

associates thunder-storms with sudden and considerable alterations of temperature in contiguous masses of air.

"This reverberation of the thunder is worthy of a little consideration. It is to me intelligible enough when it is remembered that the source of sound lay between the balloon and the earth, in which case it only resembled the artificial thunder which I have often evoked by explosions of gun-cotton. In our own experience just cited, however, the lightning flashes which appeared to course between cloud and cloud rather than between cloud and earth were like typical mountain-storms, followed only by a single short report, and in this resembled phenomena twice observed by Mr. Wise in America. This observant aeronaut on two separate occasions speaks of thunder as 'rattling like small-arms without any of the rolling reverberations that are heard below.' But another significant observation was made by Mr. Wise in both his experiences just referred to. 'The thunder pack itself developed uprising cloud columns whose motion resembled that of ebullition in a vast cauldron from whence electric flashes were discharged.' With almost the same language he describes the effect presented to him on each occasion when he approached from aloft the neighborhood of a thunder-storm; and Mr. Green, in his Newbury ascent already alluded to, uses words that are hardly dissimilar.

"Neither of the above bygone aeronauts describe to my knowledge any occasion when they have actually found themselves in the heart of a thunder-storm, and, in our own case, had there been but fair warning, I think there would have been but little difficulty in avoiding the storm by simply rising above it; but, as I have already sufficiently explained, we were practically without warning from the peculiar manner in which from our restricted point of view the thunder-cloud seemed to develop about us out of thin air."

MAN'S INFLUENCE ON THE WEATHER.

HOW far can the action of man affect the weather? This question has been studied by Dr. Wilhelm Trabert, who has reported his conclusions to the Société Météorologique, Paris. His answer is that such influence is slight and largely involuntary, tho there are cases where voluntary influence may be exerted. Dr. Trabert's article is thus summarized in *Cosmos* (Paris, February 23):

"Involuntary influence exists without doubt; it is exercised, for instance, by deforestation and by the resulting alteration of conditions of soil, which modifies the flowing of streams and increases inundations; and also by the development of industrial activity, as Russel has shown in the case of London fogs, which augment considerably with increased consumption of coal.

"The considerable increase of the number of thunder-storms, which has doubled since 1870, leads us to believe that in this case also there is an effect due, in part at least, to industrial activity; for it is difficult to attribute an increase so considerable to the sole action of sunspots.

"An attempt has been made to explain the increase in the number of storms by the abundant production of steam by industrial engines. Dr. Trabert can not accept this explanation, for he calculates that the quantity of steam thus produced in the whole of Germany would scarcely represent an evaporation of 0.0025 millimeter of water to the square kilometer [$\frac{1}{40000}$ inch to the square mile]. But it is quite different with particles of dust scattered in great abundance throughout the air by the incomplete combustion of a quantity of coal equal to 200 kilograms to the square kilometer [1,140 pounds to the square mile]. This considerable increase of atmospheric dust should exercise an action on the production of rain. When moist air passes the state of saturation, condensation takes place on particles of dust. The more there are of these, the more drops are formed; thus, for a given quantity of vapor condensed, the drops are necessarily smaller. Now the tension of saturation on a convex surface increases with the curvature of the surface, that is to say, with the smallness of the drops. An increase of the quantity of dust in the air will therefore tend to favor the supersaturation of the air, and consequently to produce thunder-storms and abundant rains.

"It is much more interesting, however, to know whether we may voluntarily act upon the weather.

"To this kind of action belong the attempts made successfully in France, on a large scale, to prevent nocturnal frosts by the production of artificial clouds. But when we come to the artificial production of rain, success is much more doubtful, as all attempts, so far, have proved. In the production of any phenomenon, it is always a question of the equivalent transformation of one kind of energy into another, and we must inquire whether the necessary amount of energy is at our disposal. Now Trabert calculates that to bring to saturation a cubic kilometer [one quarter cubic mile] of air at 40 per cent. relative humidity requires no less than 1,400 kilogrammeters of work [10,000 foot-pounds]. This scarcely allows us to think of the possibility of artificial condensation. Such a thing would appear to be possible only if the conditions necessary to condensation already existed, and if we had only to put latent forces into action.

"Finally, to this voluntary action on the weather belongs the method, used in the Austrian Alps since the time of the Emperor Joseph II., of making numerous explosions to ward off a hail-storm, a process that, as is well known, has been developed and systematized by M. Steger at Wandisch-Feistritz, in Southern Styria, with great success."—*Translation made for THE LITERARY DIGEST.*

BILE AS AN ANTITOXIN.

