

between the radiated and normal fingers, the former being much more insensitive. This relative insensitiveness to the faradic current might suggest injury to the nerve rather than to the terminal sensory end organs. It may, however, be due in some cases to increased resistance of the skin because of thickening of the horny layer.

With the idea of determining whether demonstrable histologic changes occurred in the chronically affected and relatively insensitive finger tips, Oct. 7, 1914, under aseptic precautions, without anesthesia, fragments of skin, including a portion of the corium, were excised with scissors from the tip of the right forefinger and little finger of Case 1; in the first instance there was very slight bleeding and little pain, while in the latter there was rather marked bleeding, soaking through a dressing, and considerable pain. The fragments were potted in Zenker's fluid. Both finger tips healed readily in a few days. Paraffin sections stained in eosin and methylene blue showed numerous nerves and terminal special sense organs. No marked difference was evident between the fragment from the

glass, but only after a period of days or even weeks, it will be difficult to train a worker to avoid contact with the active apparatus.

In the work of making routine applications of radium there should be a rotation in the staff, and persons affected should be freed at least temporarily from such work.

In order to avoid possible general disturbance, the body should be protected as far as possible by metal screens in form of boxes or plates about the radium; there should be frequent ventilation of work rooms, particularly if there is radium emanation present, and a change of duty, shorter hours and periodic physical examination of those working with radioactive substances with special reference to the blood examination is indicated.

SUMMARY AND CONCLUSIONS

From the foregoing it is evident that marked changes may occur on the fingers of those engaged in routine work with radioactive substances. These local objective changes consist chiefly of flattening of the characteristic ridges, thickening and scaling of the superficial layers of the skin and even atrophy and intractable ulceration. These lesions are usually slight compared with the marked subjective symptoms, such as paresthesia, anesthesia of varying degree, tenderness, throbbing and even pain. The persistence of such effects is noteworthy.

Various general systemic symptoms and also blood changes may be produced by exposure to radioactive substances. To avoid such local and general disturbance, special protective and preventive measures have been devised, and those engaged in routine handling of radioactive substances are particularly cautioned.

THE PHYSICIAN AND THE WEATHER BUREAU*

FORD A. CARPENTER, LL.D.

LOS ANGELES

INTRODUCTION

Hippocrates, the Father of Medicine, about 600 years before Christ, wrote a strangely interesting and powerful book on "Airs, Waters and Places." "Such a title immediately suggests climatology," says Dr. De Lancey Rochester¹ in a paper read before this association three years ago, entitled "Climatology as Practiced by Hippocrates," and he believes that this was one of the genuine works of Hippocrates the Great.

Hippocrates, in his introduction to this work, says:

Whoever wishes to investigate medicine properly should proceed thus: In the first place consider the seasons of the year, and what effects each of them produces (for they are not all alike, but differ much from themselves in regard to their changes). Then the winds, the hot and the cold, especially such as are common to both countries, and then such as are peculiar to each locality. We must also consider the qualities of the waters, for as they differ from one another in taste and weight, so also do they differ much in their qualities. In the same manner when one comes into a city to which he is a stranger, he ought to consider its situation, how it lies as to the winds and rising of the sun; for its influence is not the same whether it lies to the north or to the south, to the rising or to the setting sun.

* Read before the Thirty-Second Annual Meeting of the American Climatological and Clinical Association, San Francisco, June 18, 1915.
1. Rochester, De Lancey: Tr. Am. Climatol. Assn., 1912, xxviii.



Fig. 8 (Case 6).—Superficial ulceration on thigh; a reaction from the accidental application of radium, due to keeping radium tube (32 millicuries) in trouser's pocket for an hour.

control fingers by this technic, and specimens were not available for Weigert and Marchi methods.

AVOIDANCE OF INJURY

Various methods have been devised, particularly by Dr. W. T. Bovie, for avoiding these injurious local effects by the least possible contact of the fingers with the radium. Forceps or special vises are used for holding tubes and screwing in or out the tips and eyes; special applicators in the form of metal boxes have been constructed so that the active tubes may be added after the filtration and protection have been arranged, and the surface applicator is then slipped by forceps into a special rubber envelope and fastened with adhesive. This is particularly to avoid wrapping them up by hand in sheet rubber. Lead gloves, fingers, etc., are clumsy and are not readily worn.

