before</u>	<u>After</u>	<u>After 1 hour</u>	<u>After 2 hours</u>
W.B.C.	6.4	7.2	13.4	10.0
Temp.	97.4°F	98.2°F	99°F	

- 5/9/32. Legs a little better. Shoulders and elbows aching. Treatment continued.
- 12/9/32. General condition improved. Movement in shoulders normal and the condition of right knee much better and no swelling present.
- 19/9/32. Condition improved. Patient discharged.



# INFECTIVE ARTHRITIS (D)

Patient No. 12659.

Date of Admission 15/9/32.  
Date of Discharge 13/10/32.  
Occupation. Galvaniser.  
Age. 55 years.

**History of Illness.** History of Rheumatism for seven years. In September 1925, patient developed pain in knees, and gradually all his joints became affected in this way. He had to be off work for three months and at the end of that time he returned, having completely recovered from his attack. Since then he has had slight attacks periodically affecting mostly his knees. In October, 1931 he had influenza and had to go to bed. While convalescing from this ten days later his ankles, knees, hips, elbows and shoulders became painful and stiff.

**Previous Illnesses.** None.

**Examination.** Crepitus in right knee - slight in wrists - right ankle swollen and right foot flat. Dental report. There is considerable gingivitis and alveolar absorption. A clearance is indicated, but patient declines to consider it. Urine culture. Sterile - 48 hours. Faeces. Colour - normal: Re-action-Alkaline: Consistence - Formed: Mucus - Nil: Pus - Nil: Blood - Nil. Excessive undigested food - Nil: CULTURE - B Coli 90% Strep. Faecalis (a) 10%

**Treatment.** Berthollet - upper extremities and right leg - 20 minutes, alternate days. Massage - feet ankles hands and wrists. Sulphur bath - 20 minutes - Temp. 100°F - alternate days.

**Experimental Bath:-**

	<u>Before</u>	<u>After</u>	<u>After 1 Hour</u>	<u>After 2 Hours</u>
W.B.C.	8.8	13.6	13.2	10.4
Temp.	97.8°F	99.8°F	99.8°F	

On Discharge, improved.

INFECTIVE (D)

Patient No. 13,055.

Date of Admission 12/5/32.  
Date of Discharge 8/6/32.  
Occupation. Teacher.  
Age. 34 years.

History of Illness. In October, 1926, patient had a septic throat for one week. He went to work but one night he felt feverish and gradually all his joints became painful and stiff. He had a very high temperature. In March, 1932, he had influenza for a fortnight. He then went back to work but developed pain and stiffness of various joints of arms and legs.

Previous Illnesses. Acute tonsillitis, 3 times.

Examination. Pain and stiffness of ankles, knees, shoulders and elbows. Knuckles swollen. Creaking and pain in carpal bones. Fusiform swelling of fingers at junction of first and second Phalangeal joints. Muscles of hands wasted. Tonsils enlarged and inflamed. Unhealthy appearance.

Treatment. At weekly intervals given Protein Shock injection commencing with 50 millions, and then doubling the dose each time.  
The day after injection given a general massage.  
The remaining days of the week given sulphur baths at temperature of 102°F - 20 minutes duration.

Experimental Sulphur Bath. Temp. 102°

	<u>Before</u>	<u>After</u>	<u>1 Hour after</u>
W.B.C.	8.8	10.6	11.6
Temp.	97°F	101°F	99°F

This patient's condition improved but the condition of hands remained unchanged. He refused to have his tonsils out in hospital and arranged to have this done at home.

FIBROSITIS.

Patient No. 12644.

Date of Admission 13/9/32.  
Date of Discharge 4/10/32.  
Occupation. Domestic Servant.  
Age. 35 years.

History of Illness. Ten years ago had acute rheumatism. All her joints became affected. They were painful, stiff and swollen. In bed for 8 weeks. For some time after felt legs weak and movements of joints limited. This condition gradually disappeared. Since this has had periodical subacute attacks which always kept her in bed for about a fortnight. In January 1932, had a cold through getting a wetting with rain. Developed pain and stiffness in joints once again.

Previous Illnesses. Asthma.

Examination. She was of poor nutrition and pale in colour. Movements of ankles and knees fairly free but no creaking made out. Shoulders painful.

Treatment. Sulphur Bath - Temperature 102° - 20 minutes. Alternate days. Mud packs to knees.

Experimental Bath - Temperature 100° Duration 20 minutes.

	<u>Before</u>	<u>After</u>	<u>After 1 Hour</u>	
W.B.C.	9.2	10.8	14.8	12.0
Temp.	98°F	101°F	101°F	

On 19.9.32 she complained of pain in hips. Ordered to continue with sulphur baths and to have this followed by twenty minutes massage to shoulders and lumbar region.

On 26.9.32. Condition of knees splendid. Still has pain in shoulders.

On 3.10.32. Discharged very much better.

FIBROSITIS.

Patient No. 13,004.

Date of Admission 30/11/32.  
Date of Discharge 14/12/32.  
Occupation. Miner.  
Age. 38 years.  
Married.

History of Illness. Four years ago commenced having pain and stiffness of neck. One week later he had pain in shoulders and round about the various joints of arms. He became quite well and had no recurrence of symptoms until September 1932, when he again got pain in neck, shoulders, and arms. Previous to this he had a slight cold.

Previous illnesses. None.

Examination. Slight pain and marked stiffness in muscles of neck, shoulders and elbow joints.

Treatment. Leucodescent lamp to cervical region of neck. Alternate days.  
Sulphur saline bath - alternate days.

Given sulphur bath at Temperature 102°. Duration 20 minutes.

	<u>Before</u>	<u>After</u>	<u>1 Hour After</u>
W.B.C.	6.8	11.0	14.8
Temp.	99.4°F	102.2°F	100.8°F

He also benefited from the bath and it will be noticed that at the completion of the bath his temperature was 102.2°F. One hour afterwards it was 100.8°F.

