SPECIAL CONTRIBUTIONS.

AN ENDEAVOR TO DISCOVER ELECTRODYNAMIC RADIATIONS FROM THE SUN.

By Prof. JOHN TROWBRIDGE, Director of the Jefferson Physical Laboratory, Cambridge, Mass.

J. Wilsing and J. Scheiner, of the Astrophysical Observatory at Potsdam, give in the *Astronomische Nachrichten*, Band 142, No. 3386, a review of the various ways of detecting electrical waves, and conclude by a short description of the method they have adopted to detect electro-dynamic radiations from the sun. Passing over the elementary account of the various forms of Hertz oscillators, in which, by the way, Lebedew's apparatus for obtaining short electric waves is described without reference to Rhigi's earlier work in the same direction, we come to the form of apparatus which the authors used. It consists essentially of a Wheatstone's bridge with variable contacts, the resistance of which is modified by electrical oscillations. This form of apparatus has been used by various investigators, especially by Lodge. In the hands of Wilsing and Scheiner it was competent to show the existence of electrical oscillations arising from a source many feet distant. Notwithstanding the effects of direct heat radiations were excluded, and also the disturbing effect of vibrations, no deflections were observed which could be attributed to electro-dynamic radiations from the sun. It is doubtful if such radiations can be detected by the arrangement adopted by the authors, unless it is made extraordinarily sensitive. In this condition it would be affected by slight jars and mechanical vibrations. One should repair to an isolated mountain peak to carry out such experiments.

SUNSTROKE WEATHER OF AUGUST, 1896.

By W. F. R. PHILLIPS, M. D., in charge of the Section of Climatology.

The abnormal heat that prevailed over the eastern two-thirds of the United States during the last few days of July, and the first twelve days of August, 1896, suggested to the Chief of the Weather Bureau, the propriety of studying the subject of sunstrokes, in so far as it is connected with and dependent upon meteorologic conditions.

With this object in view he directed that the following circular, asking for information, be sent to different hospitals located in the affected region, and also to others from whom useful information might be secured.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
Washington, D. C., August 20, 1896.

The large number of casualties reported by the newspaper press as attributed directly to the effects of the recent hot spell of weather that prevailed extensively over the country, especially the eastern part, has suggested to the Weather Bureau the propriety of studying the subject of sunstroke in so far as it is connected with and dependent upon the meteorologic conditions, in order that the weather forecasts issued by the Bureau may, if possible, be given an additional general value.

With this object in view, the Bureau would request those into whose hands this circular may come to give the information, if any, in their possession, provided for in the subjoined blank as completely as practicable, and to return the same in the addressed franked envelope, herewith inclosed.

Should the results of the contemplated investigation be deemed of sufficient value, they will be published for public distribution.

WILLIS L. MOORE,
Chief of Bureau, and Acting Secretary of Agriculture.

The information obtained seemed to be of such importance that he gave specific instructions to the writer to make compilation and study of the same, with the result as herein stated.

In this paper and the accompanying statistical tables the term sunstroke is used to include a variety of morbid conditions, in accordance with the general practice of physicians, as defined by the following quotation from the article on "Sunstroke," contributed by Sir Joseph Fayrer, to the work entitled A System of Medicine, edited by T. C. Allbutt:

> Under the designation sunstroke, heat stroke, insolation, etc., a variety of morbid conditions, from the simplest to the gravest, are included. However these conditions may be modified by personal susceptibility, local surroundings, and climatic influences, they are essentially due to heat and are the result of direct exposure to the rays of the sun or to a high atmospheric temperature in the shade.

To those unacquainted with medical affairs it may be stated that the general inclination among pathologists is to consider excessive atmospheric heat, natural or artificial, as the chief extrinsic factor in the causation of sunstroke, using the term as above defined. As to the relative importance of the other atmospheric conditions, they are regarded as auxiliaries that may be more efficient at one time than at another, depending upon the physical state of the individual. The particular degree of heat that can be endured without injury or that may be required to produce sunstroke has not been definitely established. Both will depend upon contingencies, which will be mentioned further on.

