The Treatment of Pulmonary Phthisis
by
residence in the Karoo, Cape Colony.

The treatment of pulmonary phthisis by residence in high altitudes has been a recognised practice, steadily increasing in professional and public favour, during the last twenty-five years; the results have been more satisfactory than those hitherto attained by any other climatic means. It is interesting to note how this method of treatment began in Europe about 1870, and earlier in America, is proved in the light of modern knowledge springing from the discovery of the bacillus tuberculosi by Koch in 1882, to be upon a rational basis.

Koch's complete investigations leave room for no other existing cause of pulmonary phthisis than the tubercle bacillus; pulmonary phthisis thus becomes synonymous with pulmonary tuberculosis. Heredity, constitution, environment, occupation and certain

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I. C.T. Williams, "Climate in relation to health"—Sanitary Institute Lecture—May 7, 94. Also, "Aero-therapeutics" by same author.
conditions of soil and climate formerly looked upon as direct causes are now regarded as predisposing or auxiliary causes. Koch himself said that catarhal or other weakening disease of the mucous membrane was necessary before the bacillus could infect the subjacent tissues and set up its characteristic lesions. It is agreed that some one or more predisposing causes usually provides a suitable soil for the bacillus. Metchnikoff and others have proved nature's inherent power to resist the cause of the disease; the leucocytes of the blood and other cells, and the lymphocytes of the tonsils and adenoid tissue in the intestines possess a bactericidal or phagocytic action. When the phagocytes successfully destroy or absorb the bacilli, the health equilibrum is maintained in the body; if the body and its phagocytes are debilitated, the soil is suitable for the bacilli, they gain entrance to the system and set up disease. It is conceivable that if a healthy body is attacked in overwhelming force by the bacilli, they may conquer through power of numbers; but the cases of healthy persons predisposed bodies succumbing to the disease are comparatively few.

Koch "Die Ätiologie der Tuberculose".
Berlin 1882.
The tubercle bacillus infects man most often through the respiratory tract directly along with the inspired air, carried in dried sputa or dust. The alimentary tract however also receives the bacillus from tuberculous food (chiefly milk from tuberculous cows, or undercooked, raw meat) and Dr. Sius Woodhead points out that many cases of apparently primary tuberculosis of the lungs are in reality secondary to abdominal disease derived from such infection. Flugge thus summarizes the sources of infection: "chiefly the sputa. The spores retain their vitality in the dry state for about six months. They can adhere to linen, clothes, furniture, etc.; they are also present in the soil, under the flooring in a living condition, in dust in the sheets, etc.

In consequence of the large number of pathological patients, the number of the infective agents in the sputa and their retaining power, the sources of infection are almost everywhere present."

It is beyond my purpose to discuss the mode in which the phagocytes overcome and destroy the invading bacilli, or in which the bacilli

I Cornel: Zeitschrift für Hygiene 1887, X.
gain entrance and accomplish the destructive or "consumptive" process; but having conceded that the bacillus is the exciting cause of the disease, and having glanced at the modes of infection, and noted the power which nature possesses, under favourable circumstances, to resist and repel the invader, it is possible to draw conclusions as to what is a rational course of treatment.

Ideal Preventive Treatment thus would have as its object the combating of the bacilli; thus:—

1. Prevent access of the bacilli and spores.
2. Destroy bacilli and spores when occurring.
3. Prevent development of predisposed constitutions by:
   (a) Preventing unsuitable (physically) marriages.
   (b) Inducing the healthy in the case of the body.
   (c) Removing, so far as possible, conditions which lead to development of predisposition.
   (in environment; occupation; sanitary arrangements &c. &c.)
4. Strengthen bodies debilitated by hereditary or acquired predisposition — general or local (particularly pulmonary).
5. Remove predisposed constitutions from unfavourable to favourable environment, climate, and employment.

Similarly in
Curative treatment it would be necessary to combat the bacilli by preventing its access and destroying it and its spores where possible, and also to:

1. Strengthen the patient's resisting powers, his constitution and blood (and therefore the phagocytes).
2. Place the patient in surroundings which either do not facilitate the working of the bacilli, or which actually impede and resist the organism itself or its similarly affect the destructive process induced by it in the lungs.
3. Treat symptoms and complications.

Dr. C. Theodore Williams pitifully summarizes rational modern treatment when he says that our aims should be to "fortify and sustain the resisting powers of the patient," a phrase which, as I have elsewhere pointed out, recalls that of Dr. Rush (a Philadelphia physician who flourished about 100 years ago) viz: that successful treatment is that which "restores the original vigor of the constitution and rouses and invigorates the powers of mind and body."

II "The treatment of phthisis in three centuries" - South African Medical Journal February '95."
After this brief consideration of the aetiology and rational principles of treatment of pulmonary tuberculosis, I pass to the object of this thesis - an examination of the properties of the Karroo climate, and of its value as a preventive and curative agent on rational lines, in this disease.

The Karroo is an elevated plateau in Cape Colony covering over 100,000 square miles, and varying in elevation from one to seven thousand feet above sea-level.