He was discharged with the condition improved.

Patient No. 385.

Date of Admission 23/11/32.  
 Date of Discharge 14/12/32.  
 Occupation. Tailor Machineist.  
 Age. 48 years.

**History of Illness.** This patient was in this Hospital from 24/10/29 for one month. At that time he complained of having pain in back of neck and shoulders, knees and right hip. He was in Leeds Infirmary one month previous to this with symptoms. After treatment for three weeks here he returned home and had no return of symptoms until October 1932, when he got a chill followed by pain in cervical region of back and shoulders.

**Examination.** Painful fibrous nodules present in muscles of back and neck. Stiffness and slight pain in shoulders and neck.

**Treatment.** Leucodescent lamp to neck and shoulders, alternate days. Sulphur Bath - 102° - 20 minutes - alternate days. Given sulphur bath day after admission at temperature of 102°F for 20 minutes.

	<u>Before</u>	<u>After</u>	<u>After 1 Hour</u>	<u>After 2 Hours</u>
W.B.C.	9.6	13.6	17.6	12.4

Two days later an hourly white blood cell count was done. He was allowed to take his food and exercise in morning. At 12.30 p.m. he had lunch and then rested until the time of his bath at 2.10 p.m.

Time	White Blood Count.	
7.25 a.m.	6.8	Given sulphur water 10 ozs.
8.5	6.0	
8.25	10.8	Breakfast
9.25	7.8	
10.25	8.4	Given Magnesia Water 10 ozs.
11	10.4	
11.25	12.8	Lunch followed by rest
12.25 p.m.	10.0	
1.25	6.8	Sulphur Bath
2.5	9.2	
2.25	13.8	One hour after sulphur bath
3.25	11.6	
4.25		

It/

It will be noted that there is a great variation in the hourly count which is exaggerated when given the usual waters and exercise. It is also noticeable that when patient was rested after lunch there was a gradual fall in the white cells. Immediately after his bath there had been an increase which was very marked at the end of one hour.

This patient was discharged very much improved.

FIBROSITIS.

Patient No. 11,004.

Date of Admission 7/9/32  
Date of Discharge 5/10/32.  
Occupation. Miner.  
Age. 32 years.

History of Illness. In 1924 had slight attack of pain in lumbar region of back extending into right side. At this time was off work for six weeks. In January, 1931, he had a return of the above condition. He was given Protein shock injections at St. James Hospital, Leeds, but felt no better and was sent to Harrogate. No change in his condition on discharge. In August, 1932, he was again admitted with pain in lumbar region extending into right thigh. He states that pain has got much worse during last six months and is affected by movement.

Previous Illnesses. None.

Xray of Lumbo sacral region.

The posterior arches of the fourth and fifth lumbar are both congenitally narrower than usual. No arthritic changes seen in lumbo-sacral joints or in right hip joint.

Treatment. Sulphur Bath - Temperature 100°F - 20 minutes - alternate days. Leucodescent lamp to lumbar region of back followed by massage.

Result of Experimental Saline Bath.

	<u>Before</u>	<u>After</u>	<u>After 1 Hour</u>
W.B.C.	6.8	9.6	10.8
Temp.	98°F	98.8°F	98°F.

Discharged improved and with less pain in lumbar region.

INFECTIVE ARTHRITIS.

Patient No. Thompson.

Date of Admission 21/9/32.  
Date of Discharge 19/10/32.  
Occupation. Tailor.  
Age. 41 years.  
Married.

History of Illness. Three years ago he noticed that the great toe of his left foot was swelling as night came on. It became red, and the skin was shiny. He then got pain in the tarsal joints of the great toe. He had finally to go to bed. One month later he got better and resumed his work. Since then he has had periodical attacks and each one has been brought in with a rigor and increase in temperature. As he became crippled and his condition was getting worse he was admitted to Leeds Infirmary. There every investigation was carried out. Blood Count Normal. Urine and faeces culture normal. Tonsils and adenoids healthy. Blood urea normal. Finally sent to Harrogate for treatment and investigation.

Examination. Slight swelling of large toe of left foot and creaking of joints of foot and ankles. Pain and stiffness in both shoulders.

Treatment. Sulphur Bath - Temperature 102<sup>o</sup>F - 20 minutes duration - alternate days. Berthollet to feet followed by massage.

Result of Experimental Sulphur Bath - 20 minutes - Temperature 102<sup>o</sup>F.

	<u>Before</u>	<u>After</u>	<u>After 1 Hour</u>
W.B.C.	9.6	15.2	14.7

His white cell count was done each day for one week and always at 10 a.m. The following were the results:-  
8.8 10.0 9.6 8.2 9.4 12.0

On the day of the count of 12000 he complained of slight pain again in great toe. The following day he was given a sulphur bath and his white cell count previous to bath had increased to 13400 -

Result:-

	<u>Before</u>	<u>After</u>	<u>After 1 Hour</u>
W.B.C.	13.4	16.8	19.0



Two days later the great toe was very swollen and had all the appearances of a gout condition. Again given a sulphur bath.  
Result:

	<u>Before</u>	<u>After</u>	<u>After 1 Hour</u>
W.B.C.	17.4	14.0	10.8

It will be noticed that previous to bath he had a marked leucocytosis and at the end of the bath white cell count had fallen from 17400 to 10800.

On Discharge the condition of shoulders had improved but the foot condition remained unchanged.

CONVALESCENT RHEUMATISM.

Patient No. 13221.

Date of Admission 9/3/33.  
 Date of Discharge 8/4/33.  
 Occupation. Typist.  
 Age. 18 years.

History of Illness. In December 1931 she developed a severe cold in the head. She remained in the house for one week. She then commenced her work again but got a soaking with rain. The following day she felt fevered and her joints stiff. Gradually all became painful and she was in bed six weeks.

Previous Illnesses. None.

