Whatever may be the complications, there can be no harm in making a clean, open canal for the easy flow of the menstrual fluid; to place the uterus upon a higher plane, and relieve the pressure of the rectum and the irritability of the bladder.

I will be pardoned if I am seemingly a little over-enthusiastic for such relief to my suffering sex, and if I place the author of this operation—though wholly unknown to me—among the other benefactors of my sex, Sims, Emmet and Sir Spencer Wells, it is because as a physician I appreciate results.

THE RELATION OF ATMOSPHERIC CONDITIONS TO INTERMITTENT FEVER.

Read by Title, in the Section of Practice of Medicine and Physiology, at the Forty-second Annual Meeting of the American Medical Association, held at Washington, D. C., May, 1891.

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Among the various State Boards of Health, perhaps none have done more to raise the standard of the medical profession, and to defend the public against impostors, than that of Illinois. None has probably done more for the science of medicine than that of Michigan. What is said of the Boards, applies especially to their executive officers, who have given the distinctive character to the bodies of which they are members. Dr. Henry B. Baker's laborious care in collecting statistics, and zeal in spreading information are well known, and his work is highly valued. Like other mortals, he is liable to errors of judgment, and we fear that in such an error originated his articles on "Malaria and the Causation of Intermittent Fever," published in *THE JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION* (Vol. xi, p. 651, etc., and Vol. xv, p. 561, etc.), having been read before the appropriate Sections in 1888 and 1890.

The first article, coming from so high a source, commanded attention; its repetition demands the most careful investigation. If the conclusions are fallacious, the fallacies should be clearly exposed. If his reasoning is correct, the discovery is important, for it shows that the individual can easily protect himself from the disease by wearing suitable clothing, and keeping his surroundings as even as possible—keeping the house warmed by fires at night, for example. On the other hand, coming from so high an authority, by many the ideas will be regarded as facts until proved otherwise.

The articles in question do not show the judicial spirit of impartial investigation usually found

in Dr. Baker's studies, but rather show a labored, and, as Dr. Lee characterized it when the article was first read (*THE JOURNAL*, Vol. xi, p. 653), "ingenious" argument to demonstrate a pet theory. They show how unconsciously a careful student may sometimes be misled and blinded by impressions. That the results reached are consistent, neither with each other, nor with facts, we shall try to point out.

His first conclusion is that "intermittent fever is proportional, either directly or indirectly, to the average daily range of atmospheric temperature." This sounds well, but reminds one of a test for flour once given by a good lady: "Take a pinch of the flour and throw it against the wall. If it is good it will stick—or else it won't." If the proportion is sometimes direct and sometimes inverse, does it not seem that any argument based upon it lacks stability? If we grant that this double relationship is a possible cause of the fever, has the author presented sufficient proof of the existence of such a fact? The proof is in the form of tables and diagrams, which we will examine.

Figure 1 of Dr. Baker's series shows that during the late war, the number of cases of intermittent fever in the United States Army, and the average daily range of temperature, both increased up to May. In June we find a much greater *rise* in the curve of cases, but a fall in the daily range of temperature. In July there is a steep decline in the curve of cases, but a rise in the other line. The daily range of temperature continues to rise until, in August, it reaches its highest mark. From July the number of cases increases until September. From their highest points, both lines decline until, in December, they touch bottom. It will be seen that part of the time the lines go in the same direction, but that during much of the time the case line variations are a month behind the other. This Dr. Baker explains by saying that it is due to the accumulation of old cases.

There are two elements of fallacy in this table. Reference to figure 2 shows that the line representing the daily range of temperature in Lansing is very different from that for the average of the State of Michigan. The case line in Fig. 1 represents a wide range of country—wherever the National troops were stationed. Some were in Texas, some suffered in Florida. Many shook at Charleston, and some were taken sick in the Northern cities. If Lansing atmosphere, in the interior of the State of Michigan, is not to be taken as a basis of comparison for the State of Michigan, how much less should the sickness in the whole army be compared with the atmospheric conditions around a single building, in one corner of the battlefield.

