and named in the work reviewed) and the eastern American *Tamias*. The two latter overlap in the region around Lake Superior. Singularly enough, the Siberian *Eutamias* resembles in a number of characters the eastern American *Tamias;* so much so that Pallas in 1778 thought that the Siberian and American animals were mere forms of a single species. However, the dentition of *Tamias* is the most modified, the upper premolars being reduced to two, instead of four as in the other two groups. Howell treats *Tamias* and *Eutamias* as genera (following the current usage of modern authors), and *Neotamias* as a subgenus of the latter. The probable inference would seem to be that *Eutamias* represents most nearly the stem-form, having at an early date sent to America the ancestors of *Tamias,* and more recently those of *Eutamias,* which, being a livelier and more variable animal, supplanted *Tamias* in the west. This is at present mere guessing, but it may be that fossil *Tamias* will be found in the west some day.[1] The characters and distribution considered, there is perhaps some basis for considering *Neotamias* a genus (type *Neotamias merriami* Allen).

When we come to the species and subspecies, there is very much of interest. In *Tamias,* Howell recognizes one species with five subspecies. In *Eutamias* (*Neotamias*) he has sixteen species and sixty forms in all, including subspecies. The subspecies are found to intergrade and it is to be determined whether these intergradations are directly related to the environment or whether they are due to crossing between races which meet each other in some part of their range. That the environment affects the characters is shown by the repeated development of dark or richly colored animals in humid districts, and pallid ones in drier districts. An interesting case is that of *Eutamias minimus caryi,* which occurs only in the dry lowlands of the San Luis Valley, Colorado, while the mountains northward, eastward and westward are occupied by the larger and darker *E. minimus operarius.* At 8,200 feet specimens were found connecting these races. Reviewing the numerous cases of intergradation recorded, one is struck by the various combinations of characters, exactly as in the case of hybrids. It seems certain that we have to do with hybridization in the majority of instances, and this in itself need not necessarily indicate subspecific rather than specific rank. But in any case, the "subspecies" are closely allied, and their precise rank is a matter of minor importance.

Although the work has been so thoroughly done, the subject is by no means exhausted. There are still many localities where collecting is desirable, and additional forms may yet be found on isolated mountain ranges. Hybridization in captivity should be attempted. Many anatomical features have yet to be compared in the different forms, for example, the auditory ossicles, the alimentary canal, the musculature. Although it is outside the scope of Howell's revision, one would like to see a chapter on the internal and external parasites and the predatory enemies. The food habits are treated interestingly and quite fully by Howell, who also discusses nesting habits and hibernation. We are not quite sure that the chipmunks would approve of a picture of a weasel on the cover of the work.

The bulletin may be purchased for a trifle, but we wish the government would use better paper and type for such important papers of permanent value.

T. D. A. COCKERELL

BOULDER, COLORADO,
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[1] An extinct species, *Tamias nasutus* Brown, has been found in the Pleistocene of Arkansas.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE SPOT-PLATE TEST FOR NITRATE NITROGEN IN SOIL AND OTHER EXTRACTS

THE diphenylamin test, usually conducted as a "ring" test, gives purely qualitative results. The blue color that appears in the ring test is lost when the sulphuric acid reagent and the liquid to be tested are mixed together, since it occurs only in sulphuric acid concentrations of 70 to 90 per cent. There is a definite need for a quick and simple nitrate test for soil extracts, drainage waters, plant juices or plant extracts that gives approximate quantitative results. For instance, in the field of soil science, it is desirable to study the nitrate nitrogen content of the soil from day to day or from week to week during the growing season. Exact quantitative measurement by the phenyldisulphonic acid or Devarda's alloy methods is laborious and the delay involves a loss of valuable time before necessary corrective steps can be made, as is the case when the soil drops so low in nitrate nitrogen content as to fail to nourish the plant properly.

The author has applied the principle of the very sensitive diphenylamin color reaction to a spot-plate technique. The reagent is a freshly prepared solution of 0.05 gm of diphenylamin in 25 cc of concentrated C. P. sulphuric acid. This is conveniently used from a glass-stoppered bottle of clear glass. The writer has attempted to use amber glass contain-

ers, but for some reason the reagent is contaminated by contact with the ground glass stopper of the amber-colored dropping bottle. Hence it seems preferable to make up at once only a sufficient amount of the reagent for use within two or three days' time, rather than attempt to store it in only partially light-proof bottles which might produce contamination.

