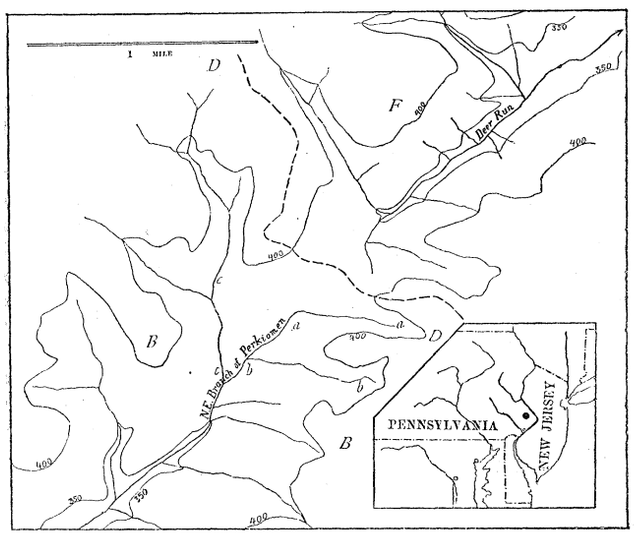
that the writer is of the belief that all efforts directed toward the accomplishment of the destruction or dissipation of the tornado-cloud by any known and practicable means, will fail of realization.

Mechanical appliances are wholly incapable of successfully coping with the forces of the tornado, which, unlike the whirlwind and waterspout, arises from the unstable state of the atmosphere in the cloud region, where the tornadic gyrations commence, and are afterwards propagated downward to the earth's surface. The tornado is controlled by the operation of forces far above the ground.

A RIVER-PIRATE.

THERE is a little river-pirate in eastern Pennsylvania unsuspected by its rural neighbors. It is in a quiet, well-watered farming district, where the streams, as a rule, are bent only on minding their own business, and not interfering with their fellows; and yet one of them is a confirmed pirate, and goes on unhindered in its robbery.

The pirate is Deer Run, and its victim is the north-east branch of Perkiomen Creek. The head waters of the latter have been captured, and led away from the basin where they were born and passed their youth, and thus diverted to swell the surreptitious vol-



ume of the intruder. The affair has happened in this way. The country hereabout was in ancient times a surface of faint relief, at a lower stand than now, traversed by idle streams; but, in consequence of elevation to a greater altitude, the streams have revived their lost activities, and set to work to sink their channels and open out their valleys in the process of reducing the land to its proper level again, even with the sea; for land finds its level, like water, but more time is required before the level is assumed. The streams that drained the country when it was elevated adopted such faint inequalities as they then found for their first settlement, and have since been engaged in perfecting their courses as best they could, cleaning them out, deepening them, and adapting them most exactly to the best transportation of land-waste. In the processes of adjustment thus called forth, every stream struggling for its own existence, it sometimes has happened that a stream with steep head waters has seized drainage area from the flat-lying head waters of an adjacent basin; because, other things being equal, the waste of the surface is fastest on the steepest slopes, and hence the steeper streams have gnawed more quickly into the land-mass than the flatter ones, and the divide between a pair of contesting streams has consequently been pushed in the direction of the fainter descent.

The abstract possibility of this process cannot be questioned; but one might well hesitate before accusing so innocent-looking a stream as Deer Run of such underhand designs. Yet the evidence of its piracy is too direct to be doubted.

In the first place, the region that the two streams drain has been accurately surveyed by the Philadelphia Water Department, and the maps thus secured have been published by the Geological Survey of Pennsylvania. The facts of the case are thus brought clearly before the world, after long remaining in unsurveyed obscurity. It is from one sheet of these maps that the accompanying figure has been traced, omitting the wooded areas and dwellings. The smaller map in the corner indicates the location of the district under discussion in the south-eastern corner of Pennsylvania, north of Philadelphia and west of Trenton. In the next place, it is to be noted that the slope of Deer Run from the divide *DD* is twice as steep to the north-east as is that of its victim to the south-west. Deer Run descends sixty feet in a mile at its head: the Perkiomen branch descends only thirty feet in the same distance. Again: it appears that the two streams, flowing on the same line but in opposite directions, both follow the same bed of shaly sandstone in the rock formation (triassic) that underlies the district: there is, therefore, no inequality of structure on the two sides of the divide to determine a difference in the rate of head-water weathering. In so short a distance as a mile or two, it cannot be thought that there is any difference in rainfall or other climatic element of significance; and, if exposure to sunshine be a factor of value in aiding the denudation of a surface by strengthening the diurnal variations of temperature in the soil and increasing the number of winter thaws, this advantage would be with the Perkiomen. Leaving this aside, it appears, that, except for difference of slope, the streams are in similar conditions, and any inequality in their action must be referred to the control that the slopes exert. As the control exerted by the slopes is distinctly in favor of Deer Run, we must conclude, that, if a patient observer should take his stand on the higher ground near by, he would certainly see the divide *DD*, migrating, rather slowly to be sure, to the south-west. After a time the uppermost side-stream of the Perkiomen branch, *aa*, would be tapped by the insidious operations of the pirate; and, powerless to withstand the temptations of a more facile descent, it would turn from its parent to join the volume of its captor. In time another side-stream, *bb*, would be led astray; and thus Deer Run would extend its territory at the expense of its more inert neighbor, and the divide would in time be shifted to *BB*.