Secondly, Fig. 1 is a partisan table. Such a study as we are now engaged in is not a control

NOTE.—For tables and diagrams 1 to 12, inclusive, see Dr. Henry B. Baker's paper on "Malaria and the Causation of Intermittent Fever," published in this journal, Vol. xi, p. 651.

experiment. If it could be shown that intermittent fever increased and diminished, either exactly with or inversely with the daily range of temperature, keeping other conditions stable, one might perhaps be justified in making deductions therefrom. Since other conditions cannot be kept stable, they must be carefully examined, and eliminated as possible elements before drawing conclusions, especially if the variation in case and daily range of temperature lines do not bear a constantly definite relationship to each other. It must be remembered that *post hoc* is by no means always *propter hoc*. We would therefore have expected at least a report on the mean monthly temperature, and should have liked to have seen some reference perhaps to the mean monthly maximum and minimum temperature, and absolute and relative humidity of the atmosphere.

From the "Tables of Differences of Mean Temperature," published in "Smithsonian Contributions to Knowledge," I obtained the average monthly temperature of the following fourteen points, intended to fairly cover the field occupied by our army: New York City, Baltimore, Washington, Charleston, Cincinnati, St. Louis, Chicago, New Orleans, Knoxville, Atlanta, Louisville, Fortress Monroe, Ft. Morgan (Mobile), and Galveston. From the same source I obtained the mean daily range of temperature at Ft. Morgan (Mobile Point, Ala.), Washington and Philadelphia, and from Dr. Baker's paper I took the daily range of temperature for Memphis. These reports each represent a series of years and are substantially correct. I could wish that, as for daily range of temperature, I might have found more data available. From the means above mentioned I obtained mean daily range of temperature and mean temperature by months, for comparison with the number of cases of intermittent fever in the army, as shown in table and diagram 13. It will here be noticed that the daily range line rises from the low point in January to the highest point in May. From May it slowly declines about a degree to July, and then rises less than half a degree to September, from which latter point it declines to January. The mean temperature curve rises to its highest point in July, remaining nearly stationary until August, and then declining to January. The case line starts to rise from December, and reaches its first crisis in June, from which it falls to July, and then reaches its highest point in September. Its low point is before the low point of both the mean temperature and daily range. Its high point is four months behind the daily range crisis, and two months after the highest mean temperature. If the disease is the *direct* result of atmospheric conditions of temperature, we should expect its crisis to correspond with the crisis of one of the other lines. If the fever is an *indirect* result of the temperature conditions, we should expect its crisis to fol-

low the crisis of the temperature, which it does in this case. The fall in number of cases from June to July, without corresponding changes in either of the other lines, clearly intimates to the student that there is some other element which must be considered. This I think is humidity, and perhaps ozonic changes also have an influence.

Diagram No. 13, showing average temperature (14 stations); average daily range temperature (4 stations). Cases per 1,000 intermittent fever in U. S. Army. (Yearly means horizontal lines.)

That the fall in the daily range of temperature from May until June is not responsible for the fall in number of cases, is shown by the fact that even in July (giving the advantage of two months fall) the daily range of temperature is *far above* the average for the year, but in July the number of cases of fever is *below* the yearly average. Further: although the case line from June to July is about five-sixths of case line from May to June, the daily range of temperature line from May to July is only about three-sixths of the daily range line from April to May.

A comparison of figures 2 and 3, clearly intimates that the disease in question is much more closely related to the absolute temperature than to its daily range, for the per cent. of reports of intermittent fever in Michigan has its highest

and lowest points exactly corresponding with the maximum temperature, and throughout the lines do not antagonize. On the other hand, from February to March the average daily range of temperature decreases without a like change in the case line; and the daily range line reaches its climax two months earlier than the case line, and the lowest point for daily range is a month before the lowest number of cases.