In placing active tubes in special applicators, it will probably not be possible to avoid all contact with the radium, and as the effects are not apparent at once, in handling very hot objects such as heated

HOW THE PHYSICIAN MAY UTILIZE THE
WEATHER BUREAU

Dr. Charles F. Marvin, the chief of the United States Weather Bureau said in a recent address, "The Functions of the Weather Bureau of the United States Department of Agriculture are so many, so widespread is its scope that it may be said to encompass practically all fields of life and work." From the very extended nature of the work of the bureau it seems opportune that the medical profession be shown some of the ways in which this service may aid them. The object of this paper, then, is to suggest means by which the medical profession may utilize the vast storehouse of climatic data accessible at Washington and at all weather bureau stations; to prove the readiness of the personnel of the bureau to assist the physician; to present some applications of these data from a layman's point of view and to offer an account of some intensive climatic studies which have been prosecuted by the writer during the past few years.

Every one is familiar with the ordinary health resort advertising literature, a perusal of which gives one the impression that ideal weather conditions only prevail in that locality. Now physicians want facts as to this. They prefer to make their own deductions. They do not want idealizations. The weather bureau presents these facts. The question is, How may these facts be obtained?

THE SOURCE OF METEOROLOGIC DATA
IN THE UNITED STATES

The source of weather data is from the regular stations of the bureau, and from the special or cooperative stations. There are about two hundred of the regular stations, and over four thousand of the special stations scattered over the United States. The geographic distribution of these regular and cooperative stations may be noted from Table 1 and Figure 1.

Each of the regular stations of the bureau represents from 1 to 15,000 square miles of territory. There is no limit to the special stations except the securing of congressional appropriation for purchase of instruments, and the securing of a satisfactory observer who will proffer his services in a locality where observa-

tions are desired. These special stations, however, must be 20 miles apart. In number of stations, of all kinds, California takes the lead, having a total of 511 meteorologic stations of all classes.

Located at each of the weather bureau stations are one or more trained observers; such stations are equipped with barometers, thermometers, wind-vanes, rain and snow gages and anemometers, and nearly all have sunshine recorders, barographs, thermographs and other apparatus which make a continuous automatic record of the local weather conditions.

HOW THE WEATHER MAP MAY BE UTILIZED

The prime object of the regular stations is to make simultaneous meteorologic observations from which the twice-daily weather map is prepared and weather forecasts are deduced. The duties of the noncommissioned and unpaid observers comprise daily temperature and precipitation observations, so that from both classes

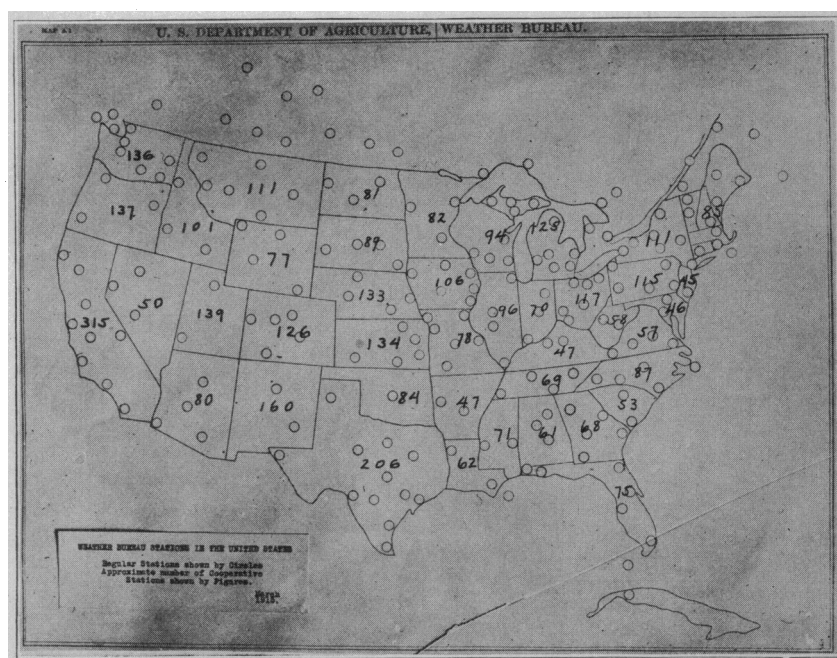


Fig. 1.—Weather bureau stations in the United States. The geographic position of the regular stations is shown by circles; the approximate number of cooperative stations is designated by figures.

TABLE 1.—APPROXIMATE NUMBER OF COOPERATIVE STATIONS OF THE UNITED STATES WEATHER BUREAU LOCATED IN THE VARIOUS PARTS OF THE UNION

Alabama.....	61	Md. and Del.	46	Ohio.....	117
Arizona.....	80	Michigan.....	125	Oklahoma.....	84
Arkansas.....	47	Mississippi.....	71	Oregon.....	137
California.....	315	Minnesota.....	82	Pennsylvania.....	115
Colorado.....	126	Missouri.....	78	South Carolina.....	58
Florida.....	75	Montana.....	111	South Dakota.....	89
Georgia.....	68	Nebraska.....	133	Tennessee.....	69
Idaho.....	101	Nevada.....	50	Texas.....	206
Illinois.....	96	New England.....	85	Utah.....	139
Indiana.....	70	New Jersey.....	45	Virginia.....	57
Iowa.....	106	New Mexico.....	160	Washington.....	136
Kansas.....	134	New York.....	111	West Virginia.....	58
Kentucky.....	47	North Carolina.....	87	Wisconsin.....	94
Louisiana.....	62	North Dakota.....	81	Wyoming.....	77

