phenomenon of Alternation of Generation among Fungi. The researches of Steenstrup and others have made us familiar with this remarkable phenomenon among the lower forms of animal life, but had hardly prepared us to meet with it in the vegetable kingdom. It appears probable, however, that the phenomenon is by no means uncommon here also,—affording another instance of the law that it is in their lowest forms that the animal and vegetable kingdoms approach one another most nearly,—and that whole tribes of fungi hitherto considered distinct are but different phases of one another. This remark applies especially to the two genera of minute parasitic fungi, *Æcidium* and *Puccinia*, to which the rusts in question belong, both belonging to the family *Uredineæ*. The well-known orange-red spots so common on the leaves of the berberry are produced by the *Æcidium berberidis*, while the rust of wheat and other cereal crops, but found equally on some other species of grass, as the common couch-grass or *Triticum repens*, is the *Puccinia graminis*. In the volume for 1865 of the *Monatsberichte der kön. preuss. Akademie der Wissenschaften zu Berlin* is a paper by Dr. De Bary, giving an elaborate account of his experiments on the propagation of these two fungi, in which, if his experiments are reliable, he clearly proves the correctness of Sir Joseph Banks's suggestion that they are one and the same species. The experiment was tried, with due precautions, of inoculating the leaves of the berberry with the spores of the *Puccinia*, the result being the production, not of the same fungus, but of the *Æcidium*, while the sowing of the spores of this latter fungus on the leaves of couch or wheat produced conversely the *Puccinia*. By sowing the spores of either fungus on the plant on which it was itself parasitic, he failed altogether to reproduce the same plant; and this alternation of generation may serve to account for the fact which has often been noticed, that rust is apt to appear not in successive but in alternate years on the same crop.

It is unfortunate to find that in a work bearing a considerable amount of scientific authority among agriculturists, and published in the same year, 1865, Prof. Buckman's "Science and Practice of Farm-cultivation," the theory which thus appears to have been proved on the Continent was scouted in the following terms: "*Æcidium berberidis* is here referred to, from an opinion prevailing

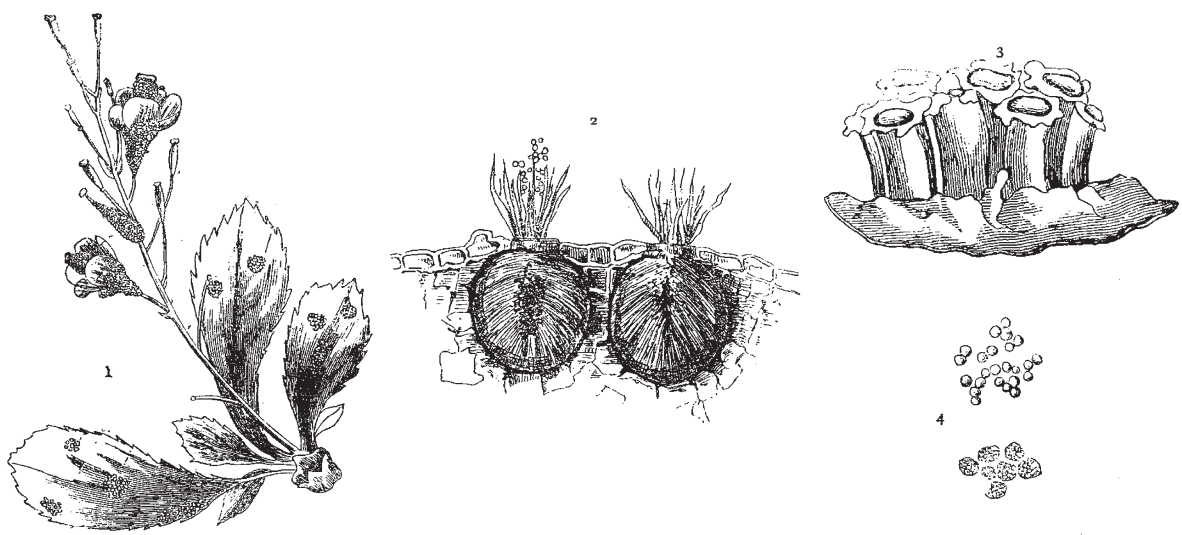

FIG. B.—*Æcidium berberidis*, Gmel. 1. Branch of berberry with spots of rust, natural size. 2. Spermagonia. 3. A group of Peridia with their orifices dentated. 4. Sporidia. (2, 3, and 4 magnified.)