Barney Yeo divides High Altitudes into:

1. Alpine - over 4,000 feet
2. Sub-alpine - from 1,000 to 3,500 feet.

There are many health stations in the Karroo from 1,000 to 5,000 feet elevation; the part where my experience has been derived (Middelburg) is 4,100 feet; it is therefore an Alpine climate according to Yeo's classification; and of it I speak.

The following are the leading characteristics of the Karroo climate:

1. Degree of air and soil:

The annual rainfall varies in different stations; some places on the Northern Border and towards the West never have more than 3 or 4 inches yearly; whereas Klipfontel, a favourite resort, has a mean of 35 inches for the last 25 years. The Karroo
dry districts are scarcely available for invalids as owing to scarcity of water, they are inhabited only by nomadic sheep-farmers. Midstelling, which may be taken as a type of the Karoo Health resorts, varies from 8 or 9 inches in dry to 17 or 18 inches in wet years. The following are the readings for an average year:

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.14</td>
<td>0.83</td>
<td>2.93</td>
<td>0.88</td>
<td>0.96</td>
<td>0.16</td>
</tr>
<tr>
<td>July</td>
<td></td>
<td></td>
<td>0.02</td>
<td>1.94</td>
<td>0.95</td>
<td>0.92</td>
</tr>
<tr>
<td>Aug.</td>
<td>0.06</td>
<td></td>
<td>1.62</td>
<td>1.94</td>
<td>0.95</td>
<td>2.03</td>
</tr>
</tbody>
</table>

Total: 14.33 inches

The chief rain falls as severe and short thunderstorms from December to March; during the other months it is comparatively trivial; occasionally in Winter a thin fall of snow may cover the ground, disappearing rapidly before the morning sun.

The soil is usually a sandy loam resting upon sandstone, lignite, or shale.

The rain rapidly runs off the sun-baked soil; it is unfortunate that hitherto no record has been kept of the days on which rain fell; the whole rainfall of a month frequently takes place on only one or two days. Dew and mist are practically unknown.
The relative humidity has not been recorded.

2. Intensity and amount of sunshine:
This is excessive, and the sunshine is rich in active properties. Clouds are rare in Mules and in Summer are seen only as precursors and accompaniments of thunderstorms. The following record which I have kept shows the state of the sky during two months (Jan. 1 to Feb. 11) which have the greatest rainfall; 3.12 inches of rain fell in January and 1.34 inches in February.

<table>
<thead>
<tr>
<th></th>
<th>Jan'</th>
<th>Feb'</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolutely Cloudless</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Whole day</td>
<td>12</td>
<td>10</td>
<td>22</td>
</tr>
<tr>
<td>2. Morning only</td>
<td>7</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>3. Afternoon only</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Whole Clouds but constant sunshine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Whole day</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>2. Morning only</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>3. Afternoon only</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Black Clouds - no rain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Whole day</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2. Morning only</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>3. Afternoon only</td>
<td>8</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Black Clouds and rain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Whole day</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2. Morning only</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3. Afternoon only</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Days</td>
<td>31</td>
<td>28</td>
<td>59</td>
</tr>
</tbody>
</table>

Therefore out of a total of 59 days there were
5 mornings and 41 afternoons of constant sunshine, and
30 days on which the sun shone constantly the
whole day. Here were six days in each month
on which rain fell and in the two months only
one day on which rain fell all day both morning
and afternoon. These are the two months of the
year when the worst record of this kind is likely
to occur, and 1875 was in no way
differed from the usual. One of the advantages
of the climate is the constancy of the seasons.

3. Temperature — warm in Summer and
          Temperate in Winter.

The following are the readings for an average
year, showing the various monthly averages,
maximum and minimum (Fahrenheit temperatures)

<table>
<thead>
<tr>
<th>Jan.</th>
<th>Feb.</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max.</td>
<td>84.4</td>
<td>83.6</td>
<td>77.3</td>
<td>71.8</td>
<td>64.7</td>
<td>60.3</td>
</tr>
<tr>
<td>Min.</td>
<td>55.5</td>
<td>55.9</td>
<td>50.9</td>
<td>43.5</td>
<td>36.</td>
<td>29.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Max.</td>
<td>64.6</td>
<td>72.2</td>
<td>77.3</td>
<td>80.5</td>
<td>84.3</td>
</tr>
<tr>
<td>Min.</td>
<td>33.4</td>
<td>40.9</td>
<td>46.</td>
<td>49.4</td>
<td>54.1</td>
</tr>
</tbody>
</table>

Broadly speaking the seasons are thus divided

- Spring: September, October, November
- Summer: December, January, February
- Autumn: March, April, May
- Winter: June, July, August
The heat of summer is easily borne owing to the degrees of transparency of the air. From April to November the climate is dry, crisp, bracing and almost continuously sunny. Even in summer the mornings until about ten o'clock are deliciously clear and bracing; residents are in the habit of rising early in summer and reclining in the middle of the day; however, at the day's end evenings and nights are always cool. In June and July the nights are often intensely cold.

