cule above a critical velocity, otherwise attachment is no longer possible.

It was found that the positive ion remains unchanged in nature down to 1/20 mm., which was the lowest pressure tried.

An account of these experiments will appear shortly in the *American Journal of Science*.

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Migrations in the Sea.

THE terms "anadromous" and "catadromous" are employed to distinguish fish which leave the sea to spawn in fresh water and fish which migrate from fresh water to the sea when they reach maturity. Gilson, in his paper, "*L'Anguille*" (1908, *Ann. d. l. Soc. roy. Zool. et Malacol. d. Belgique*, T. 43), proposed that the words should be used to define migrations to and from fresh water. The salmon, for example, is catadromous as a smolt, anadromous as a grilse, and so on. But unless new terms are to be created the words must be given a much wider significance than Gilson has suggested. The migrations of fish from the lower part of a river to the higher reaches, from a river to a stream, from the deep region of a lake to the shallows only differ in degree from the anadromous migration of the salmon. It cannot be said either that there is any difference requiring a new term in the migration of a fish from the sea into the lower part of a river or into an estuary. A fish which migrates from relatively deep water to the coast may also be said to have made an anadromous migration. There are species which may spawn in fresh or brackish water, and species which may spawn in salt or in brackish water. In short, it may be said that fishes present every degree of anadromous migration from mid-ocean to the upper limits of streams, and corresponding catadromous migrations. It is now proposed, therefore, that these words should be used to indicate the direction of the migration, however small or great that migration may be, whether passive or active, pelagic or demersal, seasonal or spawning.

But even with the wide meaning here suggested the words cannot be applied to an important feature of migrations in the sea—migrations brought about by current. The Gulf Stream is utilised by fish and other organisms for the conveyance of eggs and larvæ and young to, or towards, the continent, and its branches are no less importantly taken advantage of to convey the products from the spawning ground to a region which may be at some considerable distance. The drift may often be said to be an anadromous one, but it is sometimes catadromous, and frequently could not be defined by either term. The migration of the mature fish is in contrast to the drift of the larva.

This may be illustrated by reference to a species not a fish—the common edible crab, *Cancer pagurus*. The crabs on the east coast of Britain migrate, seasonally, catadromously from the coast for winter and anadromously to the shore region for summer. The mature females after ecdysis, sooner or later become ripe, and in response to the impulse thus conveyed migrate northwards along the coast. During or after this migration they become "berried." The larvæ, when liberated, are planktonic, and are carried by the current to the south. If there were, as there is some degree of evidence to show that there are, particular regions which present large associations of berried females, the young crabs would reach the bottom most numerous in areas to the south, which may be said to be related to the regions where the larvæ are liberated.

Thus with regard to this species there is a migration against the current of the mature females and a

migration with the current of the larvæ, and these migrations are clearly quite distinct from the seasonal movements which characterise the species at the other periods of life.

The relationship of the spawning ground to the region where the demersal fry are deposited is better defined in the case of many of our species of flat fish and round fish, since it results in the formation of schools of seasonal migrants.

To define these and other migrations which are intimately associated with currents it is necessary, therefore, to introduce two terms which will serve to indicate movement against the current and with the current. My colleague, Prof. J. Wight Duff, recommends a Latin root, *natare*. The words suggested therefore are *contranantant*, swimming against the current, and *denatant*, swimming or drifting with the current. The words *contranotation* and *denotation* are also available to indicate the act or habit of migration against or with the current.

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A Mistaken Butterfly.

IN this connection the case should be recalled of the Cleopatra butterfly of southern France and Italy, the close relative of our English Brimstone. By waving a grass-green butterfly net in its vicinity I have frequently attracted the yellow and orange coloured males, which will flutter after the net and endeavour to settle on it. The female is similarly coloured to the female Brimstone, but is rather larger. A blue net fails to attract them.

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THE "CRACKING" OF OILS AND ITS COMMERCIAL USE.

THE great consumption of petrol as a motor fuel, which last year, in spite of the disturbing element of war, rose to the enormous volume of 120 million gallons in England, and to nearly ten times that amount in America, has led to the attempt being made to add to the natural supply by the so-called "cracking" of the heavy residual oils left after the petrol and the lamp oil have been distilled off from the crude oil.

The term "cracking" is one of those delightful Americanisms which express so exactly the meaning we wish to impart that it has been adopted universally—when a molecule is decomposed it is broken up: when it is merely resolved into simpler compounds it is "cracked." The term first came over with carburetted water gas, when the oils fed into the carburetting chamber were said to be "cracked," i.e., converted into hydrocarbon gases of high illuminating value, but not "broken" into carbon and hydrogen.

A less violent form of the same operation can be utilised to convert the heavy hydrocarbon molecules in oil of high specific gravity and boiling point into volatile liquids fitted for use as a substitute for petrol. Most of the processes for doing this are based on a paper read by Sir Edward Thorpe and John Young before the Royal Society in 1871. This historical memoir was the first and only really scientific attempt to explain the actions that led to an increase in the yield of light hydrocarbons from a heavy oil under certain conditions of distillation, an action that