Examination. Joints normal in appearance. Slight stiffness on movement of shoulders and knees.

Treatment. Vichy - alternate days - 20 minutes.  
 Sulphur Bath. Temperature 102°F - 20 minutes duration - alternate days.

It was decided to find out the variation of her white cell count from hour to hour for two days before giving her a sulphur bath.

10th March:-

<u>9.15 a.m.</u>	<u>10.15</u>	<u>11.15</u>	<u>12.15p.m.</u>	<u>2.15.</u>	<u>3.15.</u>	<u>4.15.</u>
8.4	8.0	8.0	8.8	9.8	8.8	8.6

11th March

<u>9.30 a.m.</u>	<u>10.30</u>	<u>11.30</u>	<u>12.30p.m.</u>	<u>2.0.</u>	<u>3.0.</u>	<u>4.0.</u>
6.0	8.0	8.0	9.0	8.0	8.4	9.2

On 13th March, she was given a sulphur bath at Temperature of 102°F. Duration 20 minutes.

	<u>Before</u>	<u>After</u>	<u>1 Hour After</u>	<u>2 Hours</u>	<u>3 Hours</u>	<u>4 Hours</u>
W.B.C.	6.4	9.2	15.8	11.0	12.0	10.5

14th March. Again given a sulphur bath as previously.

	<u>Before</u>	<u>After</u>	<u>1 Hour After</u>	<u>2 Hours</u>	<u>3 Hours</u>	<u>4 Hours</u>
W.B.C.	8.0	10.8	13.4	10.4	10.4	10.0

At this point the experiment had to be stopped as patient had to see the Throat Specialist and became rather nervous.

21st March. Tonsils removed.

On Discharge. Very much improved.

FIBROSITIS.

Patient No. 13222.

Date of Admission 8/3/33.  
 Date of Discharge 9/4/33.  
 Occupation. Miner  
 Age. 21 years.

History of Illness. For six months patient has been having fleeting pains in various joints in his body. Lately the pain has become very severe in the muscles of his back and when he bends down he has great difficulty in straightening himself again.

Previous Illnesses. None.

Examination. He is pale, thin and amaciated. Joints normal in appearance, but stiffness in knee, and shoulders. Lumbar muscles tender. Nodules present.

The day after admission his hourly white cell count was done except for the two lunch hours.

9th March, 1933.

	<u>9 a.m.</u>	<u>10.</u>	<u>11.</u>	<u>12 noon.</u>	<u>2 p.m.</u>	<u>3.</u>	<u>4.</u>
W.B.C.	8.4	7.6	8.2	9.6	8.8	9.2	8.4

10th March, 1933.

	<u>9 a.m.</u>	<u>10.</u>	<u>11.</u>	<u>12 noon.</u>	<u>2 p.m.</u>	<u>3.</u>	<u>4.</u>
	9.6	8.0	8.8	8.4	10.0	12.0	10.8

At three o'clock he felt faintness and nausea.

On 11th March, 1933, given a sulphur bath - Temperature 102°F - 20 minutes duration.

	<u>Before</u>	<u>After</u>	<u>1 Hour</u>	<u>2 Hours</u>	<u>3 Hours</u>	<u>4 hrs.</u>	<u>5 hrs</u>
W.B.C.	7.6	8.8	10.4	16.3	18.0	16.8	11.8

On 12th March again given a sulphur bath with conditions stated above.

	<u>Before</u>	<u>After</u>	<u>1 Hour</u>	<u>2 Hours</u>	<u>3 Hours</u>	<u>4 Hours</u>
W.B.C.	13.0	13.6	12.0	12.0	13.6	14.4

On this day he complained of being very stiff and all his joints very painful.

On discharge - improved.

INFECTIVE ARTHRITIS INDETERMINATE.

Patient No. 12646.

Date of Admission 14/9/32.  
 Date of Discharge 12/10/32.  
 Occupation. Musician.  
 Age. 42 years.

History of Illness. In November 1930, he developed pain and stiffness of muscles of neck and shoulders. Ordered to bed by his doctor and gradually all his joints became painful, stiff and swollen. He was and remained in bed for three months. He got quite well but had a relapse in November 1931. Since then he has had pain and stiffness in knees, hands and wrists.

Previous Illnesses. None.

Examination. Knees painful and swollen. Fingers spindle-shaped. Metacarpal joints swollen and painful. Shoulders stiff.

Treatment. Sulphur Bath - Temperature 102°F - 20 minutes Double Berthollet to hands, and knees followed by massage. Alternate days.

Given Experimental Sulphur Bath - Temp. 100°F - 20 minutes.

	<u>Before</u>	<u>After</u>	<u>1 Hour After</u>	<u>2 Hours After</u>
W.B.C.	5.2	9.6	16.4	9.6
Temp.	97.4	99.2		

Two days later given a strong sulphur bath at the Royal Baths. Temperature 100°F - Duration 20 minutes.

The white cell count was taken every half hour in order to see when the maximum rise was.