4. Sterility of the Air:

No investigations have been made to estimate the organisms present in the air of these altitudes, but it is generally stated as a result of clinical experience that the air is sterile; the population being so scanty in the Karroo and the towns seldom bigger than villages, there are few sources of pollution. The villages are built in an open and scattered way, and although the sanitary arrangements are not in accordance with modern requirements, wounds tend rapidly to first intention, and septic ulcers are very rare indeed.

5. Diminished Barometric Pressure —

It ranges about 29 inches, and brings:

6. Rarefaction of the air, to which and to the dryness of the atmosphere the
Diathermy is due; in the air transmits the solar heat more readily than it retains it - only a small proportion is retained. According to Denison, this property leads to an increase in the difference between sun and shade temperature of 1°F for every rise of 2.35 feet.

Increased relative amount of oxygen in presence of the air, and there is said to be abundant electricity.

Wind; the prevailing wind is a gentle breeze blowing from the north-west, which tempers the summer heat agreeably. In the dry season, the days are usually still, but in June, July, and August, high winds sometimes prevail, dropping at sunset. Very occasionally these are sudden cold and eastly winds, generally arising an hour or two before sunset.

The Karoo is destitute of trees except where planted in orchards or in villages for ornament, kept up by irrigation. The rivers are such only during and immediately after the summer thunderstorms; the same drains rapidly off.

I quoted from Williams, Aero-Therapeutics, p. 108.
II Burney, Yes "Climate & Health resorts", p. 270
III Aero-Therapeutics, p. 178.
the soil into the river beds or "cliffs" and rushes in torrents to the sea, except where dams have been made for irrigation purposes. Here is no standing water. The veld (country) is covered by coarse short grass, or by the clustered Karoo-bush; in places there is nothing but bare rocky broken ground.

How far can a climate possessing these characteristics be beneficially used in the treatment of pulmonary tuberculosis?

First, in Preventive Treatment:

Reference to page 4 it will be seen that the objects of treatment two and three are such as to demand attention in all climates and need no further reference here except to urge their necessity. The Karoo climate is however adapted for the fulfillment of objects one, four, and five on page 4 in virtue of the following conditions:

1. The sources of infection are few and are comparatively easily controlled.
2. The climatic conditions are unusual to bacterial life.
3. The physiological effects of the climate oppose the predisposition to tuberculosis.
4. The sources of infection are few and
comparatively easily controlled.

Although even now tuberculosis
in any form is unknown in the Harrow country
(i.e. on farms), cases are recorded amongst
the native and mixed races of some Harrow
villages, where poor food, the unfortunate
excessive use of bad spirits, and the ravages
of syphilis have debilitated the constitutions
of a naturally idle and lazy race; syphilis
is so common that the Hollinito actually often
purposely inoculate their children, on the
ground that it is "as well to have it over."
Here people tend together in the villages in
unmercifully built huts from which light and
air are purposely excluded. I learn on the
authority of the Middletown District Surgeon
who has practised here for 14 years, that he has observed
of this to occur amongst the "coloured"
population only since the place became
a resort for European tuberculosis invalids,
whose washing and other service is done
by "coloured" people; even now it states
that there are not more than three deaths
per annum from tuberculosis disease in
this population of coloured people (5,683
in district + village combined), and that
he knows of none occurring amongst the
white population numbering 4,004
in Upper East district and village. Statistics
are not available as the Government has only this year (1875) promulgated a compulsory Dealt Registration Act. From many villages it is reported that phthisis is entirely unknown in white or coloured people. With regard to the question of tuberculosis in animals the Colonial Veterinary Surgeon writes to me:

"In the high districts such as Middling, I have not seen any cases in native bred cattle, but some cases have been observed in imported cattle, and the circumstances clearly indicated that these animals were affected before they left England. I believe the live-stock of the colony are very free from tuberculosis."

It may be concluded then that in the least favourable part of the Territory (i.e. certain villages) there are no sources of infection other than imported cases of phthisis from Europe and occasional cases amongst the coloured population and rare tuberculosis in the few imported cattle, whereas in all other parts, especially on well-conducted farms, there are absolutely no sources of infection.

M. Miguel has stated that the freedom.

I quoted Mr. Douglas Powell, 'Diaries of Lungs,' p. 367. 4th Ed.
The air of high altitudes from bacteria generally, which has investigated and proved, is due to (1) lessened dust (2) lessened power of the diluted air to hold particles in suspension (3) lessened centres for bacteria production.

The first reason scarcely holds good here for, as will be explained, dust is generally increased rather than diminished in the South African Highlands; it is conceivable however that the alternated air may not very readily condense particles in suspension, but I am of opinion that the third reason is nearer the truth; as pointed out in page 10 the sources of pollution and the conditions under which bacteria flourish readily are very much lessened in the Karron, in other words

(2) The climatic conditions are injurious to bacterial life.

The dry air gives the natural means of disinfection as (1) drying of bacteria (2) abatement of their nutrition (3) high temperature, more especially on the surface of the soil from solar heat.