It is generally accepted that the injurious action of heat is primarily exerted upon the nervous system to disarrange, in one way or another, the complex and nice adjustments existing between the physiologic processes concerned in the production of heat and the loss of heat. The manifestations of the morbid effects of heat, as seen in sunstroke, may be broadly divided into two categories. In one there is a fall of the temperature of the body below its normal; the skin is pale and cool and covered, more or less, with a clammy perspiration. This is the general class—heat exhaustion or prostration. The other class is characterized by a rise in the temperature of the body above the normal to a state of fever; the skin is usually red, hot, and dry. This is the general condition to which some writers would alone restrict the term sunstroke; it is probably best described as thermic or heat fever. Between these two categories there is no hard and fast line of demarcation, and cases may be seen which present some of the characteristics of each class, or which primarily falling in one category subsequently pass over to the other.

In connection with the following statistics of sunstroke cases and mortality, it should be stated that every effort has been made to avoid duplication of facts, and it is believed that whatever errors, if any, have crept in through this avenue they are too small to vitiate the general result. Perhaps the most serious source of doubt will be found subsisting in the matter of diagnosis; but possible error of diagnosis is a defect inherent to all statistics dealing with disease, and which can not be avoided in the present case any more than in the great number of other cases where statistics are invoked to throw light upon the relation of health to environment.

It must be borne in mind that the meteorologic data, though determined by instruments of precision can not be assumed to represent all the variations of the weather to which the human being may be subjected in the course of the day, even though both may be in the same neighborhood, because meteorologic instruments are exposed under fixed conditions, whereas man is continually changing his local surroundings, and with each change either of place or occupation, he alters more or less his meteorologic environment and its effects upon him. It is this difference in the circumstances of exposure that renders it impracticable to state

precisely by means of ordinary meteorologic records the atmospheric conditions actually experienced by the living being. The consideration of this, as well as other matters of a *more* purely physiologic nature, should prepare the reader not to expect to find any attempt made in this paper to give minute details as to the relation between sunstroke and weather.

From such sources as were accessible to the writer there have been collected 2,038 instances of death during August, 1896, directly attributed to sunstroke. This large number of fatal cases was collected as follows: 1,817 deaths reported by health officials of the cities named in Table 1; 207 from newspaper notices and not included in the foregoing; 14 from special reports. Large as this namber is it must fall far short of the actual number of victims.

TABLE 1.—*Showing the number of deaths from sunstroke during August, 1896, as reported by the health officials of certain cities.*

Place.	Week ended August—				Month.
	8	15	22	29	
Boston, Mass	0	64	2	2	66
New York, N. Y	11	648	66	1	726
Brooklyn, N. Y	5	215	99	0	319
Philadelphia, Pa	6	173	39	0	218
Baltimore, Md	12	78	7	1	98
Washington, D. C	7	29	0	0	36
Worcester, Mass	.....	.....	.....	.....	4
Rochester, N. Y	.....	.....	.....	.....	2
Buffalo, N. Y	1	1	.....	.....	2
Pittsburg, Pa	2	3	.....	.....	5
Cincinnati, Ohio	.....	10	3	.....	13
Columbus, Ohio	2	.....	.....	.....	2
Chicago, Ill	.....	.....	.....	.....	178
Muskegon, Mich	.....	1	.....	.....	1
Davenport, Iowa	.....	.....	2	.....	2
Keokuk, Iowa	.....	.....	1	.....	1
St. Paul, Minn	1	.....	.....	.....	1
St. Louis, Mo	.....	.....	.....	.....	132
Chattanooga, Tenn	.....	1	.....	.....	1
New Orleans, La	3	.....	6	.....	9
Phœnix, Ariz	.....	1	.....	.....	1
Total	50	1,224	225	2	1,817
Add newspapers	.....	.....	.....	.....	207
Add special reports	.....	.....	.....	.....	14
Total	.....	.....	.....	.....	2,038

The number of cases of sunstroke that did not end fatally must have been something enormous, but only a limited attempt was made to collect statistics of this class, owing to the difficulty of getting satisfactory data. From information so far received, there have been collected 841 cases of sunstroke treated either in hospitals or in private practice of physicians (see Table 2). Of these 841 cases it appears that 140, or 16.6 per cent, terminated fatally. If this mortality rate be assumed as an idex of the general mortality rate from sunstroke, obtaining, in general, during this epidemic, then the 2,038 fatalities would represent the occurrence of 12,277 cases of sunstroke of varying degrees of severity, and even this may be far below the truth.

