Mr. J. Warren Smith, Section Director, Columbus, Ohio, reports that on November 8, 1905, he delivered a half hour illustrated lecture at the Pan Handle Machine Shops in Columbus during the noon hour. The lecture was given at the request of the local branch of the Pennsylvania Railway Young Men's Christian Association.

The Chief of Bureau has received from Mr. L. M. Tarr, Local Forecaster, New Haven, Conn., a letter written by President Arthur T. Hadley, of Yale University, in which President Hadley expresses high appreciation of the work that Mr. Tarr is doing for the students of meteorology in Yale.

Mr. U. G. Purssell, Local Forecaster, Erie, Pa., gave an address before the Erie High School on December 19, 1905, on the organization, work, and practical benefits of the Weather Bureau. The audience was composed of the principal, teachers, and nearly seven hundred students.

At Albany, N. Y., a class of eight young ladies from St. Agnes's Academy visited the Weather Bureau office and Mr. George Todd, Local Forecaster, explained to them the instrumental equipment, charts, and map making.

During November and December, 1905, Mr. J. L. Bartlett, Observer, Madison, Wis., delivered six lectures on meteorological subjects, illustrated with the stereopticon, before various classes and organizations of the University of Wisconsin.

Mr. T. S. Outram, Section Director, Minneapolis, Minn., addressed the class in physical geography of the Minnesota State University, December 9, 1905, on the law of storms and methods of practical forecasting.

SPECIAL METEOROLOGICAL STATIONS FOR SPECIAL STUDIES.

A correspondent who is now studying botany at the Desert Botanical Laboratory of the Carnegie Institute, at Tucson, Ariz., writes as follows from his temporary location at Witch Creek, San Diego County, Cal., 116° 40′ west and 33° 5′ north, on the southwest slope of the San Jacinto Mountains, and about 50 miles northeast of San Diego:

I wonder if the Weather Bureau would not establish a few stations in this mountain country for observation of temperature, humidity, etc.; in short, make arrangements whereby the botanist, when he attempts to tell about the relations between plant societies and climatic conditions, may know what the conditions are. It would at the same time be a great boon to the health seeker. Two years ago I called on the official in charge of the San Diego station for the purpose of finding out something about humidity in the back country here. I was suffering greatly from rheumatism and needed the information, but there was absolutely none to be had. Following such advice as I could get, I came up here and found a good climate—no thanks to the Weather Bureau!

My notion is that if a good volunteer observer at each of a half dozen stations kept these records they would in a few years prove invaluable.

As soon as you get back a few miles from the sea, conditions begin to change, and by the time you reach Witch Creek, 50 miles from San Diego, you are in a climate not so dry as the desert, but intermediate between that and the climate of the coast. Suppose you had, right along this stage line, so that they could easily be supervised, observers at Ramona, 1000 feet; Witch Creek, 2400 feet; Julian, 4000 feet; and Banner, just over the ridge down in the desert; and one or two others, say at Mesa Grande (a fine fruit region), who would conscientiously keep these records—I believe that they would pay a large return.

I asked our postmaster here this morning if he had a rain gage. He answered with some pride that he had and that he always kept a record of the rainfall. The gage is a kerosene oil can. He said he would be glad to keep records as a volunteer observer if instruments and blanks for reports were furnished him. I have no doubt he would take much interest in the matter and, according to his lights, do it with scrupulous care. A gentleman at Mesa Grande, some miles from here, wants to keep such records, and went so far as to make application to the San Diego station a while ago for an outfit and instructions. The matter seems not to have gone any further. In a region like this, where the climate changes every few miles, there is great need of definite records. Such a chain of stations at these different altitudes and distances from the sea, beginning with San Diego and ending at Banner, would give data that it seems to me are absolutely necessary if we attempt to account for plant distribution and habits. They will not tell all, for the historical factor is to be reckoned with, but every substantial fact well established does throw a ray of light into the darkness.

I shall be here a month or two before going back to Tucson, and if the idea seems feasible I should be very glad indeed to help our postmaster here to get started with an actual rain gage and such other apparatus as it may seem best to provide him with; and I think I could help some others in the same way if it were decided to establish any more voluntary stations. I have had no special opportunities for doing this work myself, but I know what the botanists want. At present I am keeping records of relative humidity with Lambrecht's polymeter, but I presume some other form of psychrometer would be less liable to get out of order in the hands of an inexperienced observer.