The dry Karron air and soil and the very scarce sources of pollution supply here the first and second means, whilst the rarefied air, as shown, favours the property of disinfection to a high degree, whence the influence of solar heat is readily transmitted to the soil; the influence of the sun's direct...
rays in these altitudes is said to be due to the absence of aqueous vapour from the atmosphere, and it is known that bacteria flourish best in a moist medium. It is also recorded that in towns where the humidity of the soil has been increased by drainage, a decrease of phthisis has resulted.

Neither Miguel nor Flaggge however refer to what in the light of recent modern researches, appear to be the most powerful natural means of disinfection viz. pure air and powerful sunshine; these conditions are present to the fullest degree in the Karros. It is now established that sunshine is a powerful bactericide and Peckel of St. Petersburg has proved that it is the ultra violet or actinic solar rays which are most powerful in this respect; this is important when the statement already made (page 9) is remembered viz. that the sunshine of high altitudes is particularly rich in actinic properties. Again the acknowledged fact that the Karros or air is rich in oxygen has additional significance in the light of Bumey's experiments; it proved the destructive influence of sunshine on bacteria increased.

I Sants "Physics" page
II Parke's "Hygiene" page 6.
III Buckland "Sunshine and Microbes" May '94 in "19th Century" quoted in III
IV Burney Geo. ibid cit. and J. Weber "On treatment of Pneumonia of Prolonged residence in Elevated regions. " Vol. 52 British Medical Transactions.
in direct proportion to the amount of oxygen present; although these experiments were not performed upon the tubercle bacillii, they have been followed up by Ransome and Delaporte who have proved that "the virulence of the tubercle bacillus was reduced and actually rapidly lost by exposure to fresh air and daylight."

It would appear then that not only are the sources of infection few in thev Harrows, but that the conditions are so injurious to bacterial life that the tubercle bacillus when occurring, cannot live and multiply to anything like the extent it does in an ordinary town.

Some climates are said to be free from phthisis and Burney Yeot discourses the altitude of immunity; it is more likely however that no particular altitude is immune so long as the conditions are present which favour the disease, amongst which are poor food, overcrowding, and unhealthy indoor life. Johannesburg, a town in the South African Republic, is placed in a climate said to be highly beneficial for phthisis, at an elevation of 5,000 feet. The development of the gold-mining industry has in a few years attracted a large population.

I. Proceedings of Royal Society, 1877, and quoted by Williams.
II. Climate and Health Resorts. Lancet Nov. 3, '94.
estimated at over 50,000 whites and probably an equal number of coloured people; if this prevails there now as in a European town, having followed the development of "civilised" life.

(3) The physiological effects of the climate oppose the predisposition to tuberculosis.

The physiological effects of high altitude climate as investigated by Jacquard and described by Weber, Yeo, Williams and others are briefly as follows:

(a) Increased appetite, muscular capacity and nerve energy, and improved nutrition.
(b) Increased tone of heart and circulation, especially the pulmonary circulation.
(c) Increase of haemoglobin and the corpuscular elements of the blood.
(d) Increased lung ventilation owing to deepened respiration and expansion of lung and thorax; increase of chest circumference takes place probably as a result of dilatation of hitherto unexpanded groups of air cells.

The deepened respiration is a necessity - more air has to be respired than on the plains in order to get the required amount of oxygen from the attenuated air. It has been proved by experiment
that more oxygen is absorbed and more carbonic acid gas given off.

Here these effects are brought into play. The fourth sentence on page four is obviously fulfilled, and the patient is likewise placed in suitable environment; moreover opportunities for suitable employment are not wanting.

The Boers (farmers) born and bred in the Karroo and of European descent is tall, broad-shouldered and deep-chested, seldom fat, but usually muscular and powerfully built. The woman is also above the average height, but probably owing to remarkable neglect of exercise is frequently excruciatingly fat. Children are early reared and large families are the rule. Young Englishmen coming out to the Karroo, after leaving public schools, develop in a remarkably rapid manner; the increase in circumference and depth of the chest is noticeable, and the youth develops into a powerful-looking vigorous fellow in the course of a few months. On a farm or indeed in a village, under favourable circumstances, the whole day is spent in the open air, and there are abundant opportunities for health giving exercise. For a young man unacclimated in any way to public or any tuberculosis. Here is no belt to measure than a year or two's residence on a Karroo.
farm, either employed in farm-work or as a tutor, or as a visitor, for young women - the same applies, and situations as governesses are to be had. In the villages there are often openings both for young men and women requiring to make their living; unfortunately, however, many invalids arrive in the Colony without sufficient capital to maintain themselves until other health is restored or suitable occupation is obtained. Although farm life is most highly to be recommended, life in an ordinary village is very beneficial; youths employed in stores do a fair part of their work in the open air, the hours are short, there is no pressure or hurry, and work once done the pure open veld is within a stone's throw, with every opportunity for exercise and recreation. The villages consist of one-storied houses, built, as already stated, with broad streets in an open scattered manner in rectangular shape so that they are freely and efficiently ventilated and there is no obstruction to the sunshine. Delicate children are not at present sent to this country from Europe for health's sake, but tubercular children sent up from the unhealthy parts of the Colony or from the large Coast-Towns do splendidly.
However good the climate and its physiological effects may be, and however powerful the natural means for destroying or checking bacterial life, ordinary hygiene must be carefully attended to. The prepared person placed here with a view to contracting the predisposition must be properly clothed, fed, and housed, and all the necessary and approved precautions must be taken to destroy the bacteria from imported or other cases of tuberculosis in his vicinity. The Karros climate, then is eminently adapted for the preventive treatment of pulmonary phthisis, not less because of the freedom from sources of infection and the powerful natural means of disinfection, than because the physiological effects and the conditions of life render open-air life and exercise easy and almost compulsory; exercise in such a climate and conditions being the most powerful factor in strengthening an ill-developed or debilitated body.