that it is the cause of rust or mildew in wheat. We can no more believe that the berberry rust would produce rust in wheat than the rust of any other plant would do so. Still that wheat growing under a berberry hedge may be more blighted than in the rest of the field is quite true, and so it is with wheat growing under any kind of hedge." Mr. Buckman fails entirely to grasp the argument, which is not that wheat "growing under a berberry hedge" is attacked by rust, but when growing in the proximity of a berberry tree, say at the distance of a field's breadth. Nothing is more certain to weaken the hold of science over practical men than when men of science, in order to support their own theories, set themselves systematically to deny well-known facts. We therefore greatly regret the decision at which it is understood the council of our Royal Agricultural Society has arrived, to refuse a thorough investigation of the subject which has been urged upon them, calling in the assistance of experienced men and the most able fungologists of the day. This is not the way to command the confidence of practical farmers.

We commend to the consideration of the Royal Agricultural Society the conduct of a railway company in the south of France, described in the *Bulletin de la Société botanique de France* for January of this year, to which we have already alluded (see NATURE, vol. i., p. 516). In the commune of Genlis, department of Côte-d'-Or, a berberry hedge was not long since planted on one of the railway embankments; when immediately the crops of wheat, rye, and barley in the neighbourhood became infested with rust. The complaints of the farmers caused the appointment by the company of a commission to investigate the subject, who reported, after a full inquiry, that wherever the berberry was planted the cereals were more or less attacked by rust; where they were absent the crops were free from the disease; and that the planting of a single berberry bush was sufficient to produce the rust where it had never appeared before. The railway company's own commission held that compensation was due from the company to the farmers.

Our illustration of the *Æcidium berberidis* is taken (in part) from Greville's "Scotch Cryptogamic Flora;" that of the *Puccinia graminis* from Corda's "Icones Fungorum."

ALFRED W. BENNETT

In considering the question of the influence of the berberry on the production of rust in wheat, assuming that De Bary's observations are perfectly correct, it is necessary to consider the nature of what is commonly called "rust" in cereals. Presuming that his views are strongly

confirmed by the analogous connection of *Ræstelia cancellata*, the pear blight, with the gelatinous parasite of *Juniperus sabina*, it is well to attend to the following facts:—Professor Henslow in an article on the diseases of wheat, in the Journal of the Royal Agricultural Society, proved distinctly that what is commonly called rust is merely a condition of the common mildew, and this at a time when comparatively little was known about these parasites, and when many were inclined to accept the views of Unger that they were mere abnormal developments of tissue or spontaneous growths. The observations of Tulasne and others confirmed to a certain extent Professor Henslow's view, but threw further light upon the matter by showing that many so-called *Uredos* were merely a subsidiary form of so many species of *Puccinia*. Meanwhile, though *Uredo rubigo vera* was the subsidiary form of *Puccinia graminis*, it was recognised that *Uredo linearis* is nothing more than the early stage of the *Puccinia*. Though there is some resemblance between the Uredinoid form of the *Puccinia* and the rust of the berberry, there is none between the perfect condition of the parasite. Our readers will have noticed that at the meeting of the French Academy on August 1st, M. Roze contributed some further illustrations of this interesting subject.