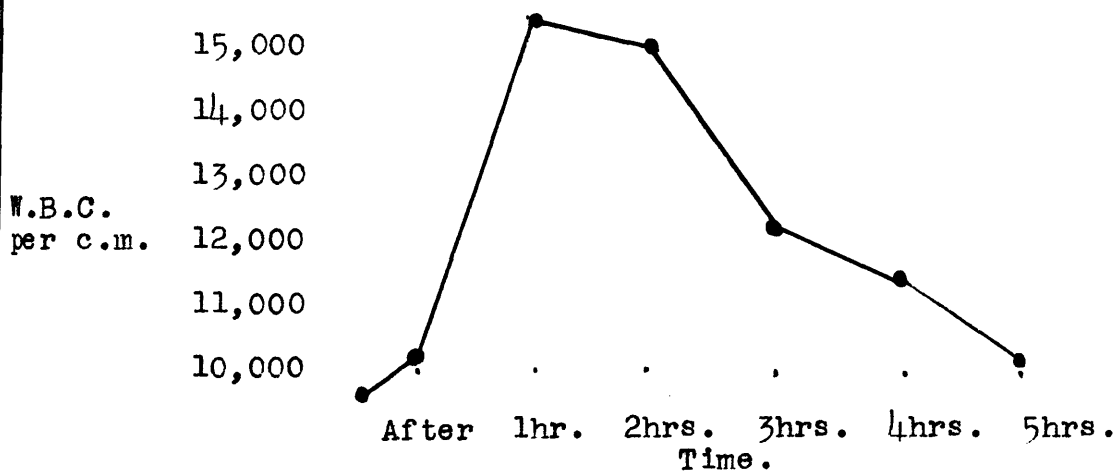
	<u>Before</u>	<u>After</u>	<u>½ Hour</u>	<u>1 Hour</u>	<u>1½ Hours</u>	<u>2 Hours</u>
W.B.C.	6.2	8.4	11.6	16.2	14.4	11.2
Temp.	97.4	99.2				

On discharge stiffness less in knees but hands still troublesome. On the whole improved.

DISCUSSION.

At first there was no restriction on the choice of case; but as more cases were done I gradually came to the conclusion that a saline sulphur bath would not cause a leucocytosis in every case.

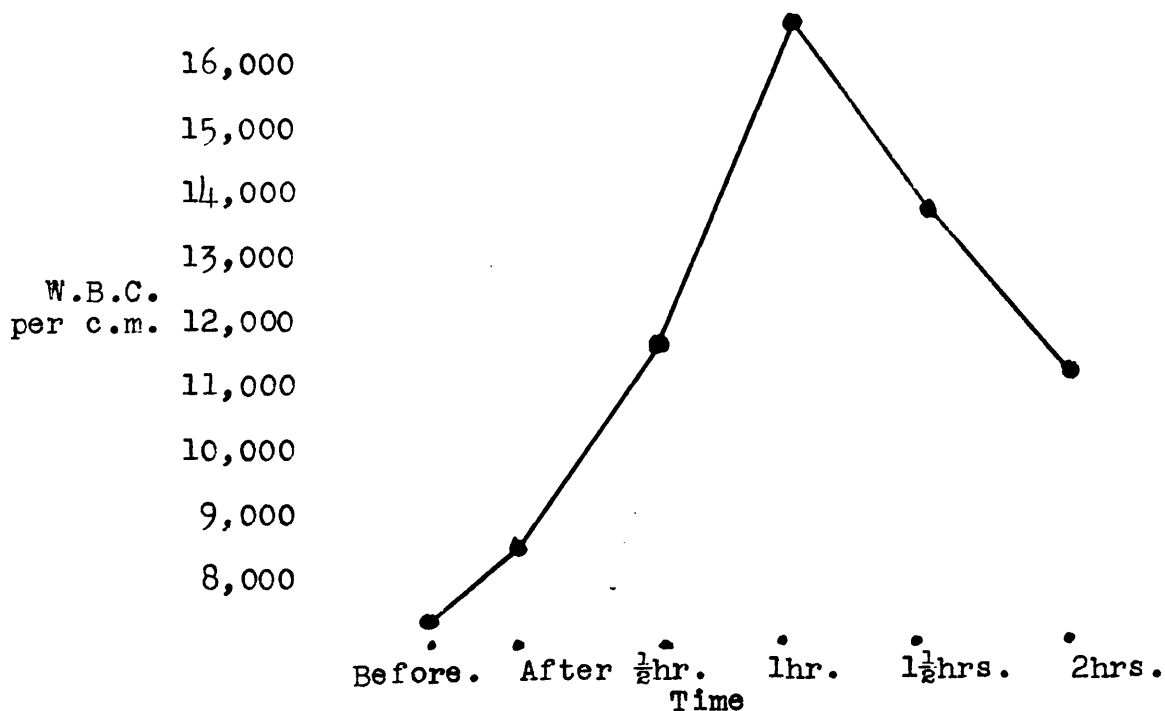
Patient No.12625 was a very interesting case. He had definite fibrositis in muscles of back and intercostal muscles. He was a man of 57 and of fair nutrition. It was decided to carry on the experiment all day in his case in order to find the duration of the leucocytosis.



The increase in white cells was 90%, and it was a polymorphonuclear leucocytosis. His temperature showed very little change, before the bath being 98.6°F., immediately after 99.8°F., and one hour after 99°F. He had a profuse sweat lasting from almost half an hour after the bath, but half an hour later he stated that he felt quite cool.