A prepared person strengthened and developed by a suitable term of residence in the Karros, may return to a crowded centre of civilization and engage in the routine of your life. So long as the good effects of this climate are maintained (and
with care they may be made permanent.} 

The bacilli which assail him in the course of his daily life are overwhelmed by his vigorous force of phagocytes and destroyed. Undoubtedly, however, the most discrete course for such a person is to reside permanently in the Karroo—a course which is comparatively easy considering that the country is full of opportunities for a man possessed of average energy and resource and with reasonable capital.

**Curative Treatment.**

In what way does residence in the Karroo lead to cure when tubercle has once gained access to the lungs?

Bearing in mind the requirements laid down on page 4 for the rational treatment of this disease, it will be seen that what has been said concerning the value of the Karroo in Preventive, applies also to Curative treatment largely. The bacilli are combated by nature's powerful disinfectants assisted by the ordinary artificial measures for destruction of the bacilli and spores, which measures are comparatively easily carried out because the sources of infection are limited in number. Again the physiological effects of the climate strengthen the patient's constitution and so increase
His resisting powers; and the open-air life and exercise in the pure air and constant sunshine are valuable factors acting similarly. There are other conditions and effects which induce a cure in many cases, but in a proportion of early cases the cure appears to be brought about by the above detailed means only. It is still undecided whether in cases of very early phthisis (the "alveolar cataract" of Douglas Powell) the disease is from the first due to the presence of the bacilli or whether the cataract precedes bacillary deposit. The following case illustrates the influence of the already detailed effects of the Karroo upon such a case "alveolar cataract."

This L. B. aged 35; no family history of lung trouble; quite well until 8 weeks before arrival here; was then resident in Grahamstown on a visit from England; first suffered from indigestion & palpitation and "heart pain." After 3 weeks treatment was told he was well, but began to lose flesh, and was advised to try Middelburg. No history of sputum; menses regular. Condition on arrival: pale, thin, tall; weight 80 lbs.; slight cough; no sweats or expectoration. Practically nil. Temperature has ranged 101° to 99° for 14 days before arrival here; never normal. Heart normal; urine normal; lungs - at right apex (sub-circular) a small area will distinct + so small as to render examination for bacilli impossible.
prolonged inspiration and a few fine crepitations with inspiration; percussion note and resonance (vocal) unaltered. Course - patient ordered to live out of doors, take milk, Bynol, and 5 min of liquid arsenic his three daily meals, fruit as well as ordinary diet, temperature never rose above normal after first four days, gained weight steadily; at end of 6 weeks weighed 97.5 lbs; lost for sea side by her own desire at end of 7th week; the crepitations having disappeared, but the breath sounds being comparatively weak in the affected area. Reported quite well 3 months later.

It is probable that by rapidly placing this patient in a climate where the danger of infection was reduced to a minimum a cure was speedily effected - presuming the cataract was not due to tubercular deposit. On the other hand if the cataract was already tubercular it is reasonable to suppose that the effects already detailed might about the successful result; in either case the physical and psychological effects of the climate and the mode of life speedily strengthened the patient’s resisting powers, which were before it was too late. In my limited experience of this climate - and as far as I can ascertain in the experience of other Harrow practitioners this early cases invariably do well, although a longer residence is necessary as a rule.
How the patient whose case is described, had.
It is to be regretted that cases do not come to the Karroo more often at the first warning of disease.
Here are many cases of pulmonary tuberculosis in which improvement or arrest takes place, and in which the effect cannot be attributed solely to those conditions which acted in the case described, and which are the essential conditions in preventive treatment. Certain other climatic characteristics and effects are brought into action which must be now briefly considered.
First, the climate is such that the patient is able to live in it all year round; the heat of summer is seldom excessive, and the cold of winter is accompanied by such sunshine and such dry crisp air that I have come to regard it as the best time for invalids; most however return to England as soon as the cold weather commences, but the few that remain, about in my experience, have greatly benefited; it is the universal opinion amongst Karroo medical men that winter is the time when suitable phthisic cases derive most benefit. Those who reclined languidly during summer find themselves bound in winter to take exercise in self-defence—and with profit.
The excessive dryness of the air helps by causing great loss of water from the lungs, and thus promoting the pulmonary circulation; it also diminishes secretion and so dries up expectoration; again, the cold dry winter air (and it must be remembered that Spring and Autumn resemble Winter more than Summer in the Harrow) induces loss of heat and so has a beneficial effect upon fever. Acting upon this principle, I carried out at the European Sanatoria of Göteborg and Valkenieren, I have found the open-air treatment a most valuable means for reducing temperature in phthisis. In one interesting case, the patient usually sat or lay in the open air all day, taking his sedatives walking cresce or intervals; in a fortnight's observation his temperature under these conditions was normal until between five and six o'clock in the evening when it rose to between 99° or 99.2°, and gradually receded to normal about 8:30 p.m.; the curious feature was that the patient found during the fortnight and repeated the experiment several times straight for my benefit that by retiring to his room and lying upon his bed with a light rug on, that he could raise his temperature thus within half an hour to a maximum of 107°8. I found it stated in...
in Parkinson's "Hygiene" that in 1860 a Dr. Blake reported in the "Pacific Medical Journal" excellent results from the open-air treatment of phthisis, making his patients sleep out of doors in summer; I have had no opportunity as yet of trying this method.