The cooperative stations enumerated in this list are taken from Climatologic Data from the United States by Sections, II, No. 3, March, 1915. As all such stations report precipitation, and some statisticians report this element only, the totals were prepared by considering the precipitation stations. Total number in the United States, 4,083.

of observations it may be possible to construct a satisfactory climatology. So we may say it takes a lot of weather to make a climate.

The regular stations of the bureau, in addition to being clearing-houses for meteorologic information, prepare, twice a day, complete weather observations which are telegraphed to Washington and to certain district centers preparing weather maps. Over a hundred of such stations publish these daily maps. The weather map may be most useful to the physician who keeps track of the storm movements and gathers first-hand information as to existing and coming weather conditions over the United States. He will soon learn to associate stormy, cloudy and comparatively warm weather with those atmospheric whirls called "lows," and fair, sparkling, comparatively cool weather with the whirls called "highs."

As to the further application of this weather map: One of the large California citrus fruit growers times the shipment of his orange and lemon cars so that they will have the advantage of the cool and dry weather

of the weather-map "highs" in their eastern journey. There is no reason why a physician should not do likewise and take advantage of the weather map and route his patients according to the great atmospheric movements and thus avoid deleterious weather conditions. It ought to be a common occurrence for the physician to consult the weather bureau as to the railroad altitudes and average weather conditions along their lines

TABLE 2.—SPECIMEN OF THE MONTHLY METEOROLOGIC SUMMARY ISSUED AT ALL STATIONS OF THE UNITED STATES WEATHER BUREAU, AND AVAILABLE FOR THE USE OF THE PUBLIC.*

U. S. Department of Agriculture Weather Bureau. C. F. Marvin, Chief. Monthly Meteorological Summary, Los Angeles, for May, 1915.

Date	Temp.			Precipitation (inches)	Character of Day	P. et. pos. sunshine	This month since 1877			Summary
	Highest	Lowest	Mean				Year	Mean Temp.	Total Precipitation	
1	55	41	48	.08	Cloudy...	31	1877	63	0.66	Barometer. Mean, 29.91 inches; highest, 30.14 inches, 9th; lowest, 29.66 inches, 28th.
2	55	44	50	.54	Cloudy...	13	1879	62	0.24	
3	65	48	56	.00	Pt. Cldy.	67	1880	65	0.04	
4	61	51	56	.29	Cloudy...	8	1881	64	0.01	
5	61	48	54	.00	Pt. Cldy.	37	1882	64	0.63	Temperature. Highest 95, on 27th; lowest 41, on the 1st; greatest daily range 31, on 27th; least, 10, on the 4th; normal for this month, 62.5; absolute highest this month for 38 years, 103, (25th, 1896); lowest, 40, (16th, 1883); average daily deficiency of this month as compared with normal, 0.1; accumulated excess since January 1, 184.
6	63	52	58	.00	Cloudy...	13	1883	64	2.02	
7	65	54	60	.00	Pt. Cldy.	54	1884	64	0.35	
8	69	53	61	T.	Pt. Cldy.	57	1885	66	0.06	
9	68	54	61	.00	Pt. Cldy.	62	1886	65	0.00	Precipitation. Total for this month, 0.88; snowfall, 0; greatest precipitation, 24 hrs., 0.57, 1st-2d; normal for this month 0.48; total for September 1, 1914 to date, 17.04; normal from Sept. 1 to date, 15.57; excess from Sept. 1, 1914 to date, 1.47; average seasonal (37 years) 15.55.
10	70	55	62	.00	Pt. Cldy.	59	1887	65	0.20	
11	74	55	64	.00	Clear....	72	1888	63	0.02	
12	74	55	64	.00	Clear....	80	1889	63	0.62	
13	67	55	61	.00	Pt. Cldy.	59	1890	63	0.03	Wind Prevailing direction, SW; total movement, 4,732 miles; average hourly velocity, 6.3 miles; maximum velocity 1914 60 0.43 (for 5 mins.), 28 miles per hour, from NW. on 19th.
14	69	53	61	.00	Clear....	100	1891	62	0.31	
15	82	57	70	.00	Clear....	100	1892	62	2.06	
16	78	57	68	.00	Pt. Cldy.	81	1893	63	0.06	
17	64	54	59	.02	Cloudy...	33	1894	60	0.20	Air Pressure Does Not Directly Affect Health.— From the multitude of problems recently presented, the one considering the relationship between air pressure and health appears now to be the most popular. There is considerable misconception regarding this subject occasioned primarily by confusing effect with cause. The mere change in atmospheric pressure from day to
18	70	51	60	.00	Clear....	79	1895	64	0.19	
19	70	51	60	.00	Clear....	99	1896	63	0.30	
20	69	51	60	.00	Clear....	76	1897	63	0.10	
21	70	51	60	.00	Pt. Cldy.	79	1898	60	1.75	Local Forecast. * Physicians may be placed on the mailing list on application to the official in charge of the station from which climatic data are desired.
22	69	52	60	.00	Pt. Cldy.	69	1899	60	0.04	
23	71	51	61	.00	Pt. Cldy.	36	1900	64	1.81	
24	68	54	61	.00	Pt. Cldy.	61	1901	60	1.50	
25	68	54	61	.00	Pt. Cldy.	68	1902	61	0.03	Note.—"T" indicates trace of precipitation.
26	77	54	66	.00	Clear....	87	1903	61	T	
27	95	64	80	.00	Clear....	100	1904	62	T	
28	85	59	72	.00	Pt. Cldy.	91	1905	61	0.95	
29	69	59	64	.00	Cloudy...	9	1906	60	1.02	FORD A. CARPENTER. Form 1030.—Met'l * Physicians may be placed on the mailing list on application to the official in charge of the station from which climatic data are desired.
30	71	58	64	.00	Pt. Cldy.	65	1907	61	0.07	
31	72	55	64	.00	Pt. Cldy.	60	1908	60	0.25	
							1909	60	0.00	
							1910	63	0.00	THE SCOPE AND AVAILABILITY OF CLIMATOLOGIC DATA
							1911	61	0.02	
							1912	63	0.12	
							1913	61	0.05	
							1914	60	0.43	As to the climatologic work of the bureau we have from the central office of the weather bureau ² the following data:
							1915	62	0.88	
										Although the 200 regular observing stations, each representing about 15,000 square miles of territory, furnish sufficient
										2. The Weather Bureau, 1915, Washington, Govt. Printing Office.
										Downloaded From: http://jama.jamanetwork.com/ by a New York University User on 06/05/2015