Patient No.12646 had a history of infective arthritis indeterminate/

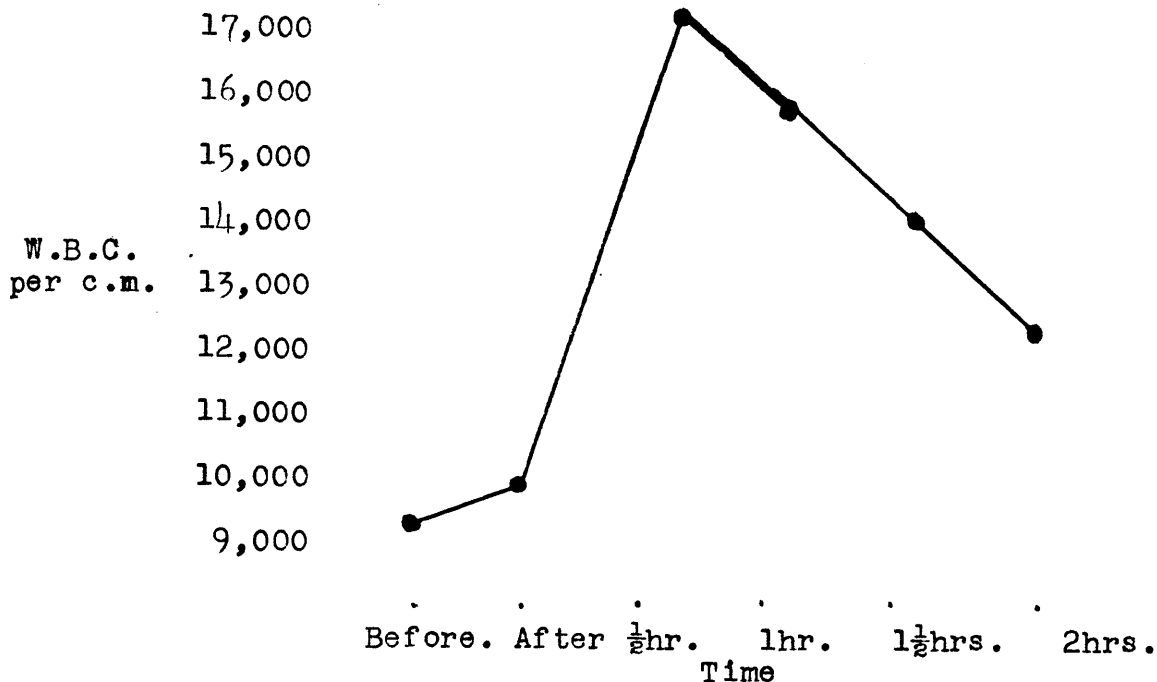
indeterminate for two years. He was a musician and aged 42 years. He gave an increase of over 200% in white cells one hour after his bath, with an increase of the polymorphonuclear leucocytes and relative decrease in lymphocytes. Two days later he was subjected again to a sulphur bath but this time at the Royal baths. It was a strong saline sulphur bath. In his case the white cell count was taken half-hourly in order to determine, if possible, when the maximum was reached.



In this case the maximum was reached one hour after the bath.

The same experiment was carried out on Patient No.12651 who was a man of 43 years, suffering from general fibrositis.

17,000/



Here the maximum appeared to be reached half an hour after the sulphur bath, with a gradual fall thereafter.

It will be seen from these results that immediately after the bath there is a slight increase in the leucocytes, the maximum point being reached one hour later.

Remembering the work of Harold Eric Martin and others, who found that the leucocyte count varied from hour to hour, it was decided in several cases to do a white cell count every hour for two successive days to see what the variation was.

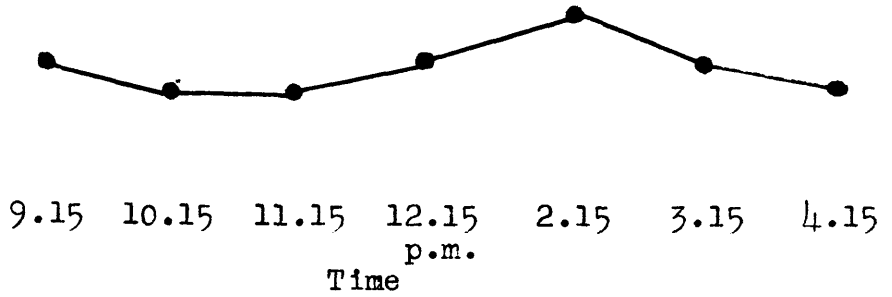
Patient No.13221 was a girl of 18, who suffered from fibrositis. She had received no treatment whatsoever, being admitted one day and the experiment commencing the following morning. The results were:

10th March/



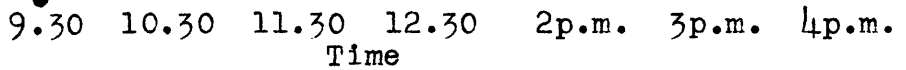
10th March

W.B.C.  
per c.m.  
9,000  
8,000  
7,000



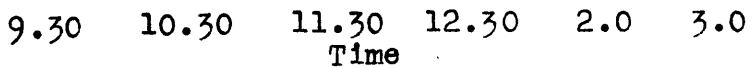
11th March

10,000  
9,000  
8,000  
7,000  
6,000



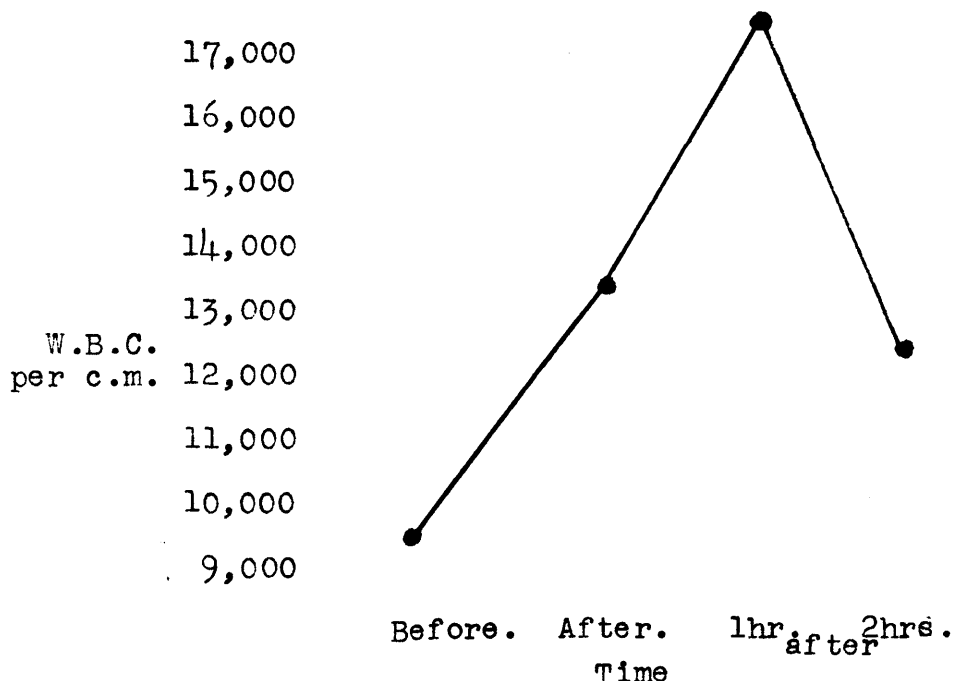
12th March given a sulphur bath, Temperature 102°, 20 minutes duration.