The general physiological effects of bringing about more complete aeration of the blood, improve the quality of the blood and the activity of the pulmonary circulation and so induce or promote a healing process.

The conditions leading to increased chest circumference have a special influence where the tubercular mischief has made progress in the lung; Williams* advances the opinion that this chest expansion is due to "local pulmonary emphysema" around the diseased portions; Burnett** however regards it as due to simple dilatation of hitherto ill-expanded groups of air-cells; this is more rational than the supposition of a special emphysema; on page 18 I explained what seems to me to be the nature of the deepened respiration and this deepened respiration no doubt is a leading factor in the expansion of the lungs as well as causing increased respiratory capacity and leading to greater absorption of oxygen.

Then there is disease and shrinking from firmus formation of surrounding lung tissue.

* New Therapeutics p. 121
** Medical Treatment 1873 p. 121.
No data available for this page.
The tone and bearing properties of the
soothing effect pure air in the Harrow from
April to October inclusive as already stated stim-
ulates the patient to muscular exercise and by the
general physiological effects of the climate his
constitution is rendered more able for it. The value
of exercise can hardly be over-estimated; I am
in the habit of prescribing a large amount of
cases which can safely bear it and it is well
known that at such elevated resorts an astonish-
ingly large amount can be borne without undue
fatigue. Cases with afternoon rise of temperature
or with a tendency to capillary oozing make
moderate use of exercise; the former bear a fair
amount in the mornings, resting completely out-
of-doors) in the afternoons. The forms of exercise
available are walking, riding and golfing; the
last-named is unsuitable for those with a
tendency to haemoptysis; or farm work is better
than a little ordinary farm work or
a moderate amount of shooting. I am inclined
to attribute more importance to the value of
exercise and to the facility with which it can
be employed in this country than is usually
done. Exercise, as is known, has a pronounced
effect upon the lungs increasing the absorption
of oxygen and the elimination of carbon, and
its influence on the circulation generally is to
promote increased activity of the forces of nutrition.
You years ago before the railways connected the coast with the Karroo and other Highlands patients had to perform the journey from Cape Town or Port Elizabeth by ox-wagon—a process which took from five to ten weeks and entailed a good deal of "roughing"; there are many living in South Africa now who attribute their recovery to that journey, and it is likely that most cases, except those foolishly sent out in an advanced state of disease, were benefited.

In this district and many others of the Karroo there are many opportunities for mountain or hill climbing—a form of exercise most efficacious in inducing lung expansion. Undoubtedly in this climate exercise is a specially powerful means of "fortifying and sustaining the resisting powers of the patient."

To sum up then, the rational requirements for curative treatment are thus fulfilled in the Karroo:—i.e. by

1. The seascapes or sources of infection and the powerful natural means of disinfection (destruction of tubercle bacilli and spores).
2. The general physiological effects upon the bodily functions and forces.
3. The special physiological effects upon
the pulmonary organs.
4. The stimulation to and facility for
exercise and daily life in the almost constant
sunshine and the always pure air.
5. The special effects of the climate upon certain
symptoms – fever, expectoration etc.

The cases of cases suitable for Karoo
treatment in my experience and in that of
others who have written on the subject are
as follows:
(a) Prediposition, i.e. latent or acquired.
(b) Haemophtysis with slight or ill-defined lesions.
(c) Limited cavitary or consolidation without any
or with little fever.
(d) More advanced, if limited, cases which have
passed into a quiescent state – with or without
early formation.