A request like the above, from one entirely devoted to a special research, appeals very strongly to the Chief of Bureau and to all who wish to see every form of meteorological research properly supported. This is, however, only one of perhaps hundreds of similar requests received every year, and as Congress has made no special provision for anything more than the necessary increase of Weather Bureau forecast work and expenses, they must all be most regretfully denied.

The weather has an intimate relation to everything that goes on at the earth's surface; seismology, geology, botany, agriculture, milling, navigation, hygienics, commerce, astronomy represent only a small portion of the wide range of subjects that are forced upon the attention of the Weather Bureau. A few years ago it was said that the $10,000,000 given by Carnegie for scientific research would suffice, but the first year's experience showed that it could all be used up on any one of several branches of research. Similarly with the Weather Bureau—its resources are now wholly occupied in taking care of weather and river forecasts and crop reports. There are other great fields of human industry calling for assistance, but for the present it will be impracticable for the Chief to incur the expense of special stations that may be needed by special investigators. It was with great regret that he was obliged to abandon the expensive mountain stations on Mount Washington and Pikes Peak, which had contributed so much to the knowledge of the upper air. As our first duty is the study of the atmosphere, with a view to forecasting the weather, it is probable that the prosecution of mountain and balloon work is a more imperative duty than the study of dry desert regions. If the latter could contribute to our knowledge of the mechanics of the atmosphere to any such degree as do the highest mountains, then they might have a similar demand upon our attention. For the present, however, it would seem that the botanist and the sanitarian must look elsewhere for funds to maintain a few observers in the localities that specially interest them. The primary and fundamental duty of the Weather Bureau is the development of our knowledge of atmospheric motions and disturbances—not the average climate, but the daily weather.

With regard to the apparatus, the important instrument is that combination of wet-bulb and dry-bulb thermometers known as the psychrometer, and especially for real accuracy the whirled psychrometer in an instrument shelter as used by the Weather Bureau, or the sling psychrometer, or Doctor Craig's combination of shelter and sling, which is portable and less expensive. The Germans use the ventilated psychrometer invented by Assmann and manufactured by Fuess in Berlin. This instrument is highly convenient and very accurate. But the simplest instrument means an expense of probably at least $6 for the two thermometers, since they must be of the best

possible grade and their errors properly stated on an accompanying correction card, such as is furnished by the United States Bureau of Standards at Washington, at a very small expense. A complete Weather Bureau station is rarely needed for such special studies.

CYCLONES AND ANTICYCLONES.

The following article on cyclones and anticyclones was written in response to a request from a correspondent, apparently a small schoolboy, for some information about cyclones and anticyclones. As other young readers of the MONTHLY WEATHER REVIEW may also wish information on the subject, the reply is here published.

The atmosphere is an envelope or layer of gas that we call air covering the whole earth just as the peel covers an orange. It is unlike the orange peel in that it is free to move, like water. The air is, in fact, a sort of ocean that flows above us.

The air, like other gases, is compressible, and the lower layers of the atmosphere, which have to bear the weight of the upper layers, are much denser than the upper layers because the weight of these upper layers is pressing down upon the layers underneath, just as the hay at the bottom of a stack or the layers of wool at the bottom of a pile of fleece are more closely packed.

You can readily understand that a crab in the ocean or a crawfish in a pond must feel the differences in pressure as the waves of water go over him, especially in the shallow water on the seashore, where waves five or six feet high frequently pass over places that had only a few inches of water a moment before. The changes in the pressure of the air are not so sudden nor so extreme. The average pressure is about fifteen pounds to the square inch, and in extreme cases a change of only a pound or a pound and a half takes place in the course of a day.

The pressure of the air is measured with an instrument called the barometer (from two Greek words, *baros*, weight, and *metron*, measure), whence barometric pressure is spoken of, meaning pressure measured with the barometer, and as the barometer is only used to measure atmospheric pressure, barometric pressure is simply pressure of the air.