In studying Michigan tables, it must be remembered that the per cent. of reports does not necessarily represent the per cent. of cases. Blanks are sent to correspondents of the State Board of Health, asking them to report simply the presence or absence of the diseases mentioned. If ninety per cent. of these correspondents have only one case each the report would be greater than if seventy of every hundred averaged five cases each and the other thirty per cent. had none. The importance of this word of caution may be seen from a study of the annual reports of the State Board of Health. They divide the State into eleven divisions, for the ten years from 1877 to 1886 the reports of intermittent fever from the upper Peninsula were only 9 per cent., while from the Northern Division of the Southern Peninsula they were 27 per cent., and from the Southwestern Division 81 per cent., and from the Southeastern Division 71 per cent. In the Southeastern Division in a single month there are probably more cases of intermittent fever than during an entire year in the upper Peninsula.

From the Michigan State Board of Health Report for 1888, I compiled table and diagram 14, showing the mean monthly temperature, absolute and relative humidity, day and night ozone for a series of years, compared with the per cent. of reports of intermittent fever as given in Dr. Baker's article. It will here be noticed that the curves representing the mean temperature and absolute humidity correspond closely with the per cent. of cases. Secondly: That in the main as the per cent. of night ozone increases the per cent. of cases decreases and *vice versa*. Thirdly: The same is true of day ozone, though not so exactly. Lastly: The relative humidity does not seem to have any relationship with the per cent. of cases.

The reports for Memphis, Tenn., (table 4) strengthen the idea that the absolute temperature and not the daily range of temperature is instrumental in the production of the fever. The mean temperature and number of cases both reach their climax in July, two months after the greatest daily range of temperature. There are, moreover, decided changes in the daily range line without any appreciable effect upon the number of cases.

In Cincinnati (table 5) the climax in the daily range line comes in May. That of temperature in July, and that of cases in August. We find a

great increase in the number of cases following the spring floods. There are very great variations in the daily range line without corresponding variations in the number of cases.

The San Francisco diagram (No. 6) shows all lines reaching their highest point in September, but here again the case line follows the mean temperature more closely than the daily range. The relationship of the lines, especially from May until August, clearly shows that there is some other factor besides temperature which produces the disease.

Diagram 14. Michigan. Showing average, 1, temperature (10 years); 2, ozone, day and night (10 years); 3, relative humidity (9 years); 4, grains of vapor per cubic foot of air (10 years); and 5, per cent. reports intermittent fever.

Diagrams 7 and 8 representing New York City and State, each show daily range line highest in June. Mean temperature highest in July, but the highest number of deaths from intermittent fever in September. It must be noticed that while other tables all refer to *sickness*, the data here refer to *deaths*. Since sickness must precede death we should expect the greatest number of deaths at least one month after the highest temperature, if high temperature is the cause of the disease.

Evidently the meteorological data in the State diagram are those of New York City. The daily

range is exactly the same as in the table 7, and the variation (less than half a degree) in the mean monthly temperature arises from the fact that for one table (No. 7) the figures are obtained by taking the reports from 1870-83, and in the other (No. 8) the reports used are from 1871-85. Believing that this did not represent the facts, New York City being about 150 miles south of the centre of the State, I prepared table and diagram No. 15, using for comparison reports for a series of years at Mohawk,¹ which is almost exactly in the centre of the state.

In table 9 we again find the greatest daily range of temperature in May, four months before the greatest sickness, and the highest temperature in July. This table is probably the most nearly correct of any in the series which cover more than a limited area. It illustrates, however, how difficult is such a table to prepare. If we imagine ten posts placed upon the same meridian, and each one of the nine southern posts having 1000 men, while the one northern post has 9000, the mean temperature of the ten posts would not give the average temperature surrounding the men. To get the correct figures the mean of the nine southern posts must be averaged with the one northern post. Here, as in the New York tables, it is to be regretted that the Doctor did not state his authority, giving the names of the stations used.

