captured even under the influence of radiation. This last process is analogous to Einstein's 'Negative Einstrahlung' or stimulated emission. Thus we may write—

Rate of photoelectric ionisation = Rate of capture with emission + Rate of capture under the influence of radiation.

Compare this with Einstein's well-known method of deducing the law of black body radiation:

Rate of absorption of light = Rate of spontaneous emission + Rate of emission under the influence of radiation.

With the aid of certain assumptions, Milne calculates the rates of free and stimulated captures and equates it to the number of photoelectric ejections. The equation may be used in two ways. It may be employed to evaluate the degree of ionisation, in which case some further assumptions are necessary. Conversely, assuming the thermodynamic formula for ionisation, it can be used for finding out the law of probability of electron capture. In this way Milne arrives at the conclusion previously reached by Eddington in his study of opacity of stars, namely, that the electron is captured only when it actually hits the nucleus. Probably a more rational way of expressing the result would be: Only one in 10^5 collisions results in a capture.

Applied to hydrogen, calcium, and mercury, Milne's method furnishes values of absorption coefficients which are in general agreement with experimental values.

It is yet too early to predict how far Milne's method in its present form will be able to advance the theory of thermal ionisation. The great difficulty which is encountered in the development of these methods is due to the absence of any suitable quantum theory of absorption of lines. The present theories are a sort of half-hearted compromise with the old Lorentz theory which ascribes absorption to damping produced by collision."

The Sea-Urchins of New Zealand.

By H. FARQUHAR, Wellington, N.Z.

THE following notes were written some time since, but were held back until Dr. Mortensen had published his zoogeographical notes on New Zealand echinoderms (*Vidensk. Medd.*, Bd. 79, 1925). They are now given here because the subject is approached from a different point of view; namely, that of the New Zealand biological region; and also because I find myself obliged to differ from him on some points. For example, Dr. Mortensen believes that Wegener's hypothesis of continental displacement "gets support also from the study of the New Zealand Echinoderm fauna"; while I am of the opinion that the evidence of our fauna and flora at large, including the littoral, is strongly against Wegener's hypothesis as regards Australia and New Zealand; and that it mainly agrees with the evidence of the micro-Lepidoptera as stated by Mr. E. Meyrick in NATURE of May 30, 1925. The more I have learnt of the New Zealand fauna and flora in general, and particularly of several small groups, the more I have been impressed by the great fundamental differences between the faunas and floras of the two regions; and, as Meyrick says, "The amount of community shown here is then no greater than might be expected if the conditions had always been as at present," etc. When we remember, moreover, that the New Zealand land-area was greatly elevated and extended far to the north-west in early Tertiary times, and, again, to a less extent perhaps, later, we may well be surprised that the affinities are not much stronger.

Reasons for the recognition of the New Zealand area as a primary zoological region were set forth in NATURE of January 11, 1900. Objections by Mr. Wallace were given in the issue of January 18, and support by Prof. Alfred Newton and Mr. Hedley in the issue of January 25, and April 19, respectively. In a letter to me, at that time, Prof. Newton wrote, "I have no doubt that the littoral marine fauna has also an exceedingly interesting story to tell"; and as the several groups of the littoral come to be worked and revised the more distinctly and clearly does this "interesting story" become known. In the preface to his "Manual of N.Z. Mollusca," 1880, that keen and indefatigable observer, the late Capt. Hutton, said, "The better the fauna of New Zealand becomes known, the more prominently does it stand out distinct from that of any other country"; and this is now being verified by all New Zealand naturalists. What makes the history of our plants and animals especially interesting and important is that this area is a *biological* region of primary rank (Holloway, *Trans. N.Z. Inst.*, vol. 55, p. 67; Cockayne, "New Zealand Plants and their Story," etc.), for here and here only the botanical region is coterminous or almost coterminous with the zoological region; and the evidence of the botany, zoology, geology, palæontology, the physical conditions of the land, and the form of the sea-bed all harmoniously contribute to the wonderful past history and present status and character of this remarkable region.