15,000  
14,000  
13,000  
12,000  
11,000  
10,000  
9,000  
8,000  
7,000  
6,000



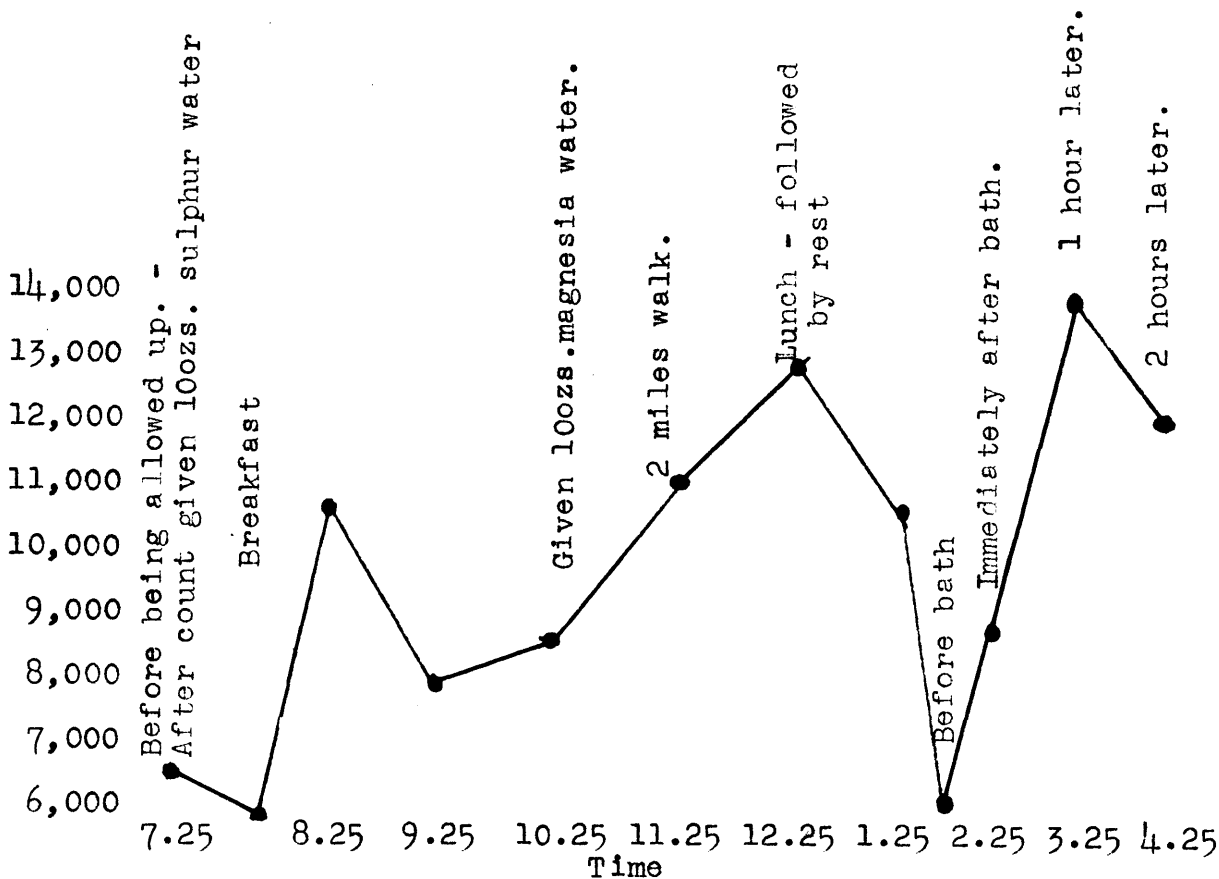
Patient/

Patient No.8909 had general fibrositis. He was thin and of poor nutrition. His age was 49 years. The day following admission he was put in an experimental saline sulphur bath at temperature 102°F. for twenty minutes.



For two days his white cell count was taken hourly, and during the mornings he ate, took the waters, exercised, etc. Immediately after lunch he was rested and then given his sulphur bath under the same conditions as previously.

