highest expression, namely, the Hopewell, lies well toward the east in this area.[3]

Without binding oneself to the thesis of Huntington,[4] that climates virtually control civilization patterns, it may be well to note that middle western climate has been until recently much less humid as judged by vegetation than it is to-day. This fact has been developed quite independently of parallel evidence in Europe. It was first established on good floristic grounds by Gleason, whose most recent paper[5] gives an excellent summary. Meanwhile Auer,[6] in Canada, and the present writer and his students, working in Iowa and the Erie Basin,[7] have secured good confirmatory evidence from a microscopic study of recent peats. Additional confirmation is afforded by a recalculation of the results reported by Lewis and Cocke[8] for the Dismal Swamp of Virginia.

Making due allowance for all the difficulties and sources of error involved in reconstructing past climates, it may be safely stated that until a few hundred years ago the characteristic vegetation of the corn belt lay considerably to the eastward, and has since shifted west. Many other details of postglacial climate are still highly debatable, but this at least appears well enough established to merit attention from all who are concerned in interpreting biological phenomena in the United States. The westward swing of such conditions in recent centuries was accompanied by an advance of the humid deciduous forest from south and east. Did this favor cultures which lived largely by war and chase as against those more dependent on tilling the soil (without the aid of steel tools and draft animals)? Did this change become effective before or with the great interior displacement of American tribes caused by white pressure and bartered firearms from New England and Dutch New York?

Any causal explanation which the writer might advance would be mere conjecture. But the fact remains that the cultural climax of the northern maize civilization occurred toward the east of the present corn belt, and at a time when corn-belt conditions were in all likelihood east of their present location.

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[3] *Ibid.*, p. 187.

[4] E. Huntington, "Civilization and Climate," 2nd Ed. 1922.

[5] H. A. Gleason, "The Vegetational History of the Middle West," *Ann. Assoc. Am. Geog.*, XII, 39–85, 1922.

[6] V. Auer, "Peat Bogs in Southeastern Canada," *Mem.* 162, Geol. Surv., Can., 1930.

[7] Inv. Manuscript read before Syst. Sec. Bot. Soc. Am., December, 1930.

[8] Lewis and Cocke, "Pollen Analysis of Dismal Swamp Peat," *Jour. Elisha Mitchell Soc.*, 45: 37–58, 1929.

TYNDALL BEAM INTENSITY OF TURBID COLORED SOLUTIONS

MOST of the work on the Tyndall beam intensity of turbid solutions has been carried out with dispersions in colorless media, or in such a way that the absorption due to the dispersion medium could be neglected. P. V. Wells has shown (*Chemical Reviews*, 3: 331) that under these conditions the Tyndall beam intensity is a power function of the depth or the concentration as a first approximation. The writers have used the Pulfrich photometer, manufactured by Zeiss, to investigate the turbidity in a colored raw sugar, in solutions of varying depth and concentration. Under these circumstances a correction must be applied for the absorption due to the coloring matter. It was found experimentally that Wells' equation holds if there be substituted for the Tyndall beam intensity itself, the ratio between it and the percentage transmittancy of the same solution, measured in the same absorption cell and at the same wave-length. For equal concentration at varying depth, or for equal depth at varying concentration, the exponent in the formula is independent of wave-length. The detailed results of this investigation, which is being continued, will be published elsewhere.

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THE CURVATURE OF SPACE

IN an address made at the dinner in honor of Professor Einstein at the California Institute of Technology, Professor Frederick H. Seares made some very interesting remarks about the curvature of space. After explaining how Einstein has shown us that we may with advantage change some of the rules of world building, he makes the rather astounding assertion "that curved space means only a new set of rules which require that measurements be made along curved lines." The layman will no doubt exclaim, "Well, I thought they were offering me a camel to swallow, but it turns out to be only a gnat." For, of course, we can make measurements in space in any way we like. From time immemorial astronomers have measured the course of a planet or comet traveling along its orbit, be it an ellipse, parabola or hyperbola. It hardly required the insight of an Einstein to discover that fact.