Now, it is noticeable that all tributaries thus acquired by the pirate would enter the head of its main channel in a back-handed manner, like the barbs at the point of an arrow, indicating by this abnormal arrangement their early training in accordance with the habits of the Perkiomen family, where they were brought up. But if this process is going on now, we must be persuaded that it has been in operation in earlier times also, and that results of the kind now predicted for the coming ages should already be visible as the product of those gone by. Such is undoubtedly the case. Deer Run bears at its head at least three small side-streams, which still manifest in their directions the clearest indications of Perkiomen habit; and thus it must stand convicted not only of piratical intentions for the future, but of piratical practice in the past.

If the reader should, perchance, be seriously inclined to geographic study, he may find many accounts of this kind of interaction among rivers in the writings of recent authors. Gilbert has considered examples of the process in our Western Territories; Löwl and Philippson have pointed out a number of instances among the rivers of Europe; and Heim has shown how the picturesque little lakes at the head of the Engadine result from the capture of head-water streams by the steep-sloping Maira from the more steady-going Inn. As our intimate acquaintance with the geographic development of our country is furthered by the publication of good topographic maps, we shall undoubtedly find many cases of head-water adjustments. The Atlantic-Mississippi divide, from Pennsylvania to Alabama, should be especially rich in them.

Yet, if what is one man's food is another man's poison, it may be that what is one man's crime is another's virtue. It is only in false allegory that we can blame Deer Run for having taken what once belonged to the Perkiomen; and instead of calling the capture of head waters a piratical act, which at best is but an *ad captandum* term, it should better be regarded as a sharing of another's burden of labor, and a willing assumption by the more active stream of its fair proportion of the work to be done by the whole river system to which it belongs. Instead of gauging the disposition of streams by

likening them to human pirates, and berating Deer Run for what it has done, let us look at the affair from the point of view that a well-disposed river would take.

When this district was lifted from its former lowly estate, the streams found a new task set before them. They at once set to work at it with the best disposition in the world. But, in their immaturity, they accepted without question such guidance as the faint relief of the surface afforded, only to discover later on that the primitive division of territory was unadvisable as a permanency, because it was not adapted to the best accomplishment of the work assigned to them. It is found that a re-adjustment of boundaries, in certain cases, will allow a more economical transportation of land-waste to the sea by better-arranged channels; and, when this becomes apparent to a stream, it at once obeys its new opportunity, whatever force of habit it may theretofore have had. If the ideal of a stream's life were always to persevere in the channel that it at first selects, this readiness to change its course would be called fickleness; but when we perceive that the true ideal of a stream's life is to carry towards the sea its full share of the waste of the land that its river system drains, then we may recognize a virtuous willingness to the performance of duty in this immediate forsaking of an old course, and adoption of a new one, where its work can be done better and quicker. It is the unwisdom of youth that is thus corrected by the better choice of maturity, and many a river has thus improved its early ways. It is undoubtedly true that Deer Run has taken something of what once belonged to the Perkiomen, but it was not seriously that the name of a river-pirate was given to it. W. M. D.

A POPULAR OBSERVATORY.