Tables 2 and 3 show the number of hospital cases and of deaths due to sunstroke on each day. It will be seen from these tables that by far the greater part both of hospital cases and of deaths from sunstroke happened upon the 9th, 10th, 11th, 12th, and 13th of August, and in the region indicated in the first paragraph of this paper. The period from August 9 to 13 may, therefore, be regarded as having been in that region particularly favorable for the operation of the causes producing sunstroke, and it may perhaps be admissible to speak of the weather during that period as being "sunstroke weather." More than 75 per cent of the hospital cases were admitted during August 9–13, and more than 80 per cent of the sunstroke mortality that could be located by weekly periods occurred during the week August 9–15.

For convenience of reference the region already indicated of maximum number of recorded cases of sunstroke may be subdivided into a coastal region and an interior region, the area included in each will be sufficiently indicated by the stations selected to represent it, as shown in Tables 2, 3, and 4. These tables show that a few sunstrokes occurred in the interior region on August 3 and in the coastal region on August 4, but that it was not until three or four days later that the number in either region began to assume portentous proportions. The last cases may be virtually said to have occurred on August 15. The weather during the interval, August 3–15, was characterized by intense heat, which became evident in the interior region on the 4th and in the coastal region on the 5th. In both regions the temperature rose from 3° or 4° to 10° or 13° above the normal during the hottest part of the period, which was from the 8th to the 10th in the interior, and from the 9th to the 12th on the coast; it then fell during the following two days in both regions to about the normal. In both regions the absolute atmospheric humidity was considerably above the average and varied with the temperature, though less rapidly. On the other hand, the relative humidity was subject to frequent fluctuations both above and below the average. The atmospheric pressure was above the average during the entire period. There does not appear to have been anything characteristic about the winds, or the clearness of the atmosphere from what is usual during protracted spells of fair and somewhat rainless weather.

Attention has been called to the interval from August 9 to 12 as the special period of sunstroke occurrence, and as being what the writer has ventured to call "sunstroke weather." Taking this period as affording a promising field for studying the causal relations of meteorologic conditions and sunstroke it would appear that: The daily mean temperatures were highest during this period, being from 10° to 13° above the normal in both regions, or, the average temperature for each of these twenty-four hours equaled or exceeded the normal temperature of the hottest hour of an average August day. The absolute humidity was greatest in both regions during these four days, and the relative humidity was above the average in the interior, but considerably below the average in the coastal region. There does not appear to be any other noticeable or characteristic meteorologic feature during this period.

[As the tables of mean temperature and maximum temperature seem to be more important than those of humidity, wind, and rainfall, therefore, these latter are reluctantly omitted from the present publication.—ED.]

From the given tables it must be concluded:

(*a*) That the number of sunstrokes follows more closely the excess of the temperature above the normal (see Tables 5 and 6) than it does that of any other meteorologic condition:

(*b*) That the number of sunstrokes does not appear to sustain any definite relation to the relative humidity, the maximum fatalities having occurred in one region with a relative humidity above the average, and in the other region with a relative humidity decidedly below the average.

(*c*) That although the absolute humidity was greatest during the maximum of sunstrokes, yet it does not appear that the variations influenced the number of cases.