Tables 10, 11, and 12 quite contradict Dr. Baker's previous argument, and tables 10 and 11, representing India, also show that high temperature does not produce the disease. Here we find the highest temperature in May and June, the greatest daily range of temperature in February, and the least in August, but the most sickness in November.

If we suppose the daily range of temperature is equally above and below the mean temperature, we may get approximately the mean maximum and minimum temperature. This may be seen in table and diagram No. 16.

It will be noticed that in most places heretofore studied in this article malarial fever is most common at a temperature between 60° and 85° F., especially at about 70°. Neither extreme heat nor extreme cold are favorable for the disease. A glance at diagram 16 shows that until April the mercury every day went below 60°. From April to June each day it went above 95°. As soon as the minimum went above 60° the cases of sickness increased, and when the maximum came down to 87° there was a much greater increase. Every gardener knows that the young plant requires much more favorable surroundings than it does at a later period. An occasional high or

low temperature would kill the young plant while the old one might thrive. So while a temperature of 56° does not favor the development of the fever, neither does it stamp out the developed disease.

Diagram No. 15, showing number of deaths from intermittent fever in New York State, and mean and daily range of temperature at Mohawk.

There is another potent factor not shown in these tables. In "Hirsh's Handbook of Geographical and Historical Pathology," Vol. 1, p. 257, we read: "In the malarious regions of the tropics the fevers appear as a rule at the beginning of the rainy season. They increase in extent and severity with the increasing rainfall, remitting usually at the height of the rains, especially if they be very heavy, and reappear towards their cessation or directly after the rainy season, which is, as a whole, the season when the conditions are most unfavorable to health." Again, on page 269: "The production of malaria takes place on the largest scale where the soil is constantly saturated or periodically inundated." A friend residing in Lucknow informs me that from about June 15 until September 20, it rains almost daily, but from September until June all the rain put together would not make a good Michigan shower.

¹ "Tables of Differences of Mean Temperature" in Smithsonian Contributions to Knowledge.

NORR.—I have searched for meteorological data for India, but did not find more than generalizations. I have therefore been obliged to use the tables of Dr. Baker—his authority not stated.

Table 12, to my stupid mind, shows nothing, unless it be that the daily range of temperature has *nothing* to do with the disease. As drawn, the lines coincide in but one place, August. There are most marked changes in the daily range, without a corresponding variation in the number of cases. Not being able to obtain the mean temperature of Ft. Apache, I took that for Camp McDowell,² shown in table and diagram 17.³ Camp McDowell is near Ft. Apache, and practically on the same isothermal line.

Diagram No. 16. India. Showing average maximum, minimum and mean temperature, and cases of intermittent fever among native troops.

Dr. Baker's second conclusion is that "the controlling cause of intermittent fever is exposure to insidious changes, or changes to which one is unaccustomed, in the atmospheric temperature." If this is true, why is the disease so much more prevalent in hot countries than in those that are cooler? If this is true, why does not the sickness follow closely the daily range? This many of the diagrams studied show that it does not. A patient under the care of the writer since this article began, was exposed to decided

variations of atmospheric temperature. For two days she was obliged to be where the temperature was quite uniform through the twenty-four hours. She had no chill until after these two days of unusually even surroundings. This case is illustrative of many.

"The daily range (of temperature) diminishes from about lat. 40° in either direction, north or south. The precise latitude of maximum range cannot yet be given."⁴ If conclusion two is true, there would be more malaria around Philadelphia

Diagram No. 17, showing average temperature at Camp McDowell, Ariz., and daily range temperature, and cases of intermittent fever at Ft. Apache, Ariz.

than around Charleston—more in Connecticut than in Florida. Is that the fact? If so, I for one am greatly mistaken. In Michigan,⁵ the average daily range of temperature at Detroit is 15.79°; at Kalamazoo 16.93°; at Marquette 17.20°; Traverse City 19.13°. If the disease is due to daily range of temperature, we should find more of the fever around Marquette than near Kalamazoo, and more near Traverse City than in Detroit. I do not understand that to be the fact.

