necessary to prevent friction between kelp-harvesters and fishermen desiring to use the beds at the same time.

ATTENTION may be directed to a paper on the anatomy of the potato plant, with special reference to the ontogeny of the vascular system, by E. F. Artschwager, published in vol. xiv., No. 6, of the *Journal of Agricultural Research*. The study was undertaken primarily to serve as a basis for work on that obscure disease—or group of diseases, possibly—to which the name "leaf-roll" has been given; and there can be no doubt that a serious scientific investigation of the nature and causes of this trouble is one of pressing importance for all countries where the potato is grown. The paper referred to will be found very useful as a convenient summary of previous work on the anatomy of the potato plant, and in some directions it throws new light on points which were formerly not altogether clear. The importance of the development of secondary phloëm is emphasised, and it is shown that the increase in size of the tuber is due more to the formation of new tissue in the perimedullary zone than to growth of the pith, as was formerly supposed. It is clearly shown that the skin of the tuber is composed of periderm derived to some extent from the original epidermis, as well as from the hypoderm. The paper is illustrated by twenty-one plates of excellent photomicrographs, as well as by a few text-figures.

IN the Journal of the Washington Academy of Sciences for October 4 Messrs. P. D. Foote and T. R. Harrison, of the Bureau of Standards, in a paper on some peculiar thermo-electric effects, point out that the production of a thermo-electric current in a homogeneous wire by heating it unsymmetrically was known to Franklin and Cavendish a hundred and fifty years ago. It continues to be "rediscovered" once a decade, but up to the present time not one of the many causes which have been suggested for the effect has proved satisfactory. The authors state, however, that in the special form of the experiment in which a hot and a cold piece of the same metal are brought into contact, the direction of the current generated is connected with the sign of the Kelvin effect in the metal.

MR. L. B. ATKINSON gave the Kelvin lecture to the Institution of Electrical Engineers on November 7. He chose as his subject "The Dynamical Theory of Electric Engines," and began by quoting a formula for inductance or "electromagnetic capacity" which Kelvin gave in the 1860 edition of Nichol's "Cyclopædia" (see Thomson's "Reprint," p. 443). He suggested that this formula and the equally well known theorem for the mutual action between electric circuits when their currents are maintained constant had been overlooked by electricians, who merely considered what may be called the statical theory of the dynamo. Mr. Atkinson then developed an analogy between the cycle of an electromagnetic engine and the cycle of a reciprocating engine, deducing what appeared to us to be very curious formulæ for the efficiency of the various cycles. He excused his neglect of the resistance of the windings of the electric machines by pointing out that in the future some material of very small resistance may be discovered from which they can be made. Nothing was said either about hysteresis or armature reaction. In order that Kelvin's theorem might apply, Mr. Atkinson had to suppose that the currents in the coils were absolutely constant. Various triple integral formulæ well known to mathematicians were given for the energy stored up in the field, but we could not follow what use he made of them. It is difficult to see how the method developed can be of any practical use. It may be pointed out that the dynamical theory of the dynamo has been developed by Lyle, Russell, and several French electricians, who have based solutions on the conservation of energy and inductance formulæ on the lines laid down by Kelvin. Their results take cognisance of both resistance and armature reaction, and are in close agreement with experiment. As in all other theories, however, the assumption is made that the iron has constant permeability.

AMONG the books mentioned in the new announcement list of *Messrs. Longmans and Co.* we notice the following:—"Boiler Chemistry," J. H. Paul, with diagrams. "The Natural Organic Colouring Matters," Prof. A. G. Perkin and Dr. A. E. Everest; "Catalysis in Industrial Chemistry," Prof. G. G. Henderson; and "Plantation Rubber," G. S. Whitby (Monographs on Industrial Chemistry). "The Rare Earth Metals," Dr. J. F. Spencer, and a new edition of "Osmotic Pressure," Dr. A. Findlay (Monographs on Inorganic and Physical Chemistry). "Naval Architects' Data," J. Mitchell and E. L. Attwood; "Experimental Education," being a new and enlarged edition of "Introduction to Experimental Education," Dr. R. R. Rusk; and "Economic Reconstruction," J. Taylor Peddie.