To make matters still clearer Professor Seares brings up the time-honored illustration of measuring distances along the earth's surface. Of course we would naturally measure the distance from Pasadena to New York on a great circle, or more likely by the actual route traveled by our railroad train—a decidedly crooked path. But suppose we wished to use this distance as a base line to find how far away the

moon is, we should then have to measure the chord connecting the two places—a straight line.

The gist of Professor Seares's remarks then seems to be that by discarding the straight line and making our measurements in space along curved lines we can "win the game with a score we could not otherwise attain." Curved lines, however, imply the existence of straight lines, and some of us still believe the game can be won by straight measurements and straight thinking.

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CONICAL SNOWFLAKES

WITHIN the writer's observation, at least, a very unusual snowfall occurred in Ann Arbor on Sunday afternoon, April 26, 1931; during the afternoon three main falls occurred, each lasting for only a short while, and each yielding but little actual precipitation.

The crystal formation was that of a solid cone with a round base. The side of the cone made an angle of about 30 degrees with the axis. The round base was part of a spherical surface. The shape was exactly like that of a conical section of a sphere.

As nearly as the eye could see into the formation of a snowdrop, the whole structure seemed to be made up of conical needles, packed together, with the upper ends forming the pointed tip of the cone, and the larger lower ends forming the rounded base.

The density was very high; a handful of snow, slightly compressed, immediately formed soft ice. The ratio of snow volume to volume when compressed to ice without air included would hardly have been higher than four to one.

Hundreds if not thousands of individual snowdrops came under observation on a window sill; irrespective of size, from tiniest to largest, the crystals were of the same form. In spite of landing on the stone sill at high speed in the high wind, nearly all crystals were tough enough to retain their shape; such few observed crystals as were shapeless were almost certainly shapeless only due to damage from impact.

The shape of the snowdrops was the same in all three falls, although the three falls occurred from a half hour to an hour apart. Many large crystals fell; one of the largest, by actual measurement, was three eighths of an inch across the base.

The day was very gusty, with rapid changes in wind velocity. Wind velocity at times during the snowfall became very high. There were rapid alternations between brilliant sunshine and considerable cloudiness. The temperature was mild. Most of the snow would melt in a few minutes, although an inch or two that became piled on the running board of a car was there the next morning, partly melted, but with somewhat globular outlines still visible.

Observation of the shape of crystals was checked by Professor William Stout.

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THE LABRADOR CURRENT AND ICEBERGS

I NOTICE on page 12 of the May 15th number of *Science Supplement* an article on "The Labrador Current and Icebergs."

In explaining this phenomenon it might be well to consult the Weather Bureau records at Key West and Havana with respect to the direction and velocity of the wind this winter as compared with normal winters.

It is my observation in the months of November, January and February that the usual northeast winds, referred to there as the "trade winds," were absent a great deal of the time and were replaced by northwest winds of very considerable velocity.

A northeast wind blowing counter current to the flow of the Gulf Stream at the south end of Florida would tend to slow down the Gulf Stream. If this atmospheric resistance to flow was eliminated one would expect the Gulf Stream to speed up and carry more heat to the north.

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THE IMMEDIATE PROBLEM FOR BIOLOGICAL ABSTRACTS

A VICIOUS circle exists in the affairs of *Biological Abstracts*. This publication finds difficulty in obtaining a maximum number of subscribers because it is incomplete and indices have been delayed; it can not become complete and indices be published without the financial support available directly and indirectly from a maximum number of subscribers.

Under the general conditions existing in the biological sciences, we can hope to pay by subscriptions only for printing and similar costs. Editorial costs must be met by some form of subsidy. These editorial costs are more than twice those for printing. Subscribers pay less than one dollar for each two dollars paid from other sources. The income from subscriptions is an important item in itself, but it is doubly important because it is the concrete evidence of the extent to which individual biologists are contributing their share to the undertaking. Nothing is so vital to the obtaining of permanent endowment for the editorial work of the *Abstracts* as a substantial increase in the subscription lists within the next twelve months. There are now three thousand subscribers. There should be five thousand.

Subscriptions are also important at the present time because printing costs must be paid by subscrip-