If it be taken into consideration that the maximum quantity of aqueous vapor in a given space is limited by the temperature of the vapor, and that the relative humidity is really not a simple meteorologic element, but an expression of a ratio that depends on both the aqueous vapor and the temperature, it would seem that the statistics herein collected confirm the proposition that sunstroke is ultimately due to excessive atmospheric temperature. In other words, sunstroke will not occur unless the atmospheric temperature be much greater than that to which the individual is accustomed, no matter what may be the state of the other meteorologic elements. The important point to be determined from our statis-

TABLE 2.—*The daily number of cases of sunstroke admitted to certain hospitals or in the practice of certain physicians from August 1 to 20, inclusive, 1896, together with the resulting mortality.*

Place.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total cases.	No. of deaths.	Authority (hospital or physician).
Manchester, N. H											1										1	1	Elliot Hospital.
Albany, N. Y								1		4	5	5									15	3	Albany Hospital.
Rochester, N. Y								2						1	2						5		Homeopathic Hospital.
Boston, Mass										4	8	18	2			1					33	8	Boston City Hospital.
New Haven, Conn										2	2	4	7	3	2						20	2	New Haven Hospital.
New York, N. Y				2	3	9	5	12	15	49	78	106	64	9	5						357	62	Hudson Street, Roosevelt, and New York hospitals.
Brooklyn, N. Y						2	4	8	5	11	26	32	11	2	2						103	22	St. John's, St. Mary's, and Brooklyn hospitals.
New Brunswick, N. J						1			1		3										5	2	Doctors Williamson and Smith.
Philadelphia, Pa					1	9	11	13	8	22	30	34	21	13	2						164	16	St. Agnes, Episcopal, Medico-Chirurgical, and Hahnemann hospitals.
Washington, D. C					1	1	2	3	2	5	1	3	2		1	1					22	7	United States Government Hospital for Insane, Garfield, Providence, and Freedman'shospitals.
Coastal group				2	5	22	22	39	31	97	154	202	107	28	14	2							
Pittsburg, Pa								1				1									2	2	S. S. Hospital.
Cincinnati, Ohio			3	2	2	4	2	8	4	9	7		1	2	3				1		48	5	United States Marine Hospital, St. Mary's and Cincinnati hospitals.
Columbus, Ohio									1						1						2		St. Francis' Hospital.
Cleveland, Ohio									4	4	1										9	2	St. Alexis', St. John's, and Huron Street hospitals.
Detroit, Mich										1	1										2		United States Marine Hospital.
Holland, Mich			1				1														2		Dr. Henry Kremeis.
Chicago, Ill				2	1	1	1	6	3	1	1			2							19	4	St. Luke's, Mercy, and Michael Reese hospitals.
Springfield, Ill					1						1										2		City physician, Wabash Emp. Hospital.
Louisville, Ky			2	1		3	1		2												9		City Hospital.
Cairo, Ill								1													1		Dr. W. F. Grinsted.
Hannibal, Mo				1			3					1									5	1	Drs. R. H. Godin, S. Q. Smith, P. L. Kabler.
Columbia, Mo																				1	1		Dr. W. A. Norris.
Kansas City, Mo						1			2					1							4	1	Drs. W. S. Wheeler, L. A. Berger, C. L. Hall.
Des Moines, Iowa														1							1		Dr. F. L. Wells.
St. Paul, Minn				1					1												2	1	City and County Hospital.
Interior group			6	7	4	9	8	16	17	15	11	2	1	6	5				1	1			
Raleigh, N. C											1										1		Rex Hospital.
Charleston, S. C																		1			1		City Hospital.
Mobile, Ala																				1	1		Dr. J. A. Abrahams.
Dallas, Tex				1				1												1	3		Parkland Hospital.
Palestine, Tex	1																				1	1	Dr. J. M. Colley.
Grand total	1		6	10	9	31	30	50	48	112	166	204	108	34	19	2		1	1	3	841	140	

TABLE 3.—*The daily number of deaths from sunstroke occurring in certain regions between August 1 and 20, inclusive, 1896.*

August, 1896.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Authority.
Coastal group (Massachusetts, Connecticut, Rhode Island, New York, Pennsylvania, Maryland, District of Columbia, and Virginia).					4	11	11	28	107	204	274	264	108	37	5	4		2	1	1	Newspaper clippings, health officers' reports, special reports, physicians and others. (The information from which this table is compiled is far from complete.)
Interior group (Ohio, Kentucky, Tennessee, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, and Oklahoma).		1		5	5	14	16	13	50	100	58	14	3	1		2	1			1	
Total: Coastal and Interior groups		1		5	9	25	27	41	157	304	332	278	111	38	5	6	1	2	1	2	