If the daily range of temperature is an impor-

² Mean 1866-70. "Tables of Differences," Smithsonian Contributions.

³ Small variations in this case line are unimportant, on account of the small number of cases represented.

⁴ Report of State Board of Health, Michigan, 1888, p. 25.

⁵ "Tables of Differences of Mean Temperature," p. 156, Smithsonian Contributions to Knowledge.

tant element in the production of intermittent fever, why should a change of climate develop the fever? Dr. Baker says: "It is a common observation that persons who travel northward or to a colder climate, where ague is comparatively rare, not infrequently have one or more paroxysms of chills and fever soon after the change.⁶ During the war I noticed this on a large scale after movements of troops from the South."⁷ Dr. Baker's explanation is not a reasonable one for me, for the reason that the temperature changes are perhaps less in the Northern than in the Southern home. In Michigan, for example, Dr. H. T. Calkins, one of the oldest practitioners in the northern part of the State, and a close observer, tells me that at Petoskey they never have malarial fever, *except in persons recently from a malarious country*. I am told the same of Mackinac. If this is true, it is a most important fact, and my own observation leads me to accept it. An individual going from Southern to Northern Michi-

The explanation of these phenomena which I have adopted, I think was first suggested by Dr. Bowditch, of Boston, though not in this exact form. The malarial poison, whether chemical or germ, acts upon the liver in such a manner as to slow the elimination of effete matter. The elimination of effete matter is accomplished through the liver, skin, kidneys and lungs. In the state of health these organs assist each other, keeping a normal balance. If an individual goes from a warm to a cold climate, the elimination through the skin and lungs is decreased. If the liver and kidneys are healthy, no harm results. If, however, as in the case of the malarial person, the liver is sluggish, it will be unable to do the work devolving upon it, and the system is poisoned with the non-eliminated effete matter. This irritates the brain and produces the chill and increase in temperature. This theory exactly agrees with my clinical experience. Antipyretics have little effect upon the disease until the liver is cleared.

TABLES FROM WHICH THE ACCOMPANYING DIAGRAMS WERE DRAWN.

No. 13.—Average Temperature, 14 Stations. Average Daily Range Temperature. Intermittent Fever, U. S. A.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Av.
Average Temperature	39.12	14.13	48.18	57.28	66.17	73.59	77.99	76.55	70.85	59.29	48.99	40.86	61.19
Daily Range Temperature	9.70	11.51	12.20	12.75	14.39	13.75	13.60	13.62	14.24	13.45	11.69	9.77	12.58
Sickness	19.4	19.6	20.4	23.6	24.5	30.6	25.6	32.	38.5	36.3	28.1	19.3	26.5

No. 14.—Michigan Day and Night Ozone. Relative and Absolute Humidity. Average Temp. Per cent. Int. Fever.

	3.33	3.46	3.44	3.21	3.09	2.88	2.69	2.88	2.74	2.78	3.01	3.18	3.66
Day Ozone	3.91	4.04	4.07	3.56	3.31	2.98	2.55	2.49	2.54	2.99	3.35	3.55	3.23
Night Ozone	1.81	.80	.77	.69	.68	.72	.72	.74	.75	.76	.79	.82	.75
Relative Humidity	.81	1.51	1.81	2.75	3.91	5.27	6.07	5.84	4.98	3.71	2.30	1.73	3.44
Absolute Humidity	20.56	23.62	29.80	44.33	56.08	65.10	70.52	68.14	61.67	59.83	36.08	26.60	46.11
Per Cent. Fever	58.4	60.8	62.75	70.4	75.8	77.8	79.5	79.0	79.0	76.1	67.0	58.8	70.4

No. 15.—Deaths New York State from Intermittent Fever. Average Temperature and Daily Range. Mohawk.