THE antitoxic action of the liver is generally supposed to be a modern idea, arising from the latest investigations and experiments of physiology; but a writer in the *Revue Scientifique* (Paris) asserts that the natives of Bengal have not only known of this fact for centuries, but are accustomed to apply it in the treatment of hydrophobia. A letter from a traveler in India, published in the *Gazette Hebdomadaire de Médecine*, relates the following facts:

"About three months ago, a mad dog bit six or seven persons, among whom were two of my porters. I ordered bits of iron to be heated white-hot for cauterizing the wounds; but the natives said to me with a laugh, 'Oh, Sahib, that is nothing; we have an excellent remedy for hydrophobia; you shall see.'

"The mad dog approached again; one of the natives took a club and killed the animal. Another opened its body, took therefrom the palpitating liver, cut it into small bits, and gave them to the wounded men, who ate them raw. 'There is no more danger,' they said to me.

"As I remained incredulous, they brought to me a young man who bore large scars on his legs. He had been bitten five years before by a mad dog, but had eaten a raw piece of the animal's liver and had felt no ill effects.

"These events took place in March, and it is now July 3. The wounds are cured and all the men continue to do well. Our natives even assert that their remedy will cure a man after he has been attacked by the disease."

Commenting on this, the *Revue Scientifique* says:

"It is unnecessary to go to Bengal to see this experiment. . . . M. Phisalix has shown that cholesterin has a very marked immunizing effect on viper's venom. In the interior of France, the peasants have used bile as a remedy for the viper's bite from time immemorial.

"This property of the liver seems on the point of leaving its empirical phase to enter on one of rigorous science. M. Neufeld has recently published in the *Zeitschrift für Hygiene* a series of very curious experiments, which show the destructive power of the bile over certain microbes.

"When one tenth of a cubic centimeter of rabbit's bile is mixed with one or two cubic centimeters of a culture of pneumococci in bouillon, it is found, on examination of the mixture under the microscope, that the number of pneumococci diminishes very rapidly, that their contours become less and less clear, are blurred, and finally disappear completely in the liquid. . . . This process of dissolution is ordinarily over in the space of three or four minutes, but sometimes it requires fifteen or twenty minutes.

"These bacteriolytic properties of bile exist as well in the healthy as in the sick rabbit. The rapidity with which the solu-

tion of the pneumococcus takes place varies, within certain limits, with the consistency of the bile (taking place more slowly when it is thick), and with the quantity of the culture (bile can dissolve three hundred times its volume of pneumococci).

"The bile of man, the monkey, the guinea-pig, the dog, the cat, all have this faculty of dissolving pneumococci, but the rapidity is less with these animals than with the rabbit.

"It may be asked whether the dissolution of pneumococci in the bile is accompanied by the destruction, or only by the dissolution, of their toxins. Experiments to test this have shown that a subcutaneous injection of bile in which pneumococci have been dissolved makes the guinea-pig and the rabbit immune to infection.

"Altho the bile of the rabbit has such intense bacterium-deströying properties, the serum of the same animal is completely without them. On the other hand, the bile of the rabbit or of man does not exert the least bacteriolytic action on the cholera vibrio, the bacillus of Eberth, the diphtheria bacillus, etc. But bile seems to have an influence, as Valée has already shown, on the virus of hydrophobia.

"According to the author's investigations, the active part of the bile, or that to which its bacteriolytic effect must be attributed, must be cholic acid, a non-nitrogenized substance formed by the hepatic cells."—*Translation made for THE LITERARY DIGEST.*

MENTAL FATIGUE IN SCHOOL-CHILDREN.

IT has been for a long time generally supposed that the work done by children in school during a session makes them less able to perform mental labor after that session—that, in other words, the child becomes mentally fatigued by the long hours and hard tasks of the schoolroom. To what extent this supposition is based on fact has been made the subject of a considerable body of research on the part of psychologists in recent years. The latest results, those of Dr. Thorndike (*Psychological Review*, November, 1900), are unexpected and rather startling. He finds that mental fatigue as a result of school work has no existence. To quote the author's own words in an introductory paragraph:

"The present research aims to settle the question of how much less able to work the child is, after having done the work of half or the whole of a school-day, than he was at start. The results . . . are unanimously in favor of the answer, 'He is just exactly as able.' If these results were legitimately obtained, they prove that the work in the case of the schools tested did not decrease one jot or tittle the ability of the scholars to do mental work."