Of course the littoral marine fauna does not speak so clearly and forcibly as the land fauna, for species of some of the groups (hydroid zoophytes, mollusks, echinoderms, etc.) have recently been widely spread by oceanic currents, but the evidence, in the main, agrees with that of the terrestrial plants and animals.

The New Zealand sea-urchins have been recently revised and the number of known forms increased by Dr. Mortensen of the Copenhagen Museum (*Vidensk. Medd.*, Bd. 73, 1921); and Dr. H. L. Clark of the Museum of Comparative Zoology has given an excellent classification of the group, based upon all the light of recent research, in his "Catalogue of the Recent Sea-urchins in the British Museum," 1925. The littoral forms are those which inhabit the area lying between high-water mark and the hundred-fathom line (the continental shelf). Large portions of this zone are entirely unknown, and many more species will by-and-by be added to our list, which at present consists of 22 forms:

1. *Goniocidaris umbraculum*, Hutton.
2. *Austrocidaris benhami* (Mortensen).
3. *Cidaris sp.* (Young), Mortensen.
4. *Arœosoma thetidis* (H. L. Clark).
5. *Amblypneustes ovum* var. *pachista*, H. L. Clark.
6. *Holopneustes inflatus*, A. Agassiz.
7. *Pseudechinus albocinctus* (Hutton).
8. *Pseudechinus novœzealandiæ* (Mortensen).
9. *Pseudechinus huttoni*, Benham.
10. *Pseudechinus variegatus*, Mortensen.
11. *Pseudechinus grossularius* (Studer).
12. *Evechinus chloroticus* (Valenciennes).
13. *Heliocidaris tuberculata* (Lamarck).
14. *Clypeaster virescens*, Döderlein.
15. *Arachnoides zelandiæ*, Gray.
16. *Peronella hinemoæ*, Mortensen.
17. *Laganum depressum*, Agassiz?
18. *Echinocyamus polyporus*, Mortensen.
19. *Apatopygus recens* (Milne-Edwards).
20. *Brissopsis zealandiæ*, Mortensen?
21. *Spatangus multispinus*, Mortensen.
22. *Echinocardium cordatum* (Pennant).

The three known species of the first order of Echini (Cidaroida) appear to be endemic. *Goniocidaris umbraculum* is nearly related to the two Australian forms, *geranioides* and its variety *Kubaria*, of this small, southern, littoral genus, as now restricted. The three species belong to closely allied genera of a widespread, very ancient group, the Cidaridæ. The young Cidaris described by Dr. Mortensen may be the young of a known form, but is more likely that of an undescribed species.

Of the second order (Diadematoida) there are ten known forms. The first of these, *Arœosoma thetidis*, which occurs also off the south-eastern coast of Australia, is a species of a prosperous, widespread genus, the home of which is in deeper water. The specimens were obtained from 70 fathoms, and it is evidently a migrant from the continental slope. The two forms *Amblypneustes ovum* var. *pachista* and *Holopneustes inflatus* belong to a very interesting but difficult group (the Temnopleuridæ). These two genera are wide-ranging and closely related; and both species occur freely on the eastern and southern coasts of Australia; and have doubtless come thence. The next group consists of five endemic species of the essentially New Zealand genus Pseudechinus. Only one other species is known (*P. magellanicus*) from the southern coasts of South America, the Crozet and Marion Islands. It is closely related to *P. albocinctus*; and it has no doubt drifted from New Zealand. All its stations are in the area of distribution of the seaweed *Macrocystis pyrifera*. Hawkins has noted that two species, *P. albocinctus* and *P. novæzealandiæ*, have been found in raised beaches of probably Pleistocene age. *Evechinus chloroticus* is the commonest New Zealand urchin; and the genus is monotypic and endemic. The other species of the family Strongylocentrotidæ, *Heliocidaris tuberculata*, is a warm-water form, a migrant from the north, which occurs freely on the north-eastern coast of Australia and at the Kermadecs.