	20.87	22.51	28.78	42.33	54.89	64.59	69.64	67.73	54.77	47.94	34.06	23.12	44.27
Average Temperature	7.21	9.27	11.06	13.72	15.72	18.04	17.00	15.85	14.89	11.03	6.49	6.28	12.21
Daily Range Temperature	176.	193.	196.	225.	208.	191.	204.	258.	325.	297.	247.	216.	228.
Deaths													

No. 16.—India. Av. Maximum and Minimum and Mean Temperature. Intermittent Fever Native Troops.

	76.0	83.0	88.5	98.2	97.3	95.4	87.1	86.4	88.1	87.0	82.1	77.4	
Av. Max. Temp.	41.2	39.8	50.1	56.4	61.1	63.0	66.9	66.6	65.5	59.2	50.5	43.8	
Av. Min. Temp.	58.6	61.4	69.3	77.3	79.2	79.2	77.0	76.5	76.8	73.1	69.3	60.6	71.3
Mean Temp.	163.	156.	178.	181.	195.	207.	207.	217.	237.	255.	257.	244.	324.
Sickness													

No. 17.—Average Temp. Camp McDowell. Daily Range Temp. and Intermittent Fever Ft. Apache, Arizona.

	50.36	53.95	59.04	69.69	75.89	83.60	92.42	83.55	83.83	73.22	60.90	52.49	71.08
Average Temperature	30.56	30.30	30.86	35.94	38.94	41.34	33.84	28.96	35.64	32.64	35.22	30.70	33.74
Daily Range Temperature	4.62	9.02	14.77	14.89	11.62	17.06	25.59	56.10	52.12	40.73	26.69	7.70	23.41
Sickness													

gan will, unless specially protected, generally within from four to ten days show clear indications of malarial poisoning. The first symptom is not a chill, nor a fever, but a copper colored skin. The purer air causes the blood at first to flow more freely through the cutaneous capillaries, which, showing through the jaundiced skin, misleads the victim to report excess of tan. A few days later and a chill occurs, followed by a fever, and if left to itself, the disease progresses until it assumes a typhoid type. For the production of this condition I am confident that it is not necessary to bring in a typhoid fever germ.

Catharsis is not the essential factor, because compound cathartic pills and other like drugs may be given until the patient is exhausted, without any material benefit. On the other hand, if the case is seen early, calomel may be given in so small doses as to effectually clear the skin, without producing catharsis.

If a person residing in a malarious country, not being sick at the time, takes a thorough mercurial treatment before going to the North or to the sea shore, he will probably escape the usual sickness. While I would emphasize the importance of extra care as to clothing in making this change of climate, I regard the preparatory treatment as the more important. In fact, a person

⁶ JOUR. AMER. MED. ASS'N, Vol. xi, p. 653.⁷ Loc. cit., footnote.

whose liver is active will need less clothing for comfort than if his liver is sluggish.⁸ In some cases, it is necessary to continue small doses of the chloride or iodide for some time.

The usefulness of this treatment is generally known, and is admitted by Dr. Baker in conclusion seven. If, however, his theory is correct, any cathartic, decreasing the tension of the portal circulation, or heavy clothing would prevent the outbreak, as well or better.

How does a mercurial decrease the temperature? It certainly has an antipyretic influence upon a malarial fever or upon diphtheria, but it does not have any appreciable effect upon a healthy person. This effect is certainly not derived through increased heat elimination, and it must therefore be by reducing the production of heat. Since, however, it does not materially check the production of heat in a healthy person, this result must be the incidental result of the removal or neutralization of the irritating cause of the fever. If this is true the fever following a chill is not the result of non-eliminated heat being stored up, as Dr. Baker suggests. Further, if I am not mistaken, the experiments of Osler show that in intermittent fever there is increased heat production.