A common artist's slab with circular depressions one inch in diameter and one fourth inch deep is the most convenient vessel for conducting the test. One drop of the solution to be tested is transferred to one of the depressions by means of an eye-dropper pipette. Four drops of the reagent are added, and the liquid stirred with a two-inch glass rod until a full color develops, which requires about two minutes. The intensity of the blue color is an approximate quantitative measurement of the nitrate nitrogen content, within the limits of from 1 to 25 p.p.m. of nitrates expressed as nitrogen. Above about 25 p.p.m. the blue color is so intense that little variation can be observed. In such cases the liquid to be tested must be diluted five, ten or more times, so that one drop of the diluted liquid will fall within the above limits. In such cases the final test is on the basis of one drop of the diluted liquid to four drops of the reagent, with calculation of results on the basis of the dilution.

A color chart of satisfactory accuracy can be made up with water colors. The color blocks in Ridgway's "Color Standards and Nomenclature," that most closely approximate the chart used by the author, is as follows:

Nitrate nitrogen concentration p.p.m.	Color name	Book Plate No.
1	Pale forget-me-not blue	XXII
2	Pale violet blue	IX
3	Light violet blue	IX
5	Dull violaceous blue	XXII
7	Phenyl blue	IX
10	Helvetia blue	IX
15	Hays blue	IX
20	Cyanine blue	IX

The purity of the reagent can be ascertained by a blank test with one drop of distilled water. If no permanent blue color appears, the reagent is satisfactory for use on that day.

The results of the author and one of his associates in the determination of nitrate nitrogen in the leachate from 136 greenhouse lysimeters containing seventeen different soils, some pots of which had been previously treated with urea, both with and without lime, are of interest as an evidence of the accuracy of the spot-plate test. One person made the nitrate-nitrogen determination by the accurate phenyldisulphonic acid method, while the other conducted the spot-plate tests. Results were compared subsequent to recording the results. Space does not permit publication of the individual results, but the following table summarizes the data in comparative form:

No. of samples in group	Exact method NO_3-N p.p.m.	Spot-plate tests NO_3 N p.p.m. range	Spot-plate tests No. of samples within group limits
23	0– 20	0– 25	20
18	21– 50	20– 75	14
27	51– 100	30– 150	19
28	101– 200	75– 300	20
19	201– 350	200– 500	16
15	351– 500	300– 600	11
6	501–1000	500–1000	5

Several applications of this test suggest themselves. For soil tests, the author employs the special porcelain block used in connection with the LaMotte-Morgan Soil Testing Set to obtain the soil extract. Where the soil compartment of this block is filled to its normal capacity and distilled water permitted to soak through the soil in amount sufficient to fill the test cup, one drop when transferred to the artist's slab and tested for nitrates as described above gives results in p.p.m. of soil extract which can be interpreted as pounds of nitrate nitrogen per acre to plow depth. Dilutions are employed when necessary.

Another very important use of the test is the determination of nitrates in expressed plant juices and extracts. A suggested method is the maceration of small portions of fresh plant tissue in one compartment of the artist's slab, the addition of a drop or two of water if necessary in order to obtain a drop of expressed juice for transfer and the subsequent test. Good results have been obtained with green tissue in studies of the nitrate content of newly developed nodal portions of herbaceous pasture and forest plants.

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EXPERIMENT STATION

THE CAPNOMETER, AN INSTRUMENT FOR THE MEASUREMENT OF AIR POLLUTION

FROM the beginning of Mellon Institute's Air Pollution Investigation, a year ago,[1] it was recognized that the photoelectric cell would play an important part in the determination of the amount of atmospheric contamination and its distribution outward and upward from sources. Sampling devices ordinarily enable one to estimate the content of solids in a small volume of air at a given time and place, or the total amount at a given place over a period of

[1] L. W. Bass, SCIENCE, 70: 186, August 23, 1929.