Note.—"T" indicates trace of precipitation.

A. W. P. FORD A. CARPENTER.

Form 1030.—Met'l Local Forecaster.
* Physicians may be placed on the mailing list on application to the official in charge of the station from which climatic data are desired.

so that advantage could be taken of railroad routes having low altitudes, warm winter and cool summer weather.

THE SCOPE AND AVAILABILITY OF CLIMATOLOGIC DATA

As to the climatologic work of the bureau we have from the central office of the weather bureau² the following data:

Although the 200 regular observing stations, each representing about 15,000 square miles of territory, furnish sufficient

cient data on which to base the various forecasts, observations at many intermediate points are necessary before the climatology of the United States can be properly studied. This need has given rise to the establishment of an important and interesting feature of the Weather Bureau in its Climatological Service, which is divided into 44 local sections, each section, as a rule, covering a single state, and having for its center a regular observing station. These centers each month collect temperature and precipitation observations from more than 4,500 cooperative and other stations, and publish each a monthly and an annual summary, giving a large amount of climatological data for each month and the year.

It is thus seen that the cooperative observers through long periods of temperature and precipitation observations have enabled the bureau to perfect extensive records. In addition to publishing monthly climatologic data in the *Monthly Weather Review* (the first volume was issued with the first of the year 1873) special contributions in climatology and meteorology are published along with the usual profiles, charts and tables. Bulletins prepared by the scientific staff are also issued by the bureau; no less than seventy have been published. One of these bulletins is the incomparable "Climatology of the United States."³ The eminently practical arrangement and the thoroughness of this volume makes it one to be earnestly recommended to the physician interested in climatic study. A copy of this book will be found in the station library of any weather bureau office. While the local libraries are as complete as circumstances may permit, and form a veritable mine of climatic data, these half a thousand volumes are insignificant when compared with the central office library in Washington with its 32,000 titles in meteorology. This is the largest meteorologic library in existence. It is available to students of meteorology generally, who either consult it personally or through correspondence. This correspondence feature makes it possible to readily consult rare and ordinarily unavailable books.

Local offices of the weather bureau have complete records covering continuous registration of the meteorologic elements. An abstract of these records is issued at all stations of the service on the first day of the month following. One of these summaries is given in Table 2.

In addition to placing the available meteorologic records at the disposal of the applicant, the weather bureau officials throughout the country will be found prompt and courteous in their treatment of applicants for data in person or by correspondence. In many instances they will render unexpectedly valuable aid to the physician in giving him clear and concise data perhaps not comprehended in their official routine, yet none the less accurate and satisfactory. From their technical training they are keen observers and their judgment on climatic matters is free from local prejudice.