TABLE 5.—*The mean temperature of each day at certain selected stations during the sunstroke epidemic of August 3 to 18, inclusive, 1896.*

Place.	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Coastal region.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Albany, N. Y	72	78	82	83	82	82	82	84	83	82	77	76	75	74	69	64
Boston, Mass	71	78	72	65	77	75	82	86	82	82	76	71	67	74	72	68
New Haven, Conn	71	77	80	72	77	81	82	84	83	84	82	74	72	73	69	64
New York, N. Y	74	77	80	82	80	82	82	84	85	84	81	75	74	73	68	65
Philadelphia, Pa	77	79	82	86	84	86	87	84	87	87	85	77	79	78	74	71
Washington, D. C	78	80	83	88	87	84	87	84	84	86	82	78	77	79	73	71
Interior region.																
Chicago, Ill	77	82	84	79	77	87	83	86	81	73	72	78	76	72	68	65
St. Louis, Mo	82	86	88	90	91	91	90	84	86	82	79	81	86	77	72	72
Cincinnati, Ohio	78	78	81	85	76	84	85	84	82	78	80	78	82	76	68	70
Southern region.																
Charleston, S. C	84	80	83	82	82	85	87	86	84	82	84	82	80	84	86	80
Jacksonville, Fla	86	84	82	83	84	84	86	86	86	84	85	83	84	84	84	86
New Orleans, La	82	86	86	84	84	81	78	82	82	86	84	82	80	82	85	87
Western region.																
Denver, Colo	77	78	74	71	74	76	76	74	68	72	77	78	76	74	73	71
Los Angeles, Cal	70	70	68	66	70	68	69	68	70	69	71	72	71	74	76	74

tical tables is the atmospheric temperature that will produce sunstroke. Referring again to these tables, it will be observed that, for instance, in the city of Boston a number of people were prostrated and some killed by sunstroke when the mean temperature of the day rose to 82°, or 13° above the August normal; but there were thousands of people living there at the same time that were unhurt by this high temperature as far as can be told; it is, therefore, evident that some people can withstand a higher temperature than others; in other words there is a personal equation to be taken into consideration. Again, it will be seen that while a mean temperature of 82° was fatal or injurious to a large number of people in Boston, yet the same degree of heat is the customary August temperature which the inhabitants of New Orleans endure without sunstroke or any particular inconvenience. Evidently there must enter into the case another factor, namely, the accommodation of the individual to average physical environment, or the climatic equation, and it is apparent therefrom that

TABLE 6.—*The departure of the daily mean temperature from the normal at certain stations from August 3 to 18 inclusive, 1896.*

Place.	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Albany, N. Y	0	+6	+10	+11	+10	+10	+11	+13	+12	+11	+6	+5	+4	+3	−2	−7
Boston, Mass	+1	+8	+2	−5	+7	+5	+13	+17	+13	+13	+7	+2	−2	+5	+3	−1
New Haven, Conn	+1	+7	+10	+2	+7	+11	+13	+15	+14	+15	+13	+5	+3	+4	0	−5
New York, N. Y	+1	+4	+7	+9	+7	+9	+10	+12	+13	+12	+9	+3	+2	+1	−4	−7
Philadelphia, Pa	+3	+4	+6	+10	+10	+11	+11	+8	+12	+12	+10	+3	+5	+4	−1	−2
Washington, D. C	+3	+5	+8	+13	+12	+9	+13	+10	+10	+12	+8	+4	+3	+5	−1	−3
Chicago, Ill	+5	+10	+13	+8	+5	+15	+12	+16	+9	+1	+1	+8	+6	+2	−6	−7
St. Louis, Mo	+4	+9	+11	+12	+13	+13	+12	+5	+8	+4	+1	+3	+8	−1	−6	−6
Cincinnati, Ohio	+2	+2	+5	+9	0	+8	+10	+9	+7	+3	+5	+3	+7	+1	−7	−5
Charleston, S. C	+3	−1	+2	+1	+1	+4	+7	+6	+4	+2	+4	+2	0	+4	+6	0
Jacksonville, Fla	+4	+2	0	+1	+2	+2	+4	+4	+4	+2	+3	+1	+2	+2	+2	+4
New Orleans, La	0	+4	+4	+2	+2	−1	−4	0	0	+4	+2	0	−2	0	+3	+5
Denver, Colo	+5	+6	+3	0	+3	+5	+5	+3	−3	+1	+7	+8	+6	+4	+3	+1
Los Angeles, Cal	−2	−2	−4	−6	−3	−5	−4	−5	−3	−4	−2	−2	−3	0	+3	+1