The method used in obtaining the results was to give some sort of a test, usually either a multiplication or spelling test, early in the school-day, and then again a similar test to the same students late in the day. It was found that the work was just as well and as quickly done in the late as in the early test. What, then, is the reason for the fact—which every teacher knows—that children do not work so well in the afternoon, or late hours of the session? Dr. Thorndike says:

"The fact that the children can work as well does not at all mean that they do work as well, or that measures should not be taken for their relief. It does mean that the argument for shorter hours and longer pauses, so far as based on alleged incompetency to work under present systems, was a false argument and its measures for relief ill-considered. . . . The more appropriate remedy would be not to give the student less to do, but to make it worth while for him to work, to make the work interesting."

Ninety-five per cent. of the decrease in mental work during the day is due, the writer says, to a feeling of boredom on the part of the student, and good teaching is the cure for it. He adds: "The great burden of the child (and of many of us grown children) is not doing things that are hard, or that hurt, but doing things that are stupid and sickening and without worth to us."

Altitude and Nutrition.—To what are the beneficial effects of a stay among the mountains due? It is generally believed that the purity of the air is the chief factor; but some have attributed it directly to the fact of decreased atmospheric pressure. In a recent series of investigations, Mr. Jaquet, of Basle, comes to the conclusion that the latter belief is the correct one. His results, which are published in full in the *Archives des Sciences Physiques et Naturelles* (December), are thus summarized in the *Revue Scientifique*:

"M. Jaquet . . . concludes that the chief, if not the only, factor in the action of altitudes is diminution of pressure, which acts by chemical modification of the blood. . . . The temperature is without evident effect on the blood, and light plays no more active part. It is the diminution of pressure which acts, and this is proved by the fact that the same beneficial results can be obtained in the laboratory under lessened atmospheric pressure, as by living on a mountain."

But a chemical modification of the blood, of the kind observed by this experimenter, requires the addition of new material. Whence does it come? Careful experiment shows that it is due to an alteration of the nutritive processes, more nitrogen than usual being retained in the blood; but this retention of nitrogen ceases as soon as the subject returns to normal pressure. The benefits of mountain life, then, are due to better nutrition, which in its turn depends on decreased atmospheric pressure.—*Translation made for THE LITERARY DIGEST.*

Candy or Whisky?—Those who do not wish to give up their alcoholic beverages are fond of reminding us that there may be intemperance in eating as well as in drinking. Candy comes in for special condemnation. The issue thus made has been met in an investigation into the relative value of sugar and alcohol to the organism, made by M. Chauveau and reported by him to the Paris Academy of Sciences, January 21. He fed a dog for fifty-four days on meat and sugar. Altho the animal ran over a course of thirty-four miles daily, he had gained at the expiration of this period one fifteenth of his weight. When one third of the sugar ration was replaced with alcohol, the dog's condition began to grow poor. He had to be urged to run by his trainer, altho he had lost only an ounce or two in weight. The two rations (sugar and part alcohol) were then alternated, each being used for a week, and the corresponding gain and loss of energy were very evident. Alcohol, M. Chauveau concludes, is not a strength-giving ration. Those who eat a reasonable quantity of pure sugar candy daily can then afford to give odds to those who take their glass of wine with equal regularity.—*Translation made for THE LITERARY DIGEST.*

SCIENCE BREVITIES.

"THE Chinese physician," says *Modern Medicine*, "receives a salary from his patients as long as they are well, but as soon as they get ill his pay stops. Some American families, not disdaining to learn something from the other side of the world, have partially adopted the same plan; that is, they pay the salary whether they are sick or well; and it is, of course, to the interest of the doctor to keep them well as far as he can, to save himself the trouble of attending them. When the Chinese method, or the American modification of it, comes into general practise, it will be to the interest of the physician who has charge of a family to study each member of it physically, mentally, spiritually; to prescribe for them correct environment, proper diet, and healthful habits; and to labor with the view of inducing them to keep in touch with all these."

"I OFTEN think," says Tecumseh Swift in *The American Machinist*, "how we ought to pity the poor inventors of the days that are gone for the stern restrictions imposed upon them in the scope of their accomplishment. It must have been in the olden time a bitter task for the inventors, altho they may not have realized the bitterness of it, to curb their imaginations to travel within the limitations of the mechanical possibilities of the times. In the days of antiquity there must have been lots of things that they could not dare to allow themselves to invent, and antiquity is not far away. How pitiable, for instance, would have been the plight of an inventor if to him had come, say only fifty years ago, a complete conception of the modern bicycle. It would have been as impossible then to produce as perpetual motion, and the vision of it would have been a nightmare. Just think of it. No mild steel or the things that we make of it, no steel tubing or the steel rod for wheel-spokes, no chain and sprocket, no rubber tires, no balls for bearings, no tools, and no knowledge of the means of making any of these things as we now make and use them."