Of the third and last order, the irregular urchins (Esocyloida), nine species have been found in New Zealand. *Clypeaster virescens* belongs to a large genus, widely spread in the Indo-Pacific region. The specimens were collected north of New Zealand, and it is evidently a migrant from the north. *Arachnoides zelandiæ* is an abundant, endemic, rather ancient (Pleistocene) form; and the only other living species of the genus, *A. placenta*, is widely diffused in the Indo-Pacific region. Of the two species of the Laganidæ, *Peronella hinemoæ* is endemic, and closely related to a Japanese species,[1] *P. pellucida*; and the other has been referred to *Laganum depressum*, an Indo-Pacific species, but its identity is doubtful. *Echinocyamus polyporus* seems to be a rare species of a northern genus, which has been found in Cook Strait and at the Kermadecs.

We come now to the most interesting of all the New Zealand echinoderms, *Apatopygus recens*. It occupies in the littoral much the same position as the Tuatara (*Sphenodon punctatus*) in the land fauna; being the only living representative of a group which was abundant and widely distributed in Mesozoic times. Prof. Hawkins has examined specimens, and he tells us that "the original contention that '*Nucleolites*' *recens* is a latter-day survival of the essentially Mesozoic Nucleolitoida is perfectly justified. . . . Save for its ambulacral plating *Apatopygus* would not have been out of place on a Middle Jurassic beach" (*Geol. Mag.*, 1920, vol. 57, p. 396).

Of the three Spatangoids, *Brissopsis zealandiæ* may be endemic, but its identity is doubtful. *Spatangus multispinus*, an endemic species, belongs to a widespread, northern genus; and *Echinocardium cordatum* is interesting on account of its remarkable discontinuous distribution. It occurs freely, and is widely spread in the littoral of both the northern and southern temperate zones. The only other echinoderm which has a similar distribution is the little brittle-star *Amphipholis squamata*.

The facies of the New Zealand littoral echinoid fauna is then eminently Neozealandian, with a strongly marked distinctive character.

[1] There is a considerable element in the New Zealand littoral marine fauna nearly related to that of Japan; and one of the extremely interesting questions to be decided by future research, is how this has come about.

Annual Meeting of the British Science Guild.

THE annual meeting of the British Science Guild was held at the Mansion House, London, on April 29. The Right Hon. Lord Askwith, president of the Guild, who opened the proceedings, moved the customary resolution that the Right Hon. the Lord Mayor of London be elected a vice-president of the Guild.

Sir Richard Gregory, chairman of the executive committee of the Guild, then moved the adoption of the annual report, and directed attention to some of its salient features. Reference was made to the establishment of the Norman Lockyer Lecture as an annual event. The first lecture, delivered by Sir Oliver Lodge on November 16, 1925, dealt with "The Link between Matter and Matter." It was mentioned that a supplement to the "Catalogue of British Scientific and Technical Books" (a second edition of which was published in June 1925) is in preparation. Further progress has been made, in collaboration with other bodies, with a Science Publicity Service scheme, which has now been confided to a representative committee. It is hoped to report on the cost of establishing and maintaining the service, and the prospective revenue to be derived from endowment or payment for contributions, at an early date, at a further conference of representatives of leading scientific and technical societies. A memorial was forwarded to the Board of Trade during the past year referring to the importance of scientific qualifications for a Comptroller of H.M. Patent Office. It may be permitted to hope that this memorial, signed by many who are well known in pure and applied science, had some influence in deciding the recent appointment to this important post. Additions to the membership of the Guild have been encouraging, and useful work has been carried out by the South Australian Branch during the past year.

The resolution was seconded by Mr. F. Twyman, who alluded to important recent developments in pure science in Great Britain, and to the growing recognition of the value of applied science, as illustrated by the public interest aroused in the recent Optical Convention.

This resolution having been declared carried unanimously, Sir Richard Redmayne spoke on "The Future of the Coal Mining Industry." After pointing out the vital importance of devising a satisfactory scheme for the maintenance of this national key-industry, Sir Richard paid a tribute to the valuable summary of the position contained in the recent report of the Royal Commission. He pointed out