TABLE 7.—*The departure of the daily maximum temperature from the normal August maximum at certain stations from August 3 to 18, inclusive, 1896.*

Place.	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Normal max.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Boston, Mass	+3	+12	+2	−9	+12	+2	+14	+17	+11	+11	+3	−3	−8	+5	+1	0	78
New York, N. Y	−1	+7	+9	+11	+11	+12	+10	+11	+14	+12	+8	0	−1	−3	−6	−7	80
Philadelphia, Pa	+6	+8	+12	+14	+13	+14	+14	+11	+15	+15	+12	0	+5	+6	−4	−2	82
Washington, D. C	+2	+7	+12	+14	+13	+9	+13	+9	+10	+12	+11	+1	+2	+4	−3	−4	84
Chicago, Ill	+8	+16	+17	+7	+4	+20	+15	+15	+14	−2	−3	+7	+5	−3	−8	−8	78
St. Louis, Mo	+6	+11	+12	+13	+14	+14	+13	+5	+11	+8	+3	+2	+11	−1	−9	−7	86
Cincinnati, Ohio	+2	+5	+8	+12	−2	+10	+10	+9	+9	+1	+4	+2	+6	−2	−7	−6	84
Charleston, S. C	+8	−1	+1	0	+1	+5	+8	+5	+4	+1	+3	+2	0	+2	+6	+3	87
Jacksonville, Fla	+5	+6	+2	0	+2	+2	+5	+5	+6	+3	+4	+5	+3	+2	+3	+6	90
New Orleans, La	+2	+6	+8	+4	+4	0	−1	+2	+2	+6	+5	+1	−3	+2	+5	+7	88

the temperature likely to cause sunstroke varies with the climate of the locality; hence, each particular locality has for its native or acclimated inhabitant a special local sunstroke temperature or range of temperature.

As a provisional index to the "sunstroke temperature" of each climate the author proposes the use of the average or normal maximum daily temperature during the warm season of the year, and as a working hypothesis derived therefrom, submits the following proposition: Sunstroke becomes imminent during the summer months, when the mean temperature of any one day, or of several consecutive days, becomes equal, or nearly equal, to the normal maximum temperature for the same period.

The following tabular statement shows the result of the application of this proposition to several of the large cities in the coastal region. The respective columns show:

1. The number of sunstroke cases admitted into the hospitals of the respective cities from the 3d to 18th of August, inclusive.
2. The normal maximum temperature for August.
3. The consecutive dates on which the mean daily temperature for August, 1896, equaled or exceeded the normal maximum for August.
4. The number of sunstroke cases admitted to hospitals during these consecutive dates.
5. The percentage of the cases admitted on these days relative to the total number of cases between August 3–18, inclusive.

Station.	1	2	3	4	5
		°	*Aug.*		*p. ct.*
Boston	33	78	9-12	30	91
New York	357	80	5-13	341	96
Philadelphia	164	82	5-13	149	91
Washington	22	84	6-12	17	77

In these special cases, therefore, the approach of the mean daily temperature to the normal maximum temperature was an excellent criterion of impending danger, and it remains for accumulated statistics to show how trustworthy this criterion may be in other cases. In the light of the data here presented for August, 1896, the above rule appears to be an empirical one; but it is based on plausible hypotheses, and can be readily applied; especially is it one that adapts itself easily and naturally to every climate, and therefore embodies at least a part of what we have called the climatic equation. As enunciated above, it has the merit of expressing a relation with considerable precision, that may be expressed in other words as follows: The liability to sunstroke increases in proportion as the mean temperature of the day approaches the normal maximum temperature for that day.