With regard to conclusions three and four it might be asked, how does Dr. Baker's theory explain the *cause* of delay in reaction from cold. The healthy person would react promptly; therefore this delay in reaction shows that neither the chill nor the fever represent the beginning of the disease. The mechanical effect of a chill may be a local congestion, but as soon as the cause is removed the system reacts and the only results are local primarily. If the intermittent fever is the result purely of the daily range of atmospheric temperature, since the body is daily exposed to the cold, the chill and fever would always be of the remittent type.

I am surprised to see conclusion six repeated. "In our climate those measures, such as drainage, which enable the soil to retain warmth during the night and thus reduce the daily range of temperature immediately over such soil, tend to decrease intermittent fever among residents thereon." Does drainage enable the soil to retain warmth? Almost any boy will tell you that sand in the sun is hot, but as soon as a shadow is thrown upon it it cools off. The rich black loam heats slowly and cools slowly. Dry climates are those most subject to great range of temperature. In northwestern Texas the traveler may suffer extremely from the heat by day, but at night he covers himself with a thick blanket and places a little water in a saucer from which he skims a thin layer of ice in the morning. In India we have already seen that there is the

greatest range of daily temperature when the ground is dry. Dr. Chas. Denison took the records of 25 dry and 25 moist climates and obtained therefrom the mean daily range of temperature for four classes of places as follows:⁹

1. { Extreme dryness, 36.51° } Fahr.
2. { Moderate dryness, 20.63° } Fahr.
3. { Moderate moisture, 17.09° } Fahr.
4. { Extreme moisture, 13.61° } Fahr.

On the contrary, then, drainage increases the daily range of temperature, and so if Dr. Baker's theory is correct it ought to favor the production of intermittent fever.

On page 417 of the Report of the Michigan State Board of Health for 1880, I found the following report from one of the correspondents of the board. "During the first half of the month (August) the moisture in the air was as abundant and the temperature so uniformly high, that unhusked corn in the shock, also corn in the corn cribs began to grow vigorously. During the third week of the month malarial diseases rapidly arose, which I think was partially due to the *prolonged uniform heat* and moisture. There was also one half less azone during the first half than during the last half of the month." This report is for Washington, in the southeast part of the State. From the same report, pages 317, 321, 326, 344, and 349, I get the mean temperature, absolute humidity, day and night ozone at Washington, and mean daily range of temperature at Detroit as follows (having no like data for Washington).

TABLE 18.

MONTH.	TEMPERATURE.		ABSOLUTE HUMIDITY.	OZONE.	
	MEAN.	DAILY RANGE.		NIGHT.	DAY.
June	64.21	18.43	5.21	2.42	2.22
July	72.47	18.84	6.31	1.21	2.06
August	68.54	18.74	5.17	0.85	1.65
Annual Mean	46.44	16.60	4.01*	3.07	2.97

It will be noticed that during these three months of summer the thermometer kept constantly within the range we have before found the most favorable for the production of malaria. While the daily range of temperature was higher than the average it was not as great as in May (22.48°).

A monograph by Dr. G. H. Wilson, of Meriden, Conn., member of the State Board of Health, published several years ago, gives an account of the progress in a definite direction from southwest to northeast, of intermittent fever. This seems to be strong evidence that the disease is due to a specific poison or germ.

From clinical evidence and meteorological investigations therefore it appears:

1. That intermittent fever is due to a specific germ.

⁹ Transactions of Ninth International Medical Congress, Vol. v, p. 40.
* Grains of vapor in cubic foot of air. Average for 9 months. No report for January, February and March.

⁸ I ordinarily prescribe two cathartic doses of calomel combined with ipecac, the first to be taken a week before starting, and the second three days after.

2. That the development of this germ, and hence the production of the fever is favored by a most atmosphere ranging in temperature between 60° and 85° F.

3. That the germ is taken into the body by inhalation or through drinking water.

4. That the fever is the result of irritation of the heat producing centre of the cerebrum. This irritation is perhaps partially due to the direct effect of the specific germ, but it is also due to the retention in the circulation of effete matter.

5. That under favorable conditions the true malarial fever may assume the character of a genuine typhoid fever, without the agency of a typhoid germ.

