its retreat, left it hanging by a short line, while she proceeded, according to the usual habit of this kind of spider, to carefully clean herself before the meal. Meanwhile I managed to replace the fly by a piece of cork without disturbing the spider. When the toilet was complete, she pulled up the line from which the supposed fly was suspended, and tried to eat the cork. She was a long time trying every part of the cork before she finally let it drop. A piece of an india-rubber ring was twisted up until it had acquired a state (well known to school-boys) of spasmodic recoil. This was placed on the carpet-like web of a large black house-spider, which Mr. Pocock tells me is known to naturalists as *Tegenaria atrica*. These, like other house-spiders, appear to be far more wary than the geometrical sort. The india-rubber was made to move slightly by being pinched from below, and then the spider pounced upon it. I did not allow the spider to carry it off, but made it seem to struggle and resist by manipulation with a pair of forceps under the web. The spider became more and more desperate, and at last, when the web was much damaged by the battle, I dragged the rubber away; but the spider could not allow this, and clambering through the hole made in the web, and hanging by her fourth pair of legs, seized the escaping insect. I then let go, and the spider carried the piece of india-rubber away to her den, perfectly satisfied. However, she did not seem to appreciate her meal, for, after biting it on every side, she was obliged to take it to the edge of her web and drop it. I then picked it up, and was surprised to find the spider willing to be similarly deceived again.

These spiders will come to a tuning-fork once or twice perhaps, but the moment they touch it they fly terrified, as they do from a common bluebottle with mica on its wings. They seem generally thirsty, and will drink water placed upon the web; and if it is scattered in drops, they are able to find the drops, but by what process I do not know. The diademas, too, especially when old, and only able to mend old webs, not to spin new ones, are always ready to drink. They will hold a piece of wheat straw six or eight inches long which has a drop of water upon it until they have drunk the water; but while the little spider is so insensitive in taste as not to entirely reject a fly that has been soaking in a paraffine lamp, especially if it is made to buzz with a tuning-fork, the diadema has a strong objection to alcohol, even well diluted, and rubs her mouth against any thing near by after tasting it, so as to get rid as quickly as possible of the noxious fluid. Is it possible that the numerous spiders which are found in secondary batteries have been killed by the acid when attempting to drink, or are they destroyed by accidentally meeting the acid in their ordinary descents? The *Tegenaria* is aware of the shout which causes the diadema to strike and the little spider to drop, but the effect is a jump such as is executed by any one when suddenly startled.

It would appear that the only sense which is developed to any extent, and that most marvellously, is the sense of touch; hearing, taste, and smell to a small degree; but sight, as we understand the term, in spite of their numerous eyes, seems to be absent. The *Tegenaria* will stand within half an inch of a fly feigning death, without being able to find it; while the geometrical spiders, under like circumstances, gently pluck line by line until the effect of the inertia (not weight) of a motionless object guides them to the proper place.

These remarks do not apply to the hunting spiders.

C. V. BOYS.

THE PRODUCTION OF IMMUNITY FROM DISEASE.

A RECENT despatch to the newspapers stated that Koch's consumption "lymph" had been analyzed by a Vienna doctor, and that the principal ingredient was found to be a substance which the chemists know as albumose. Professor Koch himself, in his articles to the medical papers, does not give the method of preparation of the "lymph," but indicates that the material used is a sterilized culture liquid of the germ that causes tuberculosis.