THE following additions will shortly be made to the series of "Military Medical Manuals," edited by Sir A. Keogh (*Hodder and Stoughton*):—"Commotions and Emotions of War," Prof. A. Léri, edited by Sir John Collie; "Disabilities of the Locomotor Apparatus, the Result of War Wounds," Prof. A. Broca, translated by Capt. J. R. White and edited by Sir Robert Jones; "Electro-diagnosis of the War," Prof. A. Zimmern and P. Perol, translated by L. P. Garrod and edited by E. P. Cumberbatch; "Mental Disorders of the War," Prof. J. Lépine, edited by Dr. C. A. Mercier; "Wounds of the Pleura and Lungs," Prof. R. Grégoire and Dr. A. Courcoux, edited by Lt.-Col. C. H. Fagge.

OUR ASTRONOMICAL COLUMN.

BORRELLY'S COMET.—This comet is now quite an easy object in a moderate telescope. Mr. R. L. Waterfield observed it at Cheltenham with a 4-in. refractor early in November. It was brighter than 9th magnitude with central condensation, but no stellar nucleus, diameter about 2′. The brightness will continue to increase throughout November, and the increasing north declination will facilitate observation.

ORBITS OF TWO SPECTROSCOPIC BINARIES.—Further interesting investigations of spectroscopic binaries are recorded in Bulletins Nos. 314 and 315 of the Lick Observatory. In the case of *p* Velorum, magnitude 4·1, Class F2, the spectra of both components are exhibited, and Dr. R. F. Sanford finds that the mass ratio is 1·23. Adopting Russell's average mass for F stars of three times that of the sun, the inclination of the orbit would be 27°. With this inclination the semi-major axes of the two orbits would be 10,880,000 km. and 13,340,000 km. respectively. The period is 10·210955 days, and the eccentricity 0·541. From some of the best spectrograms Messrs. Adams and Joy find the absolute visual magnitude to be +1·9 and the parallax 0·036″.

The star σ Scorpii, magnitude 3·1, class B1, has been investigated by Dr. F. Henroteau, whose value of 0·246834 day confirms previous conclusions as to the extreme shortness of the period. The semi-amplitude of each velocity curve has the constant value of 41·2 km. per second, but the velocity of the centre of mass is variable, as if a third body were present.

The centre of mass describes an elliptic orbit in a period of 34·08 days, with a semi-amplitude of 33 km. per second. The spectral lines vary in width, and are broadest near periastron. Some of the peculiarities of the star may be due to its being actually involved in the nebulous matter by which it appears to be surrounded.

A REMARKABLE HELIUM STAR.—A notable exception to the rule that the helium stars are usually characterised by small parallax, small proper motion, and low radial velocity has been found by Mr. J. Voûte in the star Boss P.G.C. 1517 (*Astrophysical Journal*, vol. xlviii., p. 144). The investigation was undertaken at the suggestion of Prof. Kapteyn, who had suspected that this star might be found to have the unusually large parallax of about a tenth of a second. Mr. Voûte's result is $+0{\cdot}069'' \pm 0{\cdot}006''$, in good agreement with Prof. Kapteyn's supposition. For the proper motion Mr. Voûte has found $+0{\cdot}235'' = 0{\cdot}0185$s., but this is greatly in excess of the value $-0{\cdot}0001$s. given in Boss's catalogue, and needs further confirmation. The radial velocity of the star is also exceptionally large, amounting to +83 km. per second. The position of the star for 1900 is R.A. 6h. 0m. 37s., decl. $-32^\circ\ 10'\ 12''$, and the magnitude 5·6.

THE ORBIT OF SIRIUS.—The results of a new determination of the elements of the orbit of Sirius are given by Dr. R. Aitken in Lick Observatory Bulletin, No. 316. The elements with their probable errors are:—

$P = 50{\cdot}04$ years $\pm 0{\cdot}09$ year	$i = +43^\circ\ 31' \pm 0{\cdot}25^\circ$
$T = 1894{\cdot}133 \pm 0{\cdot}011$ year	$\omega = 145{\cdot}69 \pm 0{\cdot}38$
$e = 0{\cdot}5945 \pm 0{\cdot}0023$	$\Omega = 42{\cdot}71 \pm 0{\cdot}33$
$a = 7{\cdot}570''$	

Dr. Aitken concludes that the available micrometric and spectrographic data give no evidence of departure from undisturbed elliptic motion. It will be observed that the period given above is in close agreement with that of 50·02 years recently deduced by Jonckheere.

