— Glanders is said to be quite prevalent among horses at the present time. The New York state board of health has discovered six cases at Middletown.

— The Paris *Conseil municipal* has ceded to the Society of the *Institut Pasteur* for ninety-nine years the ground upon which the institute is built. The following official statement has just been made: The whole number of persons treated by Pasteur is 1,656 (of these, 15 have died); 1,009 of these were French (3 of them died); 182, including 50 bitten by rabid wolves, were Russians (3 of these bitten by dogs, and 8 by wolves, have died); 20 were from Roumania, with one death; of the others, 59 were from England, 17 from Austria, 74 from Algeria, 18 from America, 2 from Brazil, 42 from Belgium, 58 from Spain, 7 from Greece, 8 from Holland, 25 from Hungary, 105 from Italy, 20 from Portugal, 2 from Turkey, and 2 from Switzerland (of all these, not one has as yet died: the total mortality, therefore, is less than one per cent, — a most striking commentary upon the views of those who declare Pasteur's methods a failure).

— At the last meeting of the American association, Eugene Michel Chevreul, on the motion of the section of chemistry, was elected an honorary fellow, the second only on the rolls of the association.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Dynamite explosions.

IN its issue of the first inst., referring to the recent Chicago explosion, the New York *Herald* publishes, under the heading 'Teachings of the explosion,' an article containing 'some things' claimed to be 'instructive and important,' but which are so incorrect as to be neither. In this article it says, "But we know now, happily at the cost so far of but two human lives, some things that are instructive and important. One is, that a huge mass of dynamite, say ten tons, even when blended with five times its weight of gunpowder, expends its main force downward, thus verifying, on a vast scale, a fact known of the explosion of much smaller quantities of dynamite. Another fact is, that dynamite, even in huge volumes, is less likely to ignite neighboring masses of explosives in such a casualty than an unmixed mass of gunpowder would be. There were ten large magazines close to the Laflin & Rand, and all escaped ignition."

The above statement, that 'a huge mass of dynamite,' in exploding, 'expends its main force downward,' and the deduction that this verifies, "on a vast scale, a fact known of the explosions of much smaller quantities of dynamite," are so scientifically inaccurate as to need correction. The fact is, dynamite explodes with equal force in all directions, and that, at whatever point it meets with the greatest resistance, at that point it is most destructive, whether it is upward, downward, or laterally.

It is a common error, however, that dynamite always 'expends its main force downward,' which arises, probably, from the fact that, in the majority of reported dynamite explosions, it has met with the greatest resistance from the earth, and therefore has exhibited its 'main force' in that direction.

Mr. G. M. Roberts, manager of the Nobel's explosives company, London, writes as follows to the London *Times*: "Nitroglycerine and dynamite do not, when exploded, exert such a force as is popularly believed. To speak precisely, the power developed by the explosion of a ton of dynamite is equal to 45,675 tons raised one foot, or 45,675 foot tons One ton of nitroglycerine similarly exploded will exert a power of 64,452 foot tons; and one ton of blasting gelatine, similarly exploded, 71,050 foot tons. These figures, although large, are not enormous, and need not excite terror. Seventy-one thousand tons of ordinary building-stone, if arranged in the form of a cube, would measure only 90 feet on the side, and, if it were possible to concentrate the whole force of a ton of blasting gelatine at the moment of explosion on such a mass, the only effect would be to lift it to the height of a foot. The foregoing figures are derived from experiments made at Ardeer with an instrument which gives accurate results in measuring the force of explosives."

Supposing these data to be reliable, and in view of the fact that the buildings which stood on the great excavation in Chicago have disappeared entirely, is it not reasonable to suppose that fully as much force was required to lift, splinter, and distribute, in every direction, the materials composing those buildings, overcoming the attraction of gravitation in the act, as was necessary to make the great excavation in the earth, by the expenditure of 'its main force downward'?

This fact of the elimination of the buildings seems to have escaped the notice of the writer of this article.

In verification of our statement that it explodes with equal force in all directions, the following extract from the above quoted authority, Mr. Roberts, is cited: "I have often, by way of experiment, exploded a pound of dynamite suspended from the end of a fishing-rod by a string about six feet long, holding the rod in my hand the while. As there was no solid matter to project, I received no injury, and the end of the fishing-rod was not even scratched. About three feet of the string at the end of the rod was always left uninjured."

Meeting, in the above experiment, with no resistance other than the air at any point, there was consequently no destructive power shown in any direction; but, had there been solid matter above or below or on either side, the 'main force' would have been expended upward or sideways, and not 'downward.'

This experiment illustrates another remarkable feature in dynamite, peculiar to itself, — that of its concentrated or local effects, compared with the more diffused effects of gunpowder explosions.

Quoting again from Mr. Roberts, he says, "The power exerted by an explosion on surrounding objects is in the inverse ratio of the cube of the distance from the point of explosion. Thus, at 100 feet from the exact point of an explosion, the power is only the cube of 1-100 or 1-1,000,000 part of what it is at a distance of only one foot from that point, or, in other words, if the power at one foot from the spot be represented

by 1,000,000, at the distance of 100 feet it will be but 1. It is thus seen that the effects are intensely local, and but comparatively trifling at even short distance."

The wide-spread damage in the Chicago explosion was undoubtedly due, in a much larger degree, to the gunpowder than to the dynamite exploded.

Another fact and deduction relating to the escape of several magazines near the great explosion are quite as misleading, if not as erroneous, as the former ones.

If we are correctly informed, most, if not all, of the magazines nearest the exploded buildings, contained dynamite. Now, it is a fact well known to experts that this material is non-explosive by shock or by fire applied separately, but requires some fulminate combining both concussion and combustion, acting simultaneously, to explode it. Hence, being protected from the fire or combustion of the explosion by the walls of the magazines, and being unsusceptible to the force of the concussion, there is nothing remarkable in the salvation of the adjacent magazines. Even those, if any, which contained gunpowder (that explosive being protected from contact with fire, and remaining inactive) were uninjured for equally scientific reasons.

The article concludes, referring to its statements and deductions, by saying, "These are facts which could not have been exemplified save at much cost and risk, and our government officers and other men of science will, we may be sure, bear them carefully in mind hereafter."

Now, as we have shown that the above statements are not facts, but that the contrary is the real truth, and as the actual facts have been ascertained as well by many of our government officers as by a large number of experts all over the world, we would respectfully suggest to the *Herald*, when it intends to publish another scientific dynamite article, that it secure the services of, or at least submit its facts to, some such expert as General Abbott or Gen. John Newton, both of the U. S. army, whose experience with explosives of every kind has been exhaustive, and thus obtain information that the public can rely on. A. W. G.

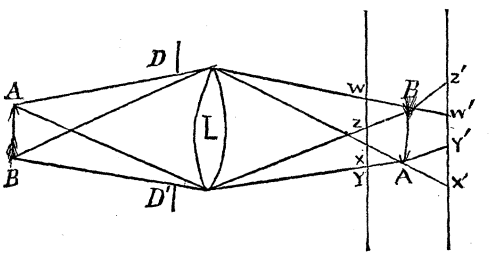
New York, Sept. 1.

On a means of determining the limits of distinct vision.

If an image ($A'B'$) of an object (A B) be thrown on a screen by means of a lens (L, for simplicity supposed free from spherical aberration), and the screen moved forward or backward, the image will be blurred. If part of the rays be stopped by a diaphragm (D D'), this blurring will be less as the aperture of D D' diminishes, for this lessens the spaces (W Z, etc.) over which the rays from any one point of the object are spread on the screen. Now, let the rays be cut off from one side alone; let a curtain (D) descend from above. The upper boundaries (W, X, etc.) of the spaces WZ, XY, etc., will descend, while the lower ones remain stationary. If the object be dark against a brilliant background, the light from above A will be cut off as B descends, and the blurred edge (XY) of the image becomes dark; so that, in the limit, instead of a blurred image (WY), there would be a distinct one (Z Y), or, as the image of D ascends, the image of A B appears to move to meet it, the part near D leading the way, since D intercepts the extreme ray from A before that from B.

If the object be light on a dark ground, the effect will be most apparent on the boundary farthest from D, since the blurred edge that changes to dark is more noticeable than that which changes to light. If the image be formed in front of the screen, making the blurred image Z' X', a little consideration will show that the apparent motion of the image will always be away from the image of D.

These results may be verified with any lens, but are most strikingly shown with the eye, using a sheet



of paper close to the eye as curtain, and any object,—as a pin, pencil, or ruler,—seen against a window or lamp as background. A slit in a piece of paper held against a lamp serves as light object on a dark ground. It is, of course, easy to hold the object so near that it will be blurred; but special effort may be required to blur a distant object, except with near-sighted persons. The applicability of this in making a test of the limits of distinct vision is now apparent. Let a ruler lean against the shade of a lamp; place the eye so near that the image is necessarily blurred, and, moving the edge of a sheet of paper back and forth before the eye, step slowly backward till apparent motion of the object ceases; continue the backward movement until the object begins to recede slightly from the screen: the space where there was no motion is that in which alone distinct vision is possible. Of course, every effort must be made to accommodate the focus of the eye to the object during the whole experiment.

It is a more difficult task than one thinks, to decide by simple judgment whether an object is seen distinctly or not, except it be much blurred. If the image is fairly distinct, most people will suppose it to be perfectly so. The test described above never fails to show whether or not the judgment is correct.

The effect noticed above also adds to the appearance seen when two networks of thread or wire not in the same plane are held before the eye. The watered appearance is of course due to curves which are the loci of the intersections of one set of wires with the other; but these intersections are made noticeable by the fact, that, when two wires not in the same plane and making an acute angle are held before the eye, the nearer acts the part of the curtain D in the above demonstration, and an irregular dark spot is seen about the point where the wires cross. The writer hopes to make a series of experiments as to the limits of distinct vision in different persons, using the test suggested above. Its simplicity, and the absence of any judgment on the part of the person experimented upon, other than as to the direction of motion of the object, commends it to the investigator. ARTHUR E. BOSTWICK.

Montclair, N. J., Aug. 30.