essential, there has often been small provision for the searching preliminary investigations demanded by the situation. Studies of the mining fields are numerous, some excellent and thorough, but many have been entrusted to men of little experience, whose results are anything but satisfactory to those who try to use them in actual practise. Almost invariably these reports ignore the accessible but hardly wrought opinions of precedent workers who have successfully applied their observations in hundreds of instances. This method has become so clearly recognized as a 'geological survey habit' that one does not now expect otherwise. The survey has grown to such gigantic proportions that it can not much longer contain itself. It would be better to diminish its scope than to essay the suicidal rôle of autocrat of American science. With a better appreciation of the shortcomings of some of its own crew, whose hasty and superficial work has caused them to guess that they know more than they really have learned, it is probable that the national bureau would raise more enduring monuments than can be possible under existing methods. Studies of regional geology and monographic productions at the hands of the recognized leaders in geology have largely given place to '*omnium gatherum*' publications of temporary and chamber of commerce application.

In conclusion, it does appear to one friend of the survey that the value of the good will and well-deserved support of the ablest workers in geology is of more consequence than the ephemeral and illusive prestige which may enable the organization to ride rough shod over all as supreme arbiter. Such greed of power, if it really exists, as many have long suspected, can not be long concealed. And once it comes out in the open, its death-blow is self-inflicted. The real fear, that thing of which geologists derated by the survey are actually afraid, is that the just outcome of its energy and resources may not accrue to the legitimate ends in view in its original establishment. This question transcends personal considerations, and it certainly is involved to some extent in the recently published discussion which is the text for this communication.

THEO. B. COMSTOCK

LOS ANGELES, CAL.,
January 12, 1907

SPECIAL ARTICLES

VARIATION IN MOSQUITO HABITS

DURING the summer of 1906, a more systematic series of observations was made on the salt-marsh area near the city of Elizabeth, New Jersey, partly to determine the number of broods, partly to ascertain the relative proportion of *C. cantator* and *C. sollicitans,* and partly to learn more of their migrations.

Generally speaking, we knew that the number of broods varied with the season, and that it was largely a matter of tides and storms as to how many there would be. We knew also that in the southern part of New Jersey *C. sollicitans* was the dominant species, *C. cantator* forming only a small minority early in the season, and that *cantator* was dominant in the northern section at least during the early part of the summer. Concerning the migrations we knew that they occurred; but just how long they were continued and how far they extended was yet a question.

As early as April 19 there was a full brood of larvæ in the pools and these matured before the end of the month. It formed brood I. of the season, was almost all *cantator,* and the adults left the meadow soon after hatching and traveled inland along the valleys of the Rahway and Elizabeth Rivers. On May 2 they were met with in great numbers at Millburn and covered the entire territory between that and the marsh, a distance of about twelve miles in a direct line. This migration was not followed from the marsh directly.

The II. brood was in the pools, already well grown May 10 and reached the adult stage May 15, 80 per cent. *cantator,* 20 per cent. *sollicitans.* It was also a large brood, left the meadow promptly in large proportion, and was followed through the Elizabeth Valley to Elizabeth, Aldene, Salem, Union, Springfield and Maplewood. It also extended all along the first ridge of the Orange Mountains and reached Summit, a distance of fifteