tread"; but if I can elicit some definite scheme from Prof. Armstrong, I shall regard my own dialectic annihilation as a small price to pay for the ultimate gain. D. S. T. GRANT.

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A Lecture Experiment.

To show that chlorine will attack mercury, some mercury was shaken up in a covered gas jar filled with chlorine. On shaking, the sides of the jar and also the cover-glass became coated with a continuous film of mercury, as though the inside were silvered. After a short time, the film was eaten through, and patches of the white chloride produced. I have not seen this effect noticed in books, so it may be worth while to call attention to it.

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Municipal Technical School, Birmingham, April 25.

VITALITY OF SEEDS.

THE duration of the vitality of seeds is perhaps the most important of the various phenomena of plant-life, especially when considered in connection with the introduction into a country of the economic plants of other countries. It is a subject that has engaged attention from very early times, and the literature relating thereto is considerable. Much of this, however, is of a traditional and unpractical character; but even if we confine ourselves to the demonstrable, or demonstrated, the subject is almost inexhaustible. There is such an infinity of variety in the behaviour of seeds under different conditions, that it is impossible in a short account, such as this must be, to do more than convey a general idea of the subject. Perhaps the best way to treat the question, apart from technicalities, is to consider the vitality of seeds under ordinary, and under extraordinary, conditions. In the development and germination of seeds, there is, in a sense, usually a period of gestation and a period of incubation, as in oviparous organisms of the animal kingdom; and the duration of these periods is within definable limits, under ordinary conditions, though seeds do not exhibit the same fixity of time in regard to development and vitality as eggs. The embryo of a seed is the result of the impregnation of the female ovum in the ovary or young seed-vessel, by the male element, generated in the anthers; and in the mature state this embryo may fill the whole space within the skin, or testa, of the seed, as in the bean and acorn; or it may be a comparatively minute body, as in wheat, maize, and other cereals; the rest of the seed being filled with matter not incorporated in the embryo. The difference is one of degree in development. In the one case, the growing embryo has absorbed into its own system, as it were, before germination or the beginning of the growth of the embryo into a new plant, the whole of the nutrient material provided in the seed for reproduction; whereas, in the latter case, the process of absorption and utilisation of the "albumen," or nutrient matter, takes place after the seed is detached from the parent plant, and during the earliest stage of growth of the new plant; so that the plant is nourished until it has formed organs capable of assimilating the food obtainable from the atmosphere and earth. Between these two extremes of development of the embryo, or future plant, before organic connection with the parent ceases, there is every conceivable degree and variety; and, as will presently be explained with examples, some plants are viviparous, in the sense that the embryo commences active life before being severed from the parent, so that when this occurs the plant is in a position to draw its sustenance from unassimilated or inorganic materials. Now it is a curious and unexplainable fact that certain seeds exhibiting the extremes of embryonal development, instanced in the bean and wheat, are equally retentive of their germinative power. The longevity, if it may be so called, of seeds is exemplified in "exalbuminous" seeds as well as in "albuminous" seeds of every degree. It should be mentioned, however, that the difference is not so much one of assimilation or development as of the earlier or later transfer of the nutrient matter of the seed to the embryo or plantlet. Assuming the perfect maturation of a seed, certain conditions are necessary to quicken its dormant vitality; and the two principal factors are heat and moisture, varying enormously in amount for different plants, and acting much more rapidly on some seeds than on others, even when the amount required is much the same. Neither under natural nor under artificial conditions will some seeds retain their vitality more than one season; and all the resources of the accumulated experience of seed-importers from distant countries are insufficient in some cases to maintain their vitality. It is not altogether because the interval between the dispersal and the germination of the seed, under ordinary conditions, is necessarily longer; but rather because in the one case the conditions under which a seed will germinate are much more restricted than in the other. Let us now examine the natural conditions under which seeds are commonly produced and dispersed, in relation to the retention of their vitality; and we shall learn how much more it depends on their nature, or natural means of protection, than on the seasons. An oak tree sheds its acorns in autumn, and the leaves which fall afterwards afford them some protection from frost and excessive dryness. But the leaves might be blown away from one spot, and the acorns exposed to intense frost or drought, either of which will speedily kill them. In another spot the leaves may drift into thick layers, with an excessive accumulation of moisture, causing decay of the underlying acorns; and there are many other unfavourable conditions which may destroy the vitality of the acorn. It is apparently impossible, however, to preserve an acorn's vitality by any artificial means for more than one season.

The scarlet-runner bean loses its germinative power on exposure to comparatively slight frost, the degree depending upon the amount of moisture in it; yet it will retain its vitality for an almost indefinite period under favourable artificial conditions. In both of the examples given, germination would naturally follow as soon after maturation as the conditions allowed. The seeds of the hawthorn behave differently. Each haw contains normally three to five seeds, every one of which is encased in a hard, bony envelope, in addition to its proper coat or testa. Committed to the earth, and under the most favourable conditions, these seeds do not germinate till the second year, and often not so soon. In this instance prolongation of vitality is probably due in some measure to the protective nature of the shell enclosing the seed.

Returning to seeds in which the embryo or plantlet forms only a very small part of the whole body, wheat may be taken as a familiar and easily observed illustration of a seed, the vital energy of which requires very little to stimulate it into active growth; and yet this same seed, having no special protection in the way of coating, will retain its vitality as long, perhaps, as any kind of seed, if not under the influence of moisture. The primary condition to the preservation of vitality in a seed is perfect ripeness. Unripe seeds of many kinds will germinate and grow into independent plants if sown immediately after removal from the parent. The facility with which immature wheat will germinate is most disastrously exemplified in a wet harvest, when the seeds will sprout while the corn is standing or in sheaf; thus destroying more or less completely the value of the grain for flour, as the starch or flour is consumed in the development of the embryo, or what is left is so deteriorated by chemical change that it is not good for food. There is perhaps no other seed more susceptible to moisture, and none less affected by dryness, or by heat or cold in the absence of moisture.