SOME POPULAR MISCONCEPTIONS RELATING TO CLIMATE AND HEALTH

Air Pressure Does Not Directly Affect Health.—From the multitude of problems recently presented, the one considering the relationship between air pressure and health appears now to be the most popular. There is considerable misconception regarding this subject occasioned primarily by confusing effect with cause. The mere change in atmospheric pressure from day to

3. Henry: Bull. Q. Climatology of the United States, Washington, 1906.

day has nothing whatever to do with one's physical well-being. The recent publicity given to this subject during the last few months is simply a revival of a myth laid a generation ago by Thomas.⁴ For example, in a recent public bulletin it is stated that when the

If there was anything in this theory we would have an "elevator disease" among the elevator conductors who continually experience excessively rapid fluctuations in bodily pressure.

It is rather the fair weather and decreased humidity which accompany rising barometric pressure that elevate one's spirits, or the cloudy threatening weather and increased humidity which accompany a falling barometer that affect the human system. Dr. C. C. Browning⁶ noted this when his studies showed that the tuberculous patients became pessimistic and some very unreasonable in their demands during days with little or no sunshine and hopeful of recovery during bright days and moderately low humidity.

Sunshine and Ventilation of More Importance Than Relative Humidity.

—I believe that the location of the home or office, the exposure of the living or workroom has much more to do with the health of the occupant than whether or not the relative humidity is much below or above normal. Exposure to sunshine and ample ventilation are all important.

barometer drops from 30 to 29 inches from one day to the next the human body is relieved of half a ton of atmospheric pressure, with resulting depression of spirits, etc. In the first place it is quite unusual for the barometer to drop 1 inch in so short a time, and in the second place experiments have proved that the influence on the body of variations in pressure are greatly overestimated.

Hann,⁵ in his handbook on climatology translated by Prof. Robert De C. Ward, quotes Thomas and says that in experiments with pneumatic chambers, pressure changes amounting to 300 mm. (over 11 inches in barometric values) a day have been produced without causing any injurious effects on the sick persons concerned in these experiments. Although these experiments were made nearly half a century ago, the pressure myth has persisted, and even this year has found its way into sober-minded periodicals. If a local example is needed to demonstrate further the untenability of the pressure theory, we have only to recall that in Los Angeles, for example, the range of the barometer from day to day averages a tenth of an inch of the mercurial column, equaling the variation experienced when riding in an elevator from the ground floor to the top of office buildings.

A friend complained of ill health and blamed the humidity of his office room. He said that it was too damp and asked me to investigate. I took my psychrometer and made a series of observations, find-

4. Thomas, quoted by Hann: Beitr. z. Allg. Klimatol., Erlangen, 1872.

5. Hann, M. Y.: Beitr. z. Allg. Klimatol., Erlangen, 1872.

6. Browning, C. C.: Tr. Am. Climatol. Assn., 1913, xxix.

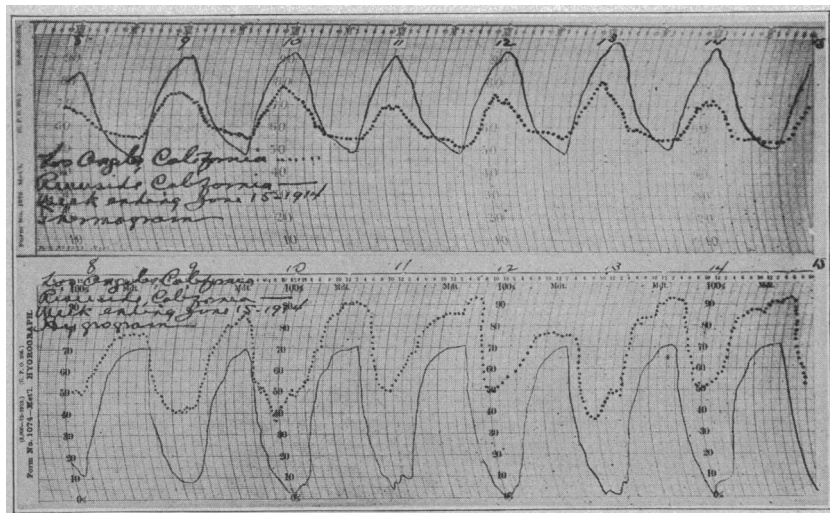


Fig. 2.—Weekly thermograph and hygrograph tracings. Variations in temperature and relative humidity between Los Angeles (10 miles from the sea) and Riverside (65 miles from the sea) for the week ending June 15, 1914.