The great difficulty has always been that mildew is most prevalent in countries where not a berberry bush is to be found; and the same remark applies to the pear rust, which abounds where not a single plant of savine is to be seen, the parasite of the savine being comparatively of rare occurrence. I think, always assuming the fact of the connection between the two parasites, that it may be easily accounted for. It may be true that the berberry plant produces mildew; but how is this? not probably from the spores of the present year, but from those which fell to the ground the previous season. There is no doubt that these parasites penetrate into the tissues of the young germinating plants, by means not of the original spores, but of minute secondary spores which are produced on them, a circumstance which is fully proved in the case of bunt. This, then, will account for the cereal being mildewed in the neighbourhood of the berberry. But another consideration is necessary to explain the prevalence of mildew where the berberry does not exist, or where it is confined to gardens. The subsidiary spores have no doubt, equally with the *Puccinia* itself, the property of reproducing the mildew, and there are always enough of these blown about, either from previous crops or from the neighbouring grasses, especially in the fens, where every ditch is filled with reeds affected more or less with mildew; and thus the parasite may be propagated season after season without the Æcidioid form intervening, a circumstance which is not without analogy in other branches of the vegetable kingdom. I may be allowed, perhaps, to recall attention to an article on the development of bunt in the second volume of the Journal of the Horticultural Society of London, which seems entirely to have escaped notice on the Continent, where it is stated in a paper communicated by me on Jan. 18, 1847, with reference to the phenomena described, that "it is quite possible that in plants as well as in the lower animals there may be an alternation of generations." M. J. BERKELEY

NOTES

A RUMOUR is current that the Government have refused both ships and assistance to the Royal and Royal Astronomical Societies, which have been for some time organising expeditions to observe the approaching total eclipse of the sun. We can hardly believe that the Government will thus venture to brave the opinion of all men of science and culture. It would be a direct acknowledgment that the Government cares as little for a recent position for England in science and the arts of peace as it did a little time ago for her position in the arts of war. Verily we are a nation of Philistines!

OUR readers will hear with great regret that Prof. Wyville Thomson is prevented by illness from taking that share in the scientific exploration of the Mediterranean basin, now about to commence, which has conduced so greatly to the success of the previous expeditions in which he has been one of the workers.

M. OTTO STRUVE, director of the Observatory at Poulkova, M. Wild, director of the Physical Observatory at St. Petersburg, and M. Mohn, director of the Meteorological Institute of Christiania, have just arrived in Paris, for the purpose of taking part in the international conference charged with establishing a universal metre. In consequence, however, of the war, the meeting of the conference is postponed until such time as it may be summoned to meet by the Government.

AMONG the chances of war which have necessitated that Paris should be placed in a state of defence against a besieging enemy, the rasing of the Bois de Boulogne has become one of the first necessary operations. The fine collection of animals belonging to the Société Impériale d'Acclimatation will then have to share the fate of those belonging to the Zoological Society of Cologne, and be dispersed or removed till better times. It is even said that the axe is already at work.

THE Franco-German War is telling heavily on science on the Continent. In the number of the *Revue des Cours Scientifiques* for August 13th, the Editor hints at the possible suspension at an early date of the publication of his journal till the war is over.

TO form an idea of the results of a general armament in Germany, it will be sufficient to learn that from the Berlin Chemical Laboratory, besides a great number of students, all the assistants, seven in number, have joined the army, partly as soldiers partly as field-apothecaries. When large masses of troops passed through Berlin, the director of the laboratory placed room for twenty soldiers at the disposal of the military authorities. University lectures have been prematurely closed. The military schools, the agricultural school, and the school of architecture had to close for want of pupils. The upper forms of the grammar schools have also sent many of their pupils into the field; one of them as many as eighteen out of forty.

THE engineering works of Messrs. Siemens and Halscke, and the ironfoundry of Borsig, are now almost exclusively occupied with the manufactory of torpedoes. It is said that great improvements have been made in these war-engines; the point chiefly kept in view being to make them moveable from the shore by means of an electro-magnetical rotatory apparatus.

THE season for Congresses Scientific and other has now fairly set in. A Medical and an Engineering Congress are now sitting in the north; we last week gave some of the arrangements for the forthcoming meeting of the British Association at Liverpool, and it is now announced that the Social Science Congress will meet from the 21st to the 28th of September, at Newcastle-on-Tyne, under the presidency of the Duke of Northumberland. The Social Science Congress has done what the British Association might also do to a certain extent with great advantage. It has stated the questions which press most for solution in the different branches of inquiry with which it deals. With two of these sections, namely, those of Education and Health, we are especially interested, and we willingly acknowledge the high importance of the questions which it is proposed to discuss. They are as follows:—Education. 1. Can better educational results in primary schools be obtained by the amalgamation of such schools? 2. By what means can a direct connection be established between the elementary and secondary schools and the Universities? 3. Is it desirable to teach science in elementary schools, and, if so,