PRODUCTION IN THE SEA.[1]

A HIGHLY interesting report by Dr. C. G. J. Petersen describes the methods and results of recent work on the evaluation of the bottom fauna and flora of the sea in the Kattegat, Limfjord, and elsewhere. Abandoning the use of the dredge, as affording misleading ideas of the abundance of life on the bottom, the author invented his "bottom-samplers," which are apparatus that can lift up a sample of the sea-floor with its contained animals and plants. The area of bottom lifted varies between 0·1 and 1 square metre, the smaller apparatus being used at the greater depths. By a process of washing, the organisms are removed, counted, and weighed. The plates represent typical results, all the organisms found being drawn, in actual size, on paper ¼ square metre in area, which is then reduced to ⅗ in. linear.

Very often the bottom deposit consists of a "black, malodorous mass of sulphurous mud," and it was difficult to imagine that animals could utilise this as food. Sampling this by means of a glass tube thrust down into it, it was, however, seen that there was a thin surface layer of quite different composition, grey or brown in colour, and charged with vegetable remains. Oysters and other bivalves and demersal worms do not feed on the black mud or on the plankton in the water, but "literally stuff themselves with this upper layer of fine detritus." "The great bulk of the bottom animals are, and must necessarily be, herbivorous." They mostly burrow in the mud, but a large number are attached to solid objects, stones, and shells. These constitute the bottom epifauna.

The bottom fauna in general may be divided up into "communities," each characterised by one or more predominant forms; thus the author describes the bottom in the deeper parts of the Kattegat as inhabited by communities of *Amphilepis pecten, Brissopsis sarsii, B. chiajei,* and *Echinocordatum filiformis,* the typical forms present in each case being indicated by the systematic names.

The survey being a quantitative one, an attempt is made at an actual estimate of the mass of life in the whole Kattegat. There are about 24,000,000 tons of Zostera, 50,000 tons of plaice, 6000 tons of cod, 7000 tons of herrings, 25,000 tons of starfishes, 50,000 tons of predatory Crustacea and Gastropods, 10,000 tons of small fishes, with, of course, much else. These estimates are based, not only on the results of bottom-samples, but also on fishery statistics, the very probable assumption being made that the fish stock is practically constant, so that the fraction taken in commercial fishing represents the production.

No attempt is made to compare density of life on sea-bottom and land. "Strange as it may seem," says the author, "there does not exist any survey of the animal communities on land based upon quantitative investigations of the commoner species." J. J.

[1] Report of the Danish Biological Station to the Danish Board of Agriculture. "The Sea Bottom and its Production of Fish Food." By C. G. Joh. Petersen. Pp. 62+10 plates+chart. (Copenhagen, 1918.)

MILITARY EXPLOSIVES OF TO-DAY.[1]

THERE have been no epoch-making discoveries in explosives such as, say, the discovery of nitroglycerine for many years. Nitroglycerine, discovered in 1846, still remains the most powerful explosive in practical use. Many useful advances have been and are being made, but new explosives are merely new mixtures of old materials, given fancy names. The nations at war use practically the same explosives, and no one can be said to be ahead of the others.

The following table gives a comparison of some of the most typical explosives in use:—

Name of Explosive	Volume of gas per gram in c.c. = V	Calories per gram = Q	Coefficient = Q × V ÷ 1000	Coefficient G.P. = 1	Calculated temperature = $\frac{Q}{C}$. Assuming C = 0·24 C = Specific Heat of Gases
	c.c.				° C.
Gunpowder	280	738	207	1	2240
Nitroglycerine	741	1652	1224	6	6880
Nitrocellulose (13 per cent. Nitrogen)	923	931	859	4·3	3876
Cordite, Mk. I. (N.G. = 57, N.C. = 38, Vaseline = 5)	871	1242	1082	5·2	5175
Cordite M.D. (N.G. = 30, N.C. = 65, Vaseline = 5)	888	1031	915	4·4	4225
Ballistite (N.G. = 50, N.C. = 50, Stabiliser = 0·5)	817	1349	1102	5·3	5621
Picric Acid (Lyddite)	877	810	710	3·4	3375

The coefficients correspond fairly well with the results obtained in practical use.

Detonating substances are called *high explosives,* and their immense shattering effect is due, not only to the volume of gas and quantity of heat, but also to the velocity of detonation and density of the explosive. Shattering power is proportional to

Volume of gas per gram × cals. per gram × velocity of detonation × density.

[1] From three Cantor Lectures delivered before the Royal Society of Arts in April last by J. Young, Chief Instructor in Science, Royal Military Academy, Woolwich.