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Greater uniformity of temperature in the central region than had been secured by other experimenters after repeated attempts to adjust properly the crowding of windings was regularly obtained at widely differing temperatures even when heat losses through the ends were reduced merely by the action of the double plugs without supplying any heating current whatever to the coils in the end blocks. Adjustment of the temperature gradient was considerably facilitated by the installation of the flat coils covering the ends of the outer heater tube described above. This change also made it rather easy to produce fair uniformity for the entire length of the heater tubes—32 cm. longer than the bars the furnace was designed to heat.

That no unusual effort is required to obtain moderate uniformity of temperature is shown by the table below, which represents sixteen consecutive runs made while determining the expansivity of a bar of invar. Alongside the temperature observed at the center is recorded

TEMPERATURE DISTRIBUTION IN CONSECUTIVE TRIALS OF AN ELECTRIC FURNACE

TEMPERATURE	CORRECTION	TEMPERATURE	CORRECTION
390°	−0.16°	233°	−0.10°
393	−0.13	214	−0.05
278	−0.03	344	−0.05
271	+0.03	314	−0.10
242	+0.13	445	−0.25
170	−0.04	294	−0.05
188	+0.04	262	+0.03
207	−0.10	175	+0.15

the correction that must be added to obtain the mean temperature throughout the 30 cm. occupied by the bar. In many of the runs the heating currents required to maintain the desired temperature were estimated and switched on late in the afternoon. The furnace was then left to itself over night. The temperature distribution found the following morning was explored and used. Reference to the table shows that in only one case (and that under known unfavorable conditions) did the mean temperature differ by more than 0.16° from that at the center.

ZOOLOGY.—*Nocturnal animals.* AUSTIN H. CLARK, National Museum.

In the discussion of zoögeographical problems, and especially in the reconstruction of hypothetical land bridges over which animals are assumed to have migrated from one region into another, comparatively little attention has been paid to analyzing the data upon which sweeping generalizations are based.

We are tempted to consider as a homogeneous unit all of the animals collectively occurring in any one locality, speaking of this unit as the "fauna" of this locality, and forgetting that in reality it is a heterogeneous collection of animal forms derived from all of the more adaptable and virile types in all the faunal complexes which from the distant past to the present day have swept over the region.

Since in reality the terrestrial animals of any given locality collectively form a heterogeneous faunal complex, instead of a homogeneous entity, it becomes essential that we should endeavor to find some criterion by which this complex may be separated into its original constituents, or at least whereby a beginning may be made in this direction.

On land, abundance of light alternates with a more or less complete absence of light, and we therefore find many animal types which are strictly diurnal, like most birds, many which are strictly nocturnal, like the bats, and many which are indifferently one or the other, like most insects.

Nocturnal animals, properly speaking, are animals which, while capable of performing all their normal functions in the day time, and not dependent upon other nocturnal animals, are active only at night.

Thus none of the amphibians come within the category of nocturnal animals, for the amphibians are active whenever the humidity is high enough so that they are in no danger of dermal desiccation, whether at night or during rains; similarly, though active chiefly or entirely at night, none of the terrestrial crustacea or molluscs are properly nocturnal.

Many of the herbivorous mammals are most active at night, at which time they often make long journeys for water; this is done to avoid overheating and loss of too much water from the body, and, in many places, to avoid certain insects, such as the species of *Simulium*, *Glossina*, the Tabanidae, etc., which, larger and more dangerous than any nocturnal insects, always breed in or near water and bite only in the daytime.

The predacious mammals and birds are active chiefly (though not by any means entirely) at night for the reason that, following the path of least resistance, they always conform to the habit of taking their prey when it is least able to defend itself, and therefore they must be considered as fortuitously, not as truly, nocturnal.

The day is physiologically the most favorable time for the performance of the normal functions of animals, and at the same time it is the period of greatest meteorological and thermal diversity. Therefore it would seem that new types of animals would always first arise as diurnal species.

If a new animal type arose as a diurnal form, and proved virile and adaptable, it would soon populate all available situations, and would increase so that there would be no room for further additions to its numbers.

But a type sufficiently virile and adaptable to attain such a condition would most assuredly give rise to crepuscular, and finally to nocturnal, forms. It is at this developmental stage that we find, for example, the rodents and the lepidoptera of the present day.

A new type of subsequent origin, of the same habits but economically more efficient, would follow the same course, and therefore would extirpate the diurnal species of the preceding less efficient type long before it had any effect upon the nocturnal species, so that, when the second type had become fully established, we would find it consisting of diurnal and crepuscular species, while the older type would consist of strictly nocturnal species hiding by day and encroaching upon their more efficient rivals' food supply at night.

This is exactly the process by which the deep sea fauna has been formed from the littoral fauna.