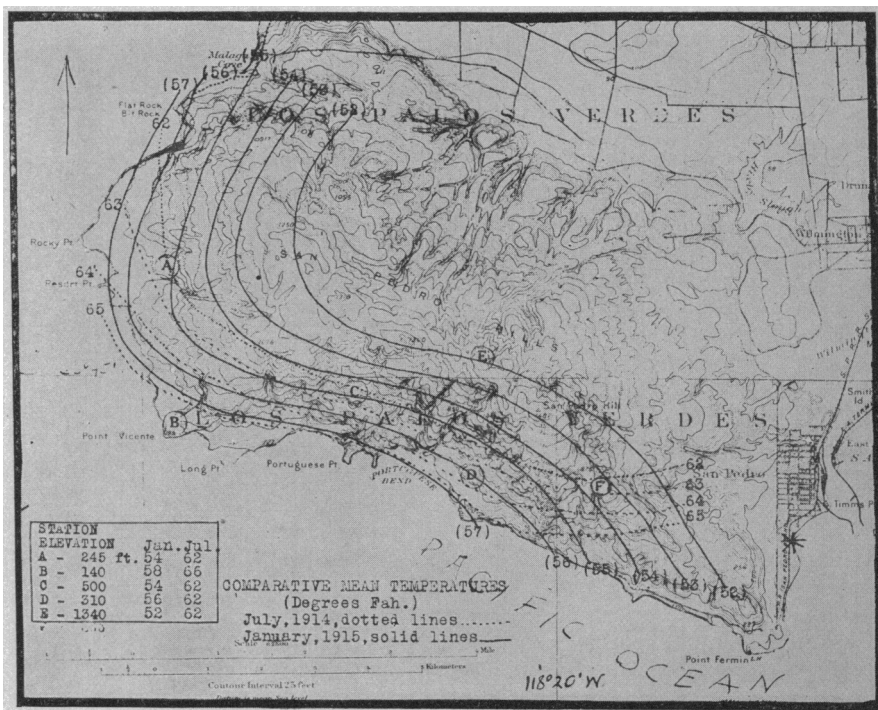


Fig. 3.—Mean temperatures for January and July at Los Palos Verdes, near Los Angeles.

ing that there was actually less humidity in his private office than out in the street. I studied the situation and eliminated temperature, humidity, air pressure, etc. Then I turned to air movement, and found the ventilation very bad. I suggested a simple air chang-

ing system and my friend regained his health in a few weeks, and was still enjoying his private office when I last heard from him.

Living Quarters and Air Drainage.—Facing houses with relation to natural air drainage is also a most important point in selecting a home. Many a home, otherwise healthful and satisfactory in every other respect, has been abandoned because the architect and owner did not consider the principles laid down by Hippocrates two thousand years ago.

Dr. Estes Nichols at last year's meeting of this association said in his paper on "Housing and Its Relation to Climate": "Can any climate rise above its housing conditions? I offer no theories concerning the building of houses, as theories are apt to be overthrown by each succeeding year. I only offer the one fact that has been well established, and that is the vital necessity of plenty of room, as well as plenty of light and air, even to the remotest part of our dwellings."

some of these studies have been taken up in southern California during the past year by the local office of the weather bureau at Los Angeles. Indirectly the mass of data is of much value to the medical profession.

Southern California is about equal in area to Indiana, and within the boundaries of this region may be found all kinds of varieties of healthful weather. This is owing to the mountains, the sea and the desert, as well as the latitude. Scattered over this one portion of California are a dozen stations equipped with thermographs and hygrographs, rain gages, etc. An examination of the curves of temperature and relative humidity as automatically traced is a most interesting study. Two sets of these curves are illustrated in Figure 2. They show simultaneous tracings of temperature and relative humidity during a week in June. One of these stations, Los Angeles, is within 10 miles of the sea and shows lower range in temperature and higher relative humidity, and the other, Riverside, which is 55 miles further east toward the desert, illustrates most clearly the influence of the desert in its range in temperature and low humidity, and above all its remarkably regular oscillations. Such a graphic representation of the diversity of climate within so short a distance would be well-nigh impossible save in southern California.