Cases of acute phthisis with much or
continuous fever, advanced and active phthisis or
phthisis complicated by disease of other organs are
quite unacted on, as also are cases in which there is a

C. Herman M.D. "South Africa – its climate & health resorts." Cape official handbook
B. Smith M.D. "Alpine North as a Health Resort." S. African Medical Journal
S. Saffer M.B. "Treatment of phthisis in the State & Karoo.
G. Caftin M.B. "Resort land, Kraaifontein & State as Health Resort.
B. African Med. Journal
Feb. '95.
risk of or tendency to ephelis haemorrhagia, arising from rupture of a vessel in, or aneurismal dilatation and rupture of a vessel in a cavity. Robes describes as specially unsuitable persons of "cretic" constitution, i.e. those who show several symptoms on the slightest cause will irritable heart and inability to bear cold or slight changes in temperature. I have found neurotic persons very unsuitable for treatment in this climate, and to my mind the question of temperament is the most important point in considering whether an individual is a fit subject for this climate or not; this is especially the case at present; for owing to the state of South African politics and accommodation generally the country is not now suitable for anyone requiring much nursing or with a delicate digestion, unless he can adopt the expensive method of taking a house and surrounding himself with all comfort. The accompanying table shows the results of 23 cases which have come under my care during my first season's residence here: the season is reckoned from Sept. 16th to March 31st. The number of patients who remain for the cool season has been small hitherto. The accommodation in Karoo villages is limited so that the number of cases in a season is naturally small; perhaps too small to draw any definite conclusion; I have been unable to obtain any definite statistics from other practitioners in
<table>
<thead>
<tr>
<th>Classification of Cases</th>
<th>Number of Cases</th>
<th>Right Lung only affected</th>
<th>Left Lung only affected</th>
<th>Both Lungs affected</th>
<th>c artworks</th>
<th>Improved</th>
<th>Unchanged</th>
<th>Bere</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predispotion only</td>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemoptysis, with no definable or only slight physical signs</td>
<td>6.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td>one doubtful case only spent last few days of illness in hospital when recorded. no return England; 2 remain in residence in Kafir land and one in Cape Town.</td>
</tr>
<tr>
<td>Cavern or consolidation, limited in extent and with little or no fever</td>
<td>9.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>3 arrested returned home, improved remains and 1 no change, remains.</td>
</tr>
<tr>
<td>More advanced but not quantative, with or without early formation</td>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 improved payment to Orange Free State.</td>
</tr>
<tr>
<td>Advanced and active</td>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 unchanged remains.</td>
</tr>
<tr>
<td>Complicated</td>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 deceased progressed and extended in both lungs; retractile; constitution; returned home.</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>10</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>small cavity; married and remains.</td>
</tr>
</tbody>
</table>

Constitutional and acquired; remains in residence.
High altitude Karoo resorts, but my table will at least illustrate the important point that success in treatment depends upon the stage of the disease. Six of the cases were females, and eighteen males; the average age of the females was 35 years, and of the males 27.5 years. The average length of residence illness before coming to Medellin was 20.8 months for the total cases; but this has no bearing on the results attained as several of the cases had undergone treatment previously in other high altitude resorts, either in Europe or South Africa.

By arrest of disease I mean, in early and catalepsic cases, disappearance of all physical signs, and in cases of consolidation, either disappearance of the consolidation, or cessation of all signs and symptoms of activity; together with restoration of constitutional vigor, increase of weight.

By improvement I mean partial arrest or partial cessation of activity, and restored vigor.

Of the twenty-three cases (and it is to be remembered there are not selected cases, for some came to the country without and some against competent medical opinion) ten cases, or 43.47 per cent. were arrested and fifteen, or 65.2 per cent. were arrested or improved. Seventeen cases come under the designation of suitable for Karoo treatment; of these
were arrested, i.e. 58.8 per cent, and 14 or 32.8 per cent were arrested or improved. The average duration of residence in Middlebury of the 28 cases was 4½ months and of the 17 suitable cases 3 months; this again is not reliable in estimating results as several patients had been previously treated at other high altitude resorts. Experience shows that to ensure permanent results from one to three or four years residence is necessary, and that for certain cases it is unsafe to leave the high altitude at all, particularly cases with hereditary predisposition; my experience is not long enough to allow me to discuss the question of relapse after leaving the climate; and indeed I wish to urge that relapse may be entirely prevented by permanent residence in the Barreto.

In 7 of the 28 cases the expectoration was practically nil, and examination for tubercle bacilli was therefore impossible; the examination was carried out in the eleven cases in two only of which did repeated examinations fail to reveal the bacilli; in five cases the patients lived upon remote farms with few facilities for communication so that sufficient examinations could not be made.

Without dwelling upon the subject of this thesis, one of the cases may be briefly mentioned; the case classified as complicated by albuminuria is stated to have been improved, the
Patient was sent home by Dr. Saunders of Pembroke-Town with the statement that his urine was loaded "nearly solid with albumen." There was consolidation of the right apex, and patches in the left lung, with moist sounds all over the left lung front and back. The urine was loaded with albumen; op. gr 102.8; 30 ounces in 24 hours; no urine casts detected.

The pulse rate was consistently 100, and the temperature rose to 99° in the afternoons. He was anemic and thin. From the first, he improved;

The moist sounds gradually diminished, and the pulse rate fell to normal as did the temperature.