In addition to the influence of heat, the statistics furnished by the hospitals and physicians enable us to determine approximately the general influence of personal habits, and of nationality and other peculiarities. For instance, of the 841 cases collected in Table 4, the history of 465 as to the use of alcoholic drinks is given as follows:

Using to excess	140	cases, or	30	per cent.
Using moderately	230	"	50	"
Using not at all	95	"	20	"
Total	465	"	100	"
History unknown	376			
Total	841			

If the 140 deaths that occurred in these 841 cases be similarly classified, the resulting figures are:

Using to excess	41	deaths, or	60	per cent.
Using moderately	22	"	30	"
Using not all	7	"	10	"
Total	70	"	100	"
History unknown	70			
Total	140			

If these facts teach anything it is that the use of alcoholic beverages in hot weather is to be reprobated most strenuously.

Table 4 shows some interesting facts as to the nationalities that contributed to these 841 cases, but it would not be safe to argue much as to the relative liability of any nationality to sunstroke unless we could first compare these numbers

with the general distribution of population by nationalities. One item gathered from the reports, but not shown by this table, is that only 15 of these cases were colored people, and the mortality among them was 2. As to sex, 100 cases were females. So far as occupation was concerned all walks of life were represented, but the greater number of cases occurred among those engaged in occupations apparently requiring physical rather than intellectual effort.

TABLE 4.—*The 841 cases of sunstroke reported from hospitals or private practice, arranged according to nativity and fatality*

Nativity.	Number reported.	Deaths.	Nativity.	Number reported.	Deaths.
United States	340	37	Austria	5	2
Ireland	253	44	Denmark	2	1
Germany	123	24	Belgium	1	1
England	32	5	South America	2	0
Italy	14	0	Spain	1	0
France	10	5	Holland	1	1
Canada	8	3	Australia	1	0
Norway and Sweden	10	5	Armenia	1	0
Russia	7	0	Greece	1	0
Poland	6	0	Unknown	15	12
Scotland	5	0			
Switzerland	3	0	Total	841	140

HOW THE CHINOOK CAME IN 1896.

By A. B. COE, Voluntary Observer (dated Kipp, Mont., December 10, 1896).

Picture to yourself a wild waste of snow, wind beaten and blizzard furrowed until the vast expanse resembles a billowy white sea. The frigid air, blowing half a gale, is filled with needle-like snow and ice crystals which sting the flesh like the bites of poisonous insects, and sift through the finest crevices. The sun, low down in the southern horizon, looks like a frozen globe, with halves, crescents, and bright prismatic bars encircling it.

Great herds of range cattle, which roam at will and thrive on the nutritious grasses indigenous to the northern Slope, wander aimlessly here and there, or more frequently drift with the wind in vain attempts to find food and shelter; moaning in distress from cold and hunger, their noses hung with bloody icicles, their legs galled and bleeding from breaking the hard snow crust as they travel—they appeal to the hardest heart for pity. It is sure death for human beings to be caught out in one of these awful blizzards, with the temperature down to 30° or 50° below zero, unless rescue is speedy. Yet, such conditions frequently exist in this latitude, as they did for fifteen days in November, 1896, when it seemed as if the elements had conspired to bring about another ice age, and annihilate every living thing.

Would the "chinook" never come? The wind veered and backed, now howling as if in derision, and anon becoming calm, as if in contemplation of the desolation on the face of nature, while the poor dumb animals continued their ceaseless tramp, crying with pain and starvation. At last, on December 1, at about the hour of sunset, there was a change which experienced plainsmen interpreted as favorable to the coming of the warm southwest wind. At sunset the temperature was only —13°, the air scarcely in motion, but occasionally seemed to descend from overhead. Over the mountains in the southwest a great bank of black clouds hung, dark and awesome, whose wide expanse was unbroken by line or break; only at the upper edge, the curled and serrated cloud, blown into tatters by wind, was seen to be the advance courier of the long-prayed for "chinook." How eagerly we watched its approach! How we strained our hearing for the first welcome sigh of the gentle breath! But it was not until 11.35 p. m. that the first influence was felt. First, a puff of heat, summer-like in comparison with what had existed for two weeks, and we run to our instrument shelter to observe the temperature. Up goes the mercury, 34° in seven minutes. Now the wind has come with a 25-mile velocity. Now the cattle stop traveling, and with muzzles turned toward the wind, low with satisfaction. Weary with two weeks standing on their feet they lie down in the snow, for they know that their salvation has come; that now their bodies will not freeze to the ground.

The wind increases in strength and warmth; it blows now in one steady roar; the temperature has risen to 38°, the great expanse of snow 30 inches deep on a level is becoming damp and honeycombed by the hot wind, and we retire satisfied that the "chinook" is a genuine and lasting one.

Twelve hours afterward there are bare brown, hills everywhere; the plains are covered with floods of water. In a few days the wind will evaporate the moisture, and the roads will be dry and hard. Were it not for the "chinook" winds the northern Slope country would not be habitable, nor could domestic animals survive the winters.

A METHOD OF FILLING A BAROMETER.

By Prof. EDWARD A. PARTRIDGE, Central Manual Training School, Philadelphia (dated November 12, 1896).

The tube selected for the barometer must be cleaned with the utmost care. This can be effected conveniently before sealing, as follows: After soaking for two hours in nitric acid, the tube is washed thoroughly with water. Then a wire drawing a string after it is passed into the tube. In the middle portion of the string there is a loop carrying a wad of cotton of suitable size. By drawing the string back and forth the cotton is made to wipe off all dirt. The tube is then washed with water, treated for a few minutes with a strong solution of caustic alkali, followed by thorough washing with pure water. A wad of cotton filled with precipitated chalk is next drawn through the tube. The precipitated chalk is preferable to rotten stone, tripoli, emery flour, or similar materials, since it can be entirely removed by subsequent treatment with nitric acid and water. This polishing of the tube is important, as it tends to give a clean surface, which allows the column of mercury to move with freedom in the tube. After the last treatment with nitric acid and subsequent careful washing with distilled water, the tube is set on end to drain, then carefully dried by drawing air (previously passed through sulphuric acid), through it, and at the same time heating it. After sealing the end the tube is arranged as shown in Fig. 1.

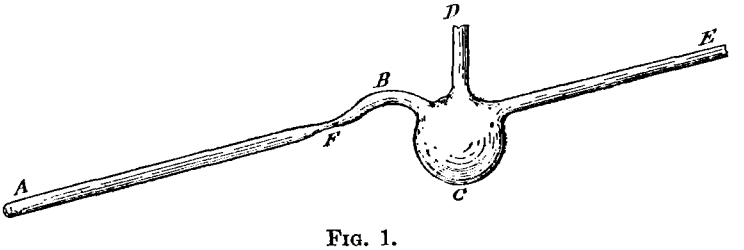

FIG. 1.

A B is the barometer tube, inclined at an angle of about 15°. The inclination should not be made more than 15°, since if it is the mercury acquires considerable velocity in sliding down the tube and will fall into the mercury already there with a splash, thus entangling a very minute portion of air. With the inclination of 15° there is no such splashing. *C* is a light glass retort which can be made by any one moderately skillful at glass blowing. *D* is a tube for introducing the proper amount of mercury to fill *A B*. *E* is a tube hermetically sealed to a mercury air pump, preferably of the Geissler type. *E* should be at least 10 inches long and inclined downward toward the retort in order that the mercury vapor may condense in it and run back to *C* instead of going to the pump. After introducing the mercury the tube *D* is heated with the blowpipe and drawn off and sealed. Between