This being the case, it is of interest to call attention to the fact that the principle which Professor Koch is applying received its first proof in a study of the fatal disease of hogs, known as hog-cholera, made by Drs. Salmon and Smith of the Bureau of Animal Industry, Department of Agriculture, Washington, D.C., in 1887. To explain clearly what has been done, it is a well-known fact that the germs which cause different diseases in men and animals can be isolated, and caused to multiply artificially outside of the body, by supplying them with food. Some germs require one sort of material, others a different one; but in general it may be said that beef-broth, or blood serum, or glycerine and gelatine, are the most useful substances. These prepared solutions are called culture liquids, or culture media. Into a tube or flask of the liquid are introduced a few of the germs it is desired to cultivate, and in a short time the germs are found to have increased so enormously that they can be seen by the naked eye. During this time great changes have taken place in the culture solutions: what was at first harmless beef-broth has been changed by the action of the germ to a liquid, which, after the germs have been removed by filtration or killed by heat, still contains poisonous alkaloids and albuminoids, which are generally fatal in their effects upon the animal body. Alkaloids formed in this way are called ptomaines; and the albuminoid bodies, albumoses; and each distinct disease-germ forms a peculiar and distinct ptomaine and albumose. The growth of the germ in the body is supposed to form ptomaines and albumoses from the blood and tissues, and these substances cause the fatal effects of the different diseases.

A horse can be gradually accustomed to arsenic; a man, to opium, nicotine, strychnine, and quinia: so that after a time a dose which would at first have been fatal to him can be taken without injury. The idea suggests itself at once, why not prepare and isolate the poisonous substances which germs form, give them in small doses to men and animals, thus gradually accustoming the body to their effect; and if then the disease-germ afterwards enters the body, the system will be already fortified against the poison which is produced, and able to resist what would otherwise be its bad effects.

This is exactly what Dr. E. A. v. Schweinitz, physiological chemist in the Department of Agriculture at Washington, D.C., has done in the case of the two diseases of hogs which cause such enormous losses to the farmers of the country; viz., hog-cholera and swine-plague. Dr. Schweinitz has made considerable quantities of culture media, and by chemical methods isolated and extracted the ptomaines and albumoses that the germs form.

These poisonous liquids have been injected into guinea-pigs, and the animals then inoculated with the virus of the disease. The guinea-pigs which had thus been treated were not seriously affected by the virus, while the guinea-pigs which had not been treated by injecting the remedy invariably died. Both swine-plague and hog-cholera have thus been prevented in guinea-pigs, which are very susceptible to the diseases.

Some experiments have also been made upon hogs, which have been fairly successful; and there is every reason to expect that this method of treatment can shortly be applied on a practical scale. It may be mentioned that the scientific results of these experiments were published in the Philadelphia *Medical News* of September and October, 1890.

While Professor Koch has been working for the benefit of mankind, the secretary of agriculture of the United States has had the pecuniary interests of the farmer and the safety of animals at heart in encouraging this difficult line of investigation; and results have been secured which are far-reaching in their importance and application for men as well as animals.

Professor Koch, in treating consumption, uses a solution the composition of which he says he does not know. The Department of Agriculture uses substances which are obtained in a solid form, as most drugs, and prepares solutions of any desired strength for treating the diseases of hog-cholera and swine-plague.

There is no reason why this line of research should not be pushed with reference to many diseases of men and animals in the large universities and laboratories of our own country. In the hands of competent investigators, there can be secured in the United States the most important results, and great discoveries can be made. The Scientific Department of the government has shown the way. Let others follow.

SPECIAL PLANTING FOR HONEY.

IT is a well-known fact, and as thoroughly appreciated by the thoughtful bee-keeper, that often, because of some peculiar condition of the weather, even our best honey-plants fail to secrete nectar. In Michigan the years 1888 and 1890, and to a less degree 1889, gave excellent illustration of this fact in respect to white clover.

Again, it frequently occurs that a drouth or over-production the previous season so weakens plants that they do not develop to the blossoming stage, or do not produce blossoms. This very season, 1890, gave us almost no basswood bloom. The same truth is illustrated not infrequently by almost all of our nectar-secreting plants.

Once more, there are times in every season and region when there is a dearth of nectar-secreting flowers. In Michigan this period comes about July and August, usually from about July 15 to Aug. 15. At this season there are neither native honey-plants in bloom, nor are there honey-plants in cultivation So at this season the bees are idle, and robbing is a common occurrence.