6. Exposure to an average temperature below that to which the person is accustomed, may develop a latent malarial condition, but exposure to cold does not produce the disease.

7. There being no definite and constant relationship between intermittent fever and the daily range of atmospheric temperature, we must conclude that daily variations in atmospheric temperature are not essential for the production of the disease.

Ozone is a potent germicide. It seems to the writer that its influence upon the disease is incidental and negative. When ozone is abundant it attacks the germs in the air and deprives them of their virulency. There is less ozone over swamps than in the open fields; less in the winds filtered through the underbrush, than in the same winds before reaching the woods. There is more malaria on the windward than on the lee side of a swamp. Conditions favorable to the growth of malaria are therefore destructive of ozone.

That the presence of ozone in the atmosphere does not greatly increase the power of the human organism to withstand the effects of the germ, I am led to think from the fact that a person going from a malarious region, where the amount of ozone is small, to a colder region, where the amount of ozone is greater, is almost sure to have strong signs of malarial poisoning soon after arrival.¹¹

The occurrence of the fever at high altitudes and in cold weather are sometimes mentioned as arguments against the paludal theory of the etiology of the disease. Let me simply hint at an explanation. One day after clambering up the crags on the coast north of Larne, Ireland, I was surprised to find myself in a bog while still close to the edge of the high cliff. Again: the upper plateau of Mackinac Island is 295 feet above

the water's edge, and yet there one may find marshy ground.

The heating of the house in winter draws air from the cellar. The air of the house is not so rich in oxygen as that out of doors. One may therefore find in the house in winter the necessary heat, moisture, and decaying vegetation—all the atmospheric conditions known to be essential.

MEDICAL PROGRESS.

MODE OF ENTRY OF THE TUBERCULAR POISON INTO THE BODY.—A very good summary of the various paths of infection adopted by the tubercle bacillus is given by C. BOLLINGER in the *Münchener Med. Wochenschrift*, 1890, No. 43. He considers that the frequency of infection through the skin has been under-estimated. Several cases have been recorded of direct inoculation by wounds received from broken spittoons, etc., by bites, after circumcision, by morphia syringes, and earrings. Eczema and impetigo increase the susceptibility of the skin. No case has as yet been attributed to vaccination, and it would appear that the tubercle bacilli are unable to live in the vaccine lymph. They also appear unable to pierce the pores of the skin as do some of the pyogenic organisms. The susceptibility of the mucous membrane is increased by inflammatory processes, such as otitis, rhinitis, conjunctivitis, pharyngitis, etc.; from thence the poison travels to the submaxillary glands and those of the neck, and generally causes local tuberculosis of the glands. The chief point of infection is of course the lungs. Local predisposition is best exhibited by apices which have been before diseased, but have undergone a healing process. The movement is deficient both in expiration and inspiration, and the liability to reinfection is increased by anæmia, irritants (such as coal and metallic dust), constitutional influences, such as diabetes, disturbances of digestion, and unhealthy surroundings. The poison may pass through the lungs and attack the bronchial glands, under which circumstances the disease may be very insidious. The predisposition of the lungs again exhibits itself in metastasis; not every tubercular disease of these organs is due to inhalation of the bacilli or their spores. As regards primary tuberculosis of the testicles, joints, and bones, Bollinger considers that a latent hæmatogenic infection must be understood, which leaves as little trace of its point of entry as does a primary septic endocarditis or an osteomyelitis. Tubercular disease of the larynx depends upon an autoinfection through the sputum. The rarity of this disease in children is explained by the infrequency of pulmonary cavities in the rapid forms of phthisis.

¹¹ Dr. Baker calls attention to the fact that persons exposed to night air over low lands are more liable to the disease than if they are exposed only through the day. It is suggestive that, according to Table 14, in Michigan, the months showing the most intermittent fever also show less night than day ozone, but generally there is more night than day ozone. Does light have any influence on the growth of the germ?