The strictly nocturnal mammals are the elephants, the hippopotamus, the tapirs, the rhinoceros, the sloths, Galeopterus (Cynocephalus), the anteaters, the aard varks, the armadillos, the pangolins, the bats, the opossums, the solenodons, the lemurs (except in Madagascar), and the monotremes (except the aquatic species); among the birds the kiwis and the owl-parrots (Stringops) are nocturnal, and among the reptiles the geckos; among the invertebrates the most striking and isolated nocturnal types are the onychophores and the millipeds.

A glance at this list of strictly nocturnal types brings out many points of interest.

Among the birds and mammals the average size is much greater than that of the diurnal types.

Most of the nocturnal mammals have long palaeontological records, and, collectively, the included groups are considered as much more ancient, primitive and aberrant than the diurnal types.

Taken as a whole the nocturnal animals of the globe indicate zoögeographic affinities very different from those indicated by the diurnal animals; for instance, the nocturnal fauna of America shows a close affinity to that of Africa, and also an affinity with that of Australia, while the occurrence of tapirs, otherwise confined to the Malayan region, is of interest; but the affinity indicated by overwhelmingly the greater part of the diurnal fauna of America is with eastern Asia.

The two fundamental differences in the conditions under which the nocturnal animals live as contrasted with the diurnal are (1) the much lower and more uniform temperature, and (2) the more or less complete absence of light.

It is precisely these two differences which delimit the conditions under which the abyssal marine animals live as contrasted with the littoral marine animals, and we are therefore not surprised to find that the nocturnal fauna of the land corresponds in its relation to the diurnal fauna exactly to the abyssal fauna of the oceans in its relation to the littoral fauna.

This comparison enables us to understand how a given type (as for example the bats), exclusively nocturnal in the tropics, may become more or less diurnal in the cold northern regions, just as an organism confined exclusively to the abysses in the tropics may become sublittoral, or even littoral, in the antarctic or in the arctic; for the coëfficient of virility and adaptability necessary to enable an animal type to thrive under nocturnal conditions in the tropics, or in the deep sea, is equivalent to that necessary to enable it to exist in unnaturally cold surroundings, or in unnaturally great diurnal temperature variations.

In this short paper no attention has been paid to the innumerable intergrades between the intertidal fauna, and the faunas of the land and of fresh water, or to the singularly instructive faunas of deserts, wet belts, saline lakes, caves, or of abnormal situations in general, nor to isolated island faunas, nor to the characters presented by burrowing animals collectively considered, nor has attention been given to the singular fact that, parallel to the abstract similarity between the nocturnal terrestrial fauna and the abyssal fauna of the oceans, the fresh water fauna is actually more closely allied to that of the deep sea than either is to the littoral fauna from which both have been derived, but in which the ancestral types have been supplanted by more efficient types of subsequent origin which as yet have not intruded either into the fresh water or into the deep sea; though these points, and many others, have a very intimate bearing upon the problem of the nocturnal terrestrial fauna.

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. Each of the scientific bureaus in Washington has a representative authorized to forward such material to this journal and abstracts of official publications should be transmitted through the representative of the bureau in which they originate. The abstracts should conform in length and general style to those appearing in this issue.

AGRICULTURAL CHEMISTRY. *Selective adsorption by soils.* E. G. Parker. Journal of Agricultural Research 1: 179–188. 1913.

Soils not only have the power of adsorbing dissolved salts from solutions but also of adsorbing one ion at a greater rate than another.

The presence of bases of the soil (Ca, Mg, etc.) in solution after shaking certain salt solutions with or percolating them through a soil is probably not due to a direct chemical reaction of the salt in solution with the silicates of the soil, but to a reaction of free acid, resulting from a selective adsorption of the cation, with the mineral components of the soil. The rate of adsorption of chlorin ions from a solution of potassium chlorid by soils is much less than of potassium ions. The selective adsorption of potassium from a potassium-chlorid solution by a soil increases in amount with the concentration up to a certain point and then remains practically constant. In general, the smaller the soil particles the greater the selective adsorption of potassium from a potassium-chlorid solution. The presence of sodium nitrate decreases the adsorption of potassium from a solution of potassium chlorid by a soil up to a concentration of about 37.5 grams of potassium chlorid per liter and then increases it. The presence of monobasic calcium phosphate does not change appreciably the adsorption of potassium from a potassium-chlorid solution.

Finally, if a mineral fertilizer be applied to a soil and exposed to the rain and thus dissolved and carried through the soil in solution, these substances will be adsorbed (an entirely physical phenomenon) either as a whole or selectively from the solution by the vast surface of the soil particles and will be held there by this same physical force until the plant or subsequent leaching removes it.