The albumen diminished until at the end of 2 1/2 months, when he returned to England on urgent affairs.

The examination of the urine showed: op. gr 102.2; no trace of albumen with nitric acid and bichromate; no casts. There was no evidence of renal or blood affections to account for the albuminuria, but it appears as if the cause was to be found in altered vascular tension. Sir Andrew Clark emphatically states that all cases of albuminuria are unsuitable for high altitude treatment, and Herman Heber and Douglas Powell corroborate.

Douglas Powell classifies the cases of albuminuria with in phthisis as due to either cardiac or disease, scrof-

I Lancet Jan 5th 1889.
II Diseases of the Lungs 4th ed. 1885.
It is beyond my purpose to enter into the question of the drug treatment of pelities; naturally when the occasion requires it drugs are employed here as in other climates; but broadly speaking the open-air life takes the place of the so-called specific drug treatments. In all suitable cases ordinary diet, which in South Africa consists for the most part of butcher's meat, is supplemented by milk, "calabash" (i.e. fermented) milk, eggs, cod-liver oil, malt extracts, and hypophosphites.

Unfortunately, under present circumstances diet and regime cannot be so strictly attended to as is desirable.

It would be unfair to discuss the advantages of this climate without also referring to its drawbacks. These are by no means trivial, but happily are for the most part capable of removal or at least avoidance.

To some invalids the sea voyage...
England is a drawback but scarcely so great a one as in the reality as in the imagination; once the Bay of Biscay is passed it is almost invariably a fair-weather voyage. The mail-steamer covers the distance from Southampton to Cape Town in about 16 days and the "intermediate" boats take 20 or 21 days. The ships are very well found and an excellent table is kept. The elevated Karoo is reached from Cape Town in about 24 hours, or from Port Elizabeth in about 12 hours, by means of Pullman sleeping cars without change. The climatic drawbacks are not great; on reference to the table of temperatures on page 9 it will be seen there is a great difference between the maximum and minimum means; there is frequently a very great daily difference, but I have found it well borne both in summer and winter, and those cases which are able to exercise invariably profit from a walk in the crisp early evening air in winter; the minimum temperatures occur in the night or early morning and therefore scarcely affect patients comfortably housed in proper sleeping apartments. In July and August high winds prevail and bring with them undesirable dust-storms, in the Orange Free State and some parts of the Karoo these are truly appalling and cannot
be avoided; in this district however, and in many other parts of the Karroo, owing to the sheltering mountains and the close carpet of grass or Karroo bush, the dust is limited to the ill-kept streets of the villages, where the regular use of a water-cart would be a complete preventive. The easy access to this district from the coast and its practical freedom from dust render it superior to the Orange Free State, which it resembles in all other respects, except that the Free State is hotter in Summer and colder in Winter and is one long dreary uninteresting level Table-land. At present the sanitary affairs of South African villages are entirely neglected, but an adequate Public Health Bill is promised in the coming session of Parliament (May '96), which will give the necessary power and to nature powerful disinfecting forces at work in the Karroo.

At present the accommodation for invalids in the Karroo, and indeed in all South Africa, is not up to the European Standard; as Dr. Symes Thompson says, it is a country at present for only "robust" invalids, or for those with the means to surround themselves with necessary comforts; for the average invalid comfort, in the European sense, is not available. Further there is no place where the systematic and rigorous treatment
of phthisis is carried out; no statistics of results have been published, and the conditions have not been the best possible; Colonial Hotel keepers pray no attention to dyspepsia or other details.

Considering the increasing number of political persons coming to the country, the unsurpassed climate of the Karoo, and the attention now being directed to South Africa in Great Britain, it is to be hoped that an effort will be made to provide accommodation for proper systematic treatment.

In conclusion I urge, as has been frequently urged before, that it is in early cases of phthisis that cure or benefit can reasonably be expected; in some carefully selected advanced or complicated cases amelioration may be obtained.

I have endeavored to draw attention to the country's wonderful adaptability for the preventive treatment of phthisis by climatic means; and I venture to predict that in preventive rather than in curative treatment the greatest use and benefit of the Karoo will be found in the future; this subject scarcely receives the attention it deserves. From the nature of the country it is improbable that the
Karoo will carry a crowded population, and large towns are never likely to arise in it; but it will always support a scattered farming community; various circumstances are combining to make the old-fashioned Boers discontented with their surroundings and they are "treading" to pastures new far away North; owing to a succession of bad seasons and want of enterprise and capital many others are rapidly going to the wall; in the opinion of leading Colonial politicians the farming future of the country can be saved only by the importation of European energy and capital. It is not unreasonable to point out what an opportunity this offers to youths of energy and ability but handicapped for life in England or Scotland by the curse of an hereditary, constitutional or acquired predisposition to tubercular disease. In the 100,000 square miles of the Karoo there is ample room, and that the prospects for health are infinitely safer, if less dazzling, than those to be found in the gold and diamond mining centres where so many new-comers, including rivals, flock.

W. Langi Gordon.

Middelburg, Cape Colony.