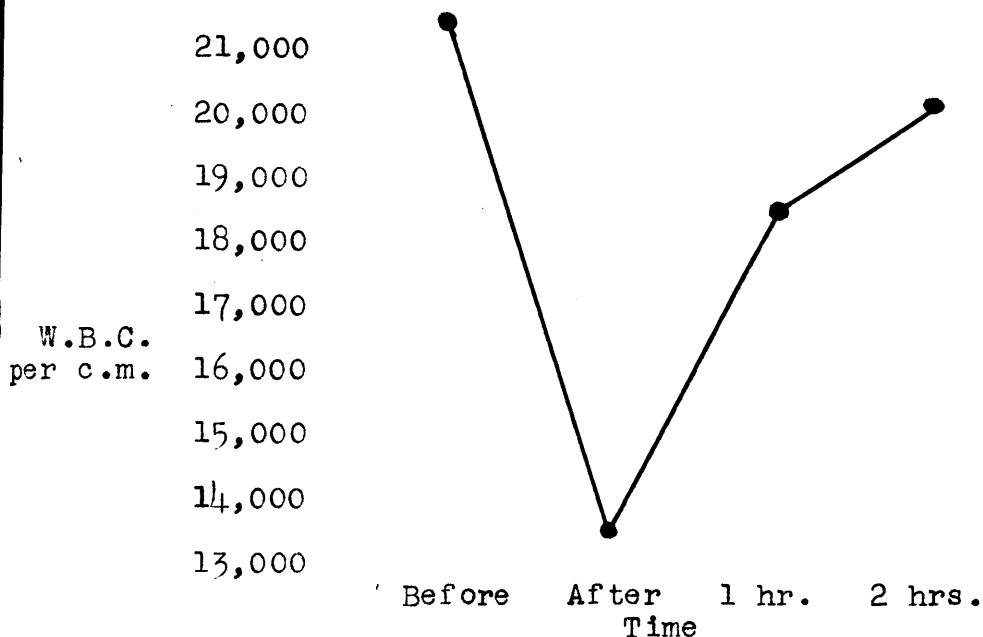
14,000/



It was most essential that the initial white cell count should be a normal one. It was very surprising to find that a number of patients who had been selected had a definite leucocytosis. As a result they could not be used for this work. In seventeen such cases, however, the experiment was proceeded with. Of the seventeen patients, eleven were infective arthritides indeterminate, one spondylitic, one arthritic of spine, three fibrositic, and one sub-acute rheumatic.

Patient No.12141/

Patient No.12141 was an infective arthritic, age 35 years. he was given a saline sulphur bath, temperature 102°, duration 20 minutes.



It will be noticed that immediately after his bath the white cells fall from 21,000 to 13,400. There is then a gradual rise again. This is typical of what happened although in two cases where the initial white cell count was about 13,000 there was an increase of 70% one hour after the bath. All these patients did not benefit by the bath. One hour after the completion of the bath their limbs were very stiff. In fact, they were stiffer than they had been before this treatment was begun.

Seven men, who were found to be fit in every way, were given a sulphur bath at temperature 102°, duration 20 minutes. The majority worked in the Hospital, their occupations being:

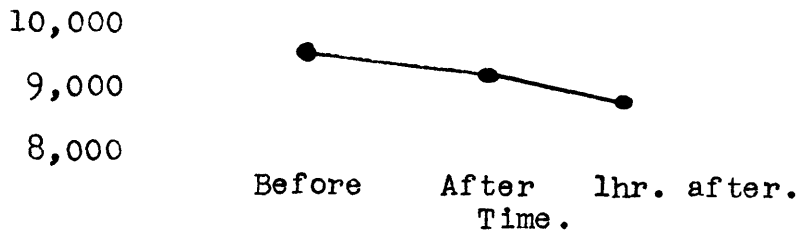
2 bath attendants, 1 porter, 1 clerk, 2 laboratory technicians, and 1 chemical analyst. They sweated profusely after the bath, and in one case the man's temperature rose three degrees. The greatest increase in white cells was one of 23%, an hour after the bath.

Through time, by examination and the general appearance, I could almost select the patients who would give a definite increase in white cells. Most of them were patients suffering from fibrositis. Their age did not matter, but they were of moderate nutrition or thin. The fat, flabby man or woman gave very little reaction, or none at all. Infective arthritis with normal white cell count reacted.

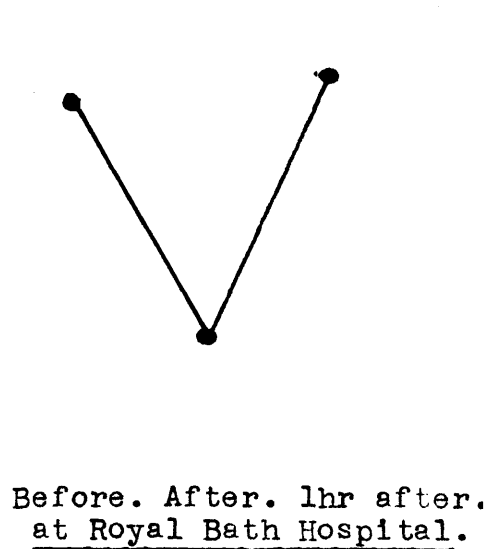
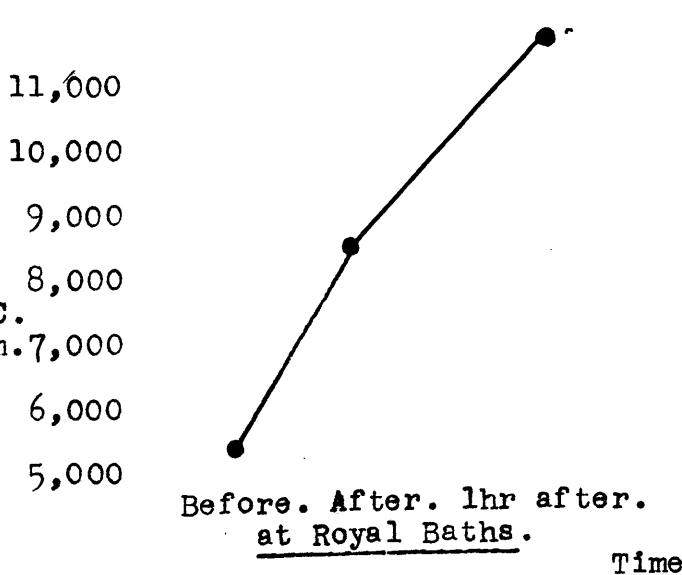
In an Hospital such as the Royal Bath Hospital a number of patients are sent by their Insurance Companies for treatment as they complain of pain and stiffness in various joints. These patients never come except in the summer months. Examination forces one to the conclusion that they have come for a holiday and that they have nothing wrong with them. They will attempt to evade the treatment which is prescribed. Most of them are given sulphur baths. I concluded that their reaction would be small, and this was verified by results in three cases.