The barometer most commonly used is called the mercurial barometer and consists of a piece of glass tube about a yard long, closed at one end by melting the glass together. This tube is held open end up, and filled with mercury, and a small bowl is also filled with mercury. The tube is tightly covered with the finger, turned end for end, and the open end is put under the mercury in the bowl and the finger taken away. The mercury in the tube runs out into the bowl until about 30 inches of mercury remain in the tube, leaving at the top an empty space. The pressures of the mercury in the tube and the air outside balance each other, in just the same way as the columns of water in the two arms of a U-shaped tube balance each other. When the pressure of the air becomes less, the pressure on the surface of the mercury in the bowl becomes less, and some of the mercury runs out of the tube into the bowl. In this case the barometer is said to fall, meaning that the top of its column of mercury is lower. When the air pressure becomes greater, the pressure on the surface of the mercury in the bowl becomes greater, and the mercury runs back up into the tube. Then the barometer is said to rise, meaning that the top of the column is higher. These changes are measured by placing a piece of metal marked like a ruler or yardstick beside the tube of the barometer. This is called the scale of the barometer, and because the scale is divided into inches the pressure is spoken of as being so many inches of the barometer: the inches are subdivided into tenths and hundredths. On the weather map lines are drawn through all the places where the barometric reading is the same. There are other kinds of barometers besides the mercurial barometer. A kind very frequently seen is the aneroid barometer (aneroid from *a*, without, and *neros*, wet, without fluid), which consists of a small metal box with a spring inside. When the pressure becomes greater the sides of the box are pressed together, and when the pressure becomes less the sides are pushed outward by the spring. The sides are connected by a thread to a hand that moves around a dial like the face of a clock. Barometers can be made with water instead of mercury, but then the tube has to be about 30 feet high. A difference of an inch in the height of the mercury in the barometer corresponds to a difference of about a half a pound of pressure to each square inch.

You may have noticed little whirlpools in the water of a brook or river, where the bank juts out or where the current flows around a log or stone. Perhaps you have also noticed places where the water seemed to be boiling up from below, and wondered if there might be a whirlpool upside down that was causing the water to come up from the bottom. Whirlpools like these frequently occur in the atmosphere, for it is not still like the water in a pond, but is moving in great currents or streams like water in a canal or river. One such stream flows high above the ground over the Northern Hemisphere in the Temperate Zone and another over the Temperate Zone of the Southern Hemisphere. Both of these flow from west to east. The air over the tropical regions of the earth between these two streams of air is almost calm, except down at the surface of the ocean where the trade winds blow, in the Northern Hemisphere from the northeast toward the equator, and in the Southern Hemisphere from the southeast toward the equator.

You can see that the United States is under a stream of air flowing from the west by watching the high, thin clouds called cirrus or "mare's tails," which generally come from a westerly direction, either northwest, west, or southwest.

Whirls are formed in these aerial streams just as whirlpools and uprushes are formed in the rivers and brooks, but as the rivers of air are much larger than the rivers of water so the whirlpools of air are much larger than the whirlpools of water. The little whirlpools in the brook or river are generally only a few inches in diameter and last but a few minutes, while they are carried along a few feet or yards. The whirls that are formed in the air are of all sizes, the largest ones are sometimes so large that they cover several States and sometimes a third or half of the whole United States; they last for several days and even for a week or more and travel great distances, some having been known to travel almost around the earth.

These big whirls in the air are of two kinds; in one the air at the surface of the earth flows inward toward the center of the whirl, rises, and when it gets high above the ground flows outward from the center. This kind of whirl is called cyclone (from the Greek word *kuklos*, which means whirling around). The other kind of atmospheric whirl is more like the whirlpool in the river for in it the air comes down from above with a spiral movement and spreads out over the land. This is the anticyclone, so called because it is opposite to the cyclone in many ways (*anti* is a Greek prefix, meaning opposed to, or contrary to), as stated in the opposite paragraphs in the following comparison of the state of things near the surface of the earth:

In the cyclone—	*In the anticyclone—*
The wind blows spirally inward toward the center.	The wind blows spirally outward from the center.
The air pressure is lowest at the center, for which reason cyclones are also called "lows".	The air pressure is highest at the center, and anticyclones are called "highs".
The air in cyclones is warm, especially at the front.	The air in anticyclones is cold, especially at the front.
The weather in cyclones is cloudy and rainy.	The weather in anticyclones is clear and dry.