Intensive Meteorology to the Aid of Colonization and Health.—For the first time in history climatic surveys are being made to determine land values. This is a practical, business-like, commercial application of meteorology to colonization and intensive farming. This climatic survey was begun in June, 1914, on the old Spanish grant of 16,000 acres, the Palos Verdes, which is just south of Los Angeles and between San Pedro (Los Angeles harbor) on the east and Redondo beach on the west. Six complete sets of meteorologic instruments comprising standard

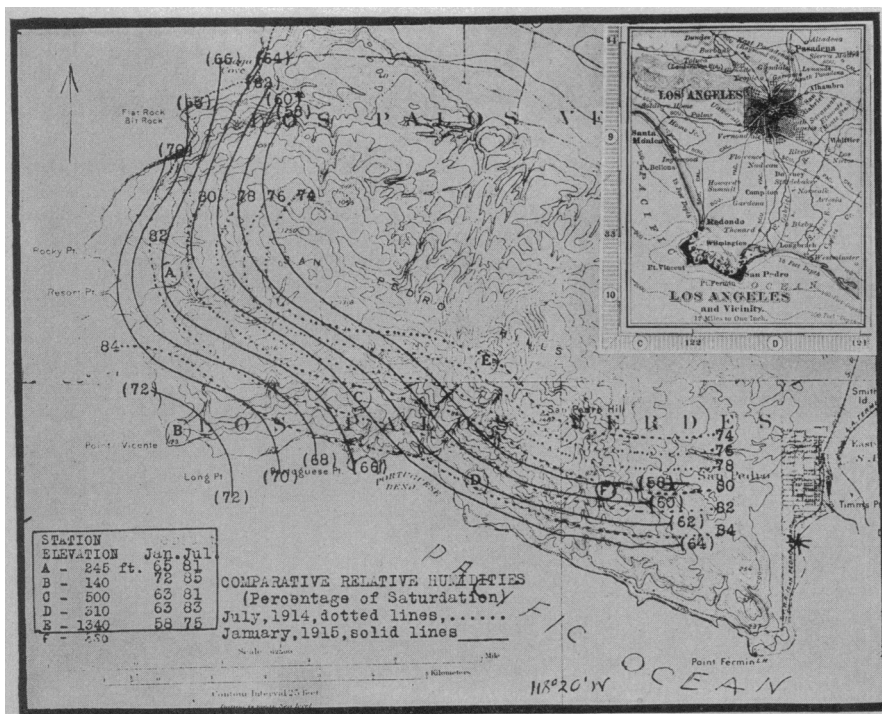


Fig. 4.—Mean relative humidities for January and July, at Los Palos Verdes, near Los Angeles.

PROBLEMS FOR THE CLIMATOLOGIST

Investigation by the Physician.—There are other opportunities for the study of health and its relation to climate, as further transactions of this association show. In the light of augmented data, a few of them might be, for example, the proper selection of sanatorium sites, sensible temperature (wet-bulb thermometer readings) and infant mortality; acute infectious diseases and sunlight (using the sunshine charts of the weather bureau), etc. These are within the scope of the medical profession; the weather bureau, however keenly interested, can assist only with its climatic data.

Intensive Studies by the Climatologist.—There is one phase of the relationship of the physician to the weather bureau in which the balance of proof falls on the weather service, and that is in the matter of intensive climatic investigation. Primarily, owing to the extensive citrus fruit culture in which the United States Department of Agriculture is deeply interested,

thermographs, hygrographs, rain gages, anemometers, and a photographic sunshine recorder were erected at various elevations from 100 to 1,300 feet above the sea, and from the seashore to several miles inland. The readings of these instruments have been plotted and comparative charts of temperature and humidity for January and July are shown in Figures 3 and 4. With such intensive study it is believed possible to chart the climate for every 10-acre plot. The climatic charts will show without error not only proper location of dwellings with relation to air drainage, temperature, humidity, etc., but will give positive information as to soil drainage, and all of this in addition to the all-important agricultural and horticultural feature.

WHAT THE WEATHER BUREAU SHOULD DO FROM A PHYSICIAN'S POINT OF VIEW

In closing this paper I feel that a physician friend who has long practiced medicine in one of the towns in California has clearly stated some of the ways the

7. Nichols, Estes: Tr. Am. Climatol. Assn., xxx, 17.

physician may properly claim the assistance of the weather bureau. This eminent physician says:

I believe the field has been but little explored. We physicians are guilty of many things; among them is guessing. If the U. S. Weather Bureau will prove some of this guessing true or false it will add one more good thing to its past fine record. I think that the time is near at hand when our health officers will be required to be specialists. They will then have the time, the special training and other equipment to go into the subject in conjunction with your bureau and give us some scientific findings. I think the state should be plotted showing the real atmospheric conditions of all localities and showing the influence on the functions of the body. Whether the old east wind of Boston is accountable for all of the vile things charged to it or not nobody really knows, but it should be investigated. That altitude, temperature, humidity, prevailing and unusual winds have much effect on many individuals there is no doubt. The nasal and pulmonary mucous membranes are constantly affected by atmospheric conditions. Locally I have observed that semichronic bronchial coughs that do not yield readily in the city will often clear up in a few hours in the mountains and foothills east of the city. A congested nasal mucous membrane that will kick up a rum-pus much of the time in the mountains will disappear promptly at a lower elevation near the coast. Some patients with bronchial asthma that is incurable in the business section of the city will be very comfortable a short distance out of town and in a higher, drier location. Two hot dry days last month have been charged up with some rather serious pulmonary conditions in aged people. These are a few instances of hundreds coming to my mind that I have observed in my years of practice. The subject should be worked out by a union of effort of the Weather Bureau and the medical profession.