For the above reasons bee keepers are much interested to know if there are plants that will always secrete nectar irrespective of weather,—plants that will secrete not simply enough to attract bees, but enough to give a surplus and insure a profit. They are also practically interested in knowing whether or not there are plants that will secrete so liberally that it will pay to grow them for honey alone. It is further a matter of importance to find if there are plants that bloom at the time of the honey-dearth in July and August, and so, valuable to grow, either for honey alone or for honey and other purposes. There are always more or less waste places, by roadsides, along railways, etc., near by most apiaries. It is important to know if it will pay to utilize such by planting for honey, and, if so, to know what to plant.

That these are important matters for investigation is clear from the fact that many bee-keepers have spent considerable sums in trying to solve these questions.

It is clear, that, to arrive at any definite and reliable conclusions, experiments must be tried on a large scale. We must not see simply that bees work on the flowers, but we must get results. We must be assured that the bees actually store, and that in paying quantities.

It occurred to me, and to the board of our Michigan experiment station, that this was a very proper subject for investigation at our station, and so for the past two seasons we have devoted about fourteen acres to this purpose. The seasons have been very opportune, as there was an almost total failure in the honey-harvest both years; and so, if any plan adopted was a success, it would have ample chance to prove its excellence.

I decided to try the three following honey-plants: Rocky Mountain bee-plant (*Cleome integrifolia*), Chapman honey-plant (*Echinops spherocephalus*), and a foreign mint of the genus *Melissa*. I hoped to find a plant that would secrete nectar every year, especially in times of drouth, that would grow with little or no care on the part of the bee-keeper, and would yield bountifully of nectar. As the Chapman honey-plant was loudly praised, and was reported a success upon actual trial, and as the seed had been distributed by the government, it occurred to me that it should be one of the plants first tested. The Rocky Mountain bee plant flourishes on the dry plains of Colorado, where it is said to give prodigious yields of nectar; and as I had been quite successful in growing it in small plats for years, where it seemed to attract the bees from early July till frost, I looked upon that plant as well worthy a trial. This plant is also reported as growing wild in Wisconsin and Minnesota, and as affording much nectar. The *Melissa* belongs to the mint family,—a family of honey-plants,—is strongly praised by those who have tried it, and who have no pecuniary interest in its becoming popular: so I concluded to make it third in the list to be adopted.

The Chapman Honey-Plant.

I have planted, in all, four or five acres of the seed of this plant, some on clay and others on sand. When the seed came, the plants made a very vigorous growth, but did not blossom at all the first year. Thus the plant is a biennial. No nectar can be secured from it until the second year after planting. The plant looks like a thistle, the spines doubtless suggesting the generic name *Echinops*. The flowers form a very perfect globe or sphere; hence the specific name *spherocephalus* is very appropriate. The plant, if cultivated till once well started, will care for itself, as it is very vigorous. It begins to bloom here at the Michigan Agricultural College about the middle of July, and continues to blossom till the middle of August. The blossoms commence to open at the lower margin of the head, and continue to open towards the centre. The seasons have been very dry, yet the bees visited the *Echinops* very freely, and secured considerable honey; and this, too, just at the most desirable period of the year.

A very serious objection to the general adoption of this plant is the difficulty of securing the seed. The chaff has barbed awns, that are very minute. These fly everywhere as we clean the seed, and, except one is protected better than he will be unless previously taught by experience, these awns are sure to enter the eyes and pierce the skin at every possible opportunity. The effect of this is almost maddening. For three or four days the pain in the wounded eyes and skin is almost unendurable.

After the plants bear a full crop of seed they seem exhausted, and very few survive to blossom the second year. Our plants in 1889 were wonderfully fine and vigorous: the plants on the same area this year are very few and scattering. To be sure, young plants have come up thickly from seed, but they will bear no bloom till 1891. Thus we see that we cannot grow this plant profitably except as we plant, or permit it to self-plant, every