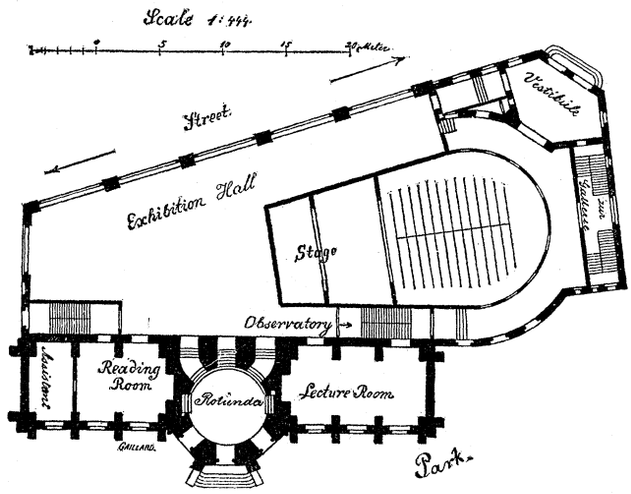
A FEW months ago a company was formed in Berlin, the aims and purposes of which are well worth being widely known. The company is named "Urania," and it was established for the purpose of diffusing the interest in the phenomena of nature. Some of the most prominent German scientists are the promoters of this enterprise, the plan of which originated with the distinguished astronomer Professor W. Foerster, who explains the objects of the company as follows: The object of the society is to promote knowledge. In order to inculcate knowledge, it is necessary to educate man to use his mental powers. Therefore institutions for the diffusion of knowledge can only be successful when they try to teach how to use one's mental powers. The society has limited its work principally to astronomical, geographical, and physical phenomena, and for reaching its object has established a great popular observatory, which will be a model for all similar institutions, and publishes a journal, *Himmel und Erde* (Berlin, H. Paetel), which is beautifully printed and illustrated, and gives, in a popular form, reports on astronomical and geographical phenomena and questions.

The popular observatory, of which we reproduce the plan, is divided into three sections, — the rotunda, which forms the foundation of the observatory proper; the large hall, in which instruments and microscopes are exhibited; and the scientific theatre. It is the plan of the founders of this institute to benefit the general public, which embraces uneducated as well as educated persons. Therefore the methods of instruction are varied according to the intelligence and education of the various classes. The scientific theatre forms the lowest stage, on which the results of exact investigations are presented in as attractive a form as possible, in order to give a stimulus to intelligent observation. Solar and lunar eclipses, comets, and meteors are shown to the spectator; the scenery representing beautiful and characteristic landscapes of the parts of the globe in which these phenomena were seen. Thus the desire is aroused to understand the origin of these phenomena, which, only a few centuries ago, were considered as forebodings of evil. These views are accompanied by lectures calling attention to the peculiarities of the phenomena observed on the scene. Among others, a series of astronomical panoramas has been prepared for the purpose of explaining the phenomena of solar eclipses.

At the commencement of the lecture the stage represents a landscape near Berlin, at the beginning of the total eclipse of Aug. 19, 1887. At that time unfavorable weather prevented the remarkable phenomena from being seen, to which attention had been called in newspapers and journals. In the theatre all phenomena of the eclipse will be shown as they would have happened in clear weather. First the landscape will be seen in the light of the early dawn; then the sun will slowly rise on the horizon in the shape of a crescent between purple clouds. The crescent grows narrower rapidly until the dark shadows of the eclipse appear. After two minutes the character of the illumination changes again, and soon the landscape is seen lighted by the clear sun.

While the lecturer explains this phenomenon, the scene changes, and the spectator is transported to a place at some distance from the earth. The huge globe rotates in front of the zodiac, whose signs form the background. The moon, moving through the sunlight, throws its shadow upon the planet, and it is seen crossing the continent of Europe. It is at once understood how the eclipse originated. We continue our journey and reach the moon. We see its desolate mountain ranges. There is deep night in the valleys, while the summits of the mountains are lighted by the rising sun. On the starry sky the earth is seen, giving some light to the parts of the moon over which the sun has not yet risen. On the earth a small dark dot is seen, the point of the shadow of the moon, and its track shows the region where the eclipse is visible. Our journey is continued toward the sun and the planets, the surfaces of which are shown according to the result of the most recent investigations.

A higher stage of instruction is given in the exhibition hall, in which instruments, apparatus, and arrangements of various kinds,



PLAN OF THE POPULAR OBSERVATORY IN BERLIN.

are exhibited, for the purpose of explaining physical phenomena. The composition of sounds, particularly those of speech, are exhibited. The wonderful phenomena of light; its enormous velocity; its composition of numerous colors, which makes nature appear so beautiful; the wonders of the spectroscope, which betrayed the chemical composition of the celestial bodies, and is at present used in many industries, for instance, in the Bessemer process, and in the examination of wines and other liquids regarding their adulteration; the phenomena of polarization and their application in the manufacture of sugar, — all these will be shown and explained to the visitor. In another section of the hall the phenomena of heat will be explained. Models of machines will be exhibited here in great numbers. In still another part of the hall electricity and magnetism, and their extensive applications in manufactures and as a means of rapid communication between distant places, will be shown. Furthermore, fifty microscopes will be placed in this hall, in which the use of this powerful help to scientific investigation will be explained.

Instruments of precision will be exhibited in the same hall. From the latter a staircase leads to the observatory, passing the lecture-room. Here astronomical and microscopical objects will be shown by means of the lantern, and a lecturer will call attention to the characteristic features of each object before it is seen through the telescopes and microscopes.