Patient 13127 was 55 years of age, who complained of pain and stiffness in both shoulders. His general condition was good, and he looked the picture of health. Nothing could be made out on examination. He was given a sulphur bath at temperature 102°F, 20 minutes duration. The following was the/

the result :



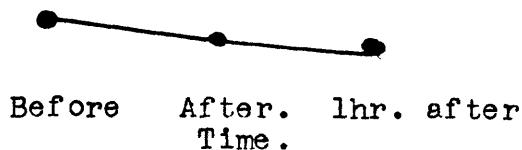
It will be remembered I stated previously that at the beginning of the year 1933 the reaction to the sulphur baths at the Royal Bath Hospital was poor. Twelve of these same patients were given a sulphur bath at the Hospital, and the following day a sulphur bath at the Royal Baths. They were unanimous in their opinion that they felt better after the bath at the Royal Baths but not after the bath at the Hospital. The following were typical results:



It is rather interesting to note in the case of a patient who had advanced osteo-arthritic changes in both hip joints that/

that he asked the Honorary Physician to be given other treatment than sulphur baths. Asked his reason for this, he replied that he felt no better after the baths; in fact, he was more stiff. I was asked if I had given him a sulphur bath at temperature 102° and for twenty minutes. On looking up my notes I discovered that I had. He gave no reaction at all. Result:-

W.B.C. 9,000  
per c.m.



#### RESULT OF PLAIN BATH.

Eighteen patients who had given a definite reaction were subjected to a plain hot water bath at temperature 102°F. for twenty minutes. One hour after the bath the maximum increase in the white cell count in any of these patients did not exceed 20%.

#### TYPE OF CELL INCREASE.

Of the hundred cases subjected to saline sulphur baths, in all - with the exception of four - there was an increase in the polymorphonuclear leucocytes and a relative decrease in the lymphocytes, the leucocytosis reaching its maximum from half-an-hour to an hour after the bath.

#### POSSIBLE CAUSE OF LEUCOCYTOSIS.

The possible cause of this leucocytosis has to be considered. The same eighteen patients, who had reacted strongly/

strongly to a saline sulphur bath and had given a poor reaction to a plain hot water bath, were also subjected to sodium carbonate and sodium chloride baths. The amount of these chemicals was calculated from their total in a saline sulphur bath. None of them showed a marked reaction with the exception of one patient who gave an increase in white cells immediately after a sodium carbonate bath, and the probable explanation of this was that he felt faint during the bath and after being revived was very excited and distressed.

Six patients were given a saline sulphur bath at the same temperature and for the same length of time, but instead of breathing in air from the bath-house and the gases from the bath they breathed air from outside by means of an apparatus consisting of a mask to which was attached a long rubber tube. These patients still reacted strongly to the bath exactly as they had done previously without a mask.

The blood of two bath attendants who were in the habit of inhaling fumes from the baths was examined, but in neither case was there a gradual increase nor a leucocytosis found. Patient No.12838 was given a bath in which sodium sulphide had been put, so as to evolve  $H_2S$  gas; but there was only 8% increase as against 58.7% after a saline sulphur bath.

TEMPERATURE OF BATH.

From the individual results it will be noticed that the bath temperature was not the same for every patient. It varied/



varied from 98° to 104°F., in order to ascertain what effect the temperature of the bath had on the leucocyte count. The increase was found to be just as great in those patients who had a bath at 98°F. as in those who had one at 102° - 103° - 104°F.

#### TEMPERATURE OF PATIENT.

The increase in temperature of patients after the bath varied from 1° to 5°F.; and, here again, the increase in leucocytes did not correspond to the rise in temperature.

It would seem, therefore, that the reaction is not, to any particular gas or salt, but to the combination of them all, and probably something which the chemical analyst has not been able to analyse.

W. Grunow and Professor Edmund Malina are both of opinion that the reaction after a saline sulphur bath had an analogous stimulant action to protein shock injections. In the course of my own observations it was found that there was very little increase, or none at all, in the patient's temperature. It must be admitted that all had a very profuse sweat. In the work of Campbell on Protein Shock he found that there was a great increase in white cells corresponding to the increase in temperature, but this is certainly not the case with saline sulphur baths.

The possible source of these leucocytes has next to

be considered.

1. Expulsion from the Spleen.
2. Dilatation of Quiescent Capillaries.
3. Expulsion from the Lymphatic Glands.

1. Expulsion from the Spleen.

If it had been due to this there would have been also an increase in the red cells, but this was not found. The red cells remained the same.

2. Dilatation of Quiescent Capillaries.

It has been shown that in the patients who reacted strongly to a saline sulphur bath there was a marked hyperaemia. In all probability this is the source.

3. Expulsion from Lymphatic Glands.

If this were so, it would be a lymphocytosis and not a polymorphonuclear leucocytosis.

In conclusion, I think it is only right that Spa physicians should study carefully the type of patient before prescribing saline sulphur baths. They should realise that they do not benefit everyone and that this form of treatment may greatly aggravate the condition of some patients.

## C O N C L U S I O N S

1. In saline sulphur baths we have a natural agent which is capable of producing in a short time improvement in between eighty and ninety per cent. of fibrositic patients. In arthritics where the disease is confined to the pariarticular tissues and if the condition is subacute, it acts as a useful adjuvant.
2. The cases which do not do well are those of the osteo arthritic type.
3. Of the hundred patients investigated all showed an increase in white cells of from 4% to 200%, the greatest increase being found in fibrositic patients.
4. The maximum increase was obtained half-an-hour to one hour after the application of the bath.
5. A differential count showed an absolute increase in the polymorphonuclear leucocytes and a relative and absolute decrease in the lymphocytes at this time.
6. Normal healthy individuals react poorly to a saline sulphur bath and do not derive benefit from them.
7. The saline sulphur baths produce also:
  - (a) A quick and marked hyperaemia of the capillaries.
  - (b) An increase of the body temperature of 1° to 5° immediately after the bath.

(c)/

(c) Profuse sweating.

8. Patients who have an acute condition and a relative leucocytosis do not benefit from a saline sulphur bath and immediately after the bath there is a decided fall in the leucocytes.

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I desire to make my appreciation of the interest shown in my work by the Honorary Staff of the Royal Bath Hospital and by Dr. Edgecombe of Harrogate.