U. S. Weather Bureau.

TARDY OR LATE PARALYSIS OF THE ULNAR NERVE

A FORM OF CHRONIC PROGRESSIVE NEURITIS DEVELOPING
MANY YEARS AFTER FRACTURE DIS-
LOCATION OF THE ELBOW JOINT

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The type of neuritis which is the subject of this paper is peculiar, in that it develops many years after fractures and dislocations about the elbow joint. For this reason it has been termed "tardy" or "late" paralysis. Usually, the injury to the joint has been received in childhood, the first symptoms of ulnar neuritis making their appearance in adult life. Thus, an interval which may vary from six to thirty-five years elapses between the initial injury and the first symptoms of ulnar neuritis, which are then gradually progressive.

This remarkably long latent period excludes the group of cases, not uncommon, in which secondary paralysis follows redundant callus formation, vicious union, or other mechanical complications of fracture which jeopardize the integrity of neighboring nerve structures.

The curious, and at the same time characteristic, feature of the late paralysis is its appearance so long after reception of the original injury that a direct connection between the two conditions might be open to question, and a natural skepticism as to the etologic relationship may lead to diagnostic doubts and

errors. This is especially true on account of the gradual and progressive atrophy of the small muscles of the hand which is the essential symptom, the sensory disturbance being very slight, or in the earlier stages even absent. Under these circumstances, the possibility of progressive muscular atrophy may be seriously considered, and in one case of my series this diagnosis was made by several neurologists of wide experience and training.

It is of historical interest to note that Duchenne, the great authority on muscular atrophy and of the hand muscles in particular, confessed that he had once diagnosed spinal amyotrophy in such a case, an error which he subsequently recognized and corrected. This little incident of the past, confided to Panas,¹ who first described the condition, will serve to emphasize the special importance of this group of cases from the diagnostic standpoint.

The later literature of the subject will receive consideration in the discussion of the symptomatology.

REPORT OF CASES

CASE 1.—Fracture of the elbow joint at the age of 5 followed by cubitus valgus and deformity in region of the internal condyle. Thirty-six years later without apparent exciting cause, slow development of ulnar neuritis, with atrophy, pain, paresthesias and disturbance of epicritic sensibility limited to the distribution of the ulnar nerve.

History.—The patient is a man aged 45, married, and a stock broker by occupation. His wife has had three healthy children; no miscarriages. He is moderate in the use of alcohol and denies syphilis. At the age of 5, he incurred a fracture of the right elbow joint which was treated by the best methods in vogue at that time. The joint never regained complete freedom of movement, flexion remaining somewhat restricted, and the internal line of the arm presenting an angular deformity (cubitus valgus). He played baseball, however, and indulged in most of the athletic exercises of youth. Occasionally, after a strain, he would feel some stiffness and pain in the affected joint, and in later years, these symptoms have been especially conspicuous after cranking an automobile.

Onset.—In the summer of 1912, thirty-six years after the original injury to the elbow joint, he first noticed a slight weakness of the right hand. At that time there was no pain, numbness or tingling of the fingers. The weakness progressed very gradually, and in August, 1913, he experienced an aching pain in the three ulnar fingers of the right hand with numbness. The aching pain was especially localized in the palm of the hand on the ulnar side. The weakness was accompanied by a progressive atrophy of the small muscles of the hand, especially apparent in the first interosseous space. There was often pain and cramping of the muscles of the hand while writing.

Examination.—A strong, robust man of good muscular development. Gait and station are normal. The pupils are equal and react to light and accommodation. There are no tremors, and the tendon reflexes of the upper and lower extremities are equal on the two sides and are of normal intensity. The skin reflexes, abdominal, cremasteric and plantar, are also normal; no Babinski.

The general motor power is normal, save for the right hand, which is weak and atrophic. On holding out the hand there develops the posture typical of ulnar palsy with atrophy of the interossei and hypothenar. The thenar eminence is of normal volume. No fibrillary twitches are apparent at any time. There is complete paralysis of the muscles of the hypothenar, and marked paresis of the interossei. The adductor pollicis is paralyzed, as is also the palmaris brevis muscle. There is, however, good ulnar flexion of the wrist.

The general sensory examination is normal, except for alterations of the epicritic sensibility in the right ulnar dis-

1. Panas: Sur une cause peu connue de paralysie du nerf cubital, Arch. gén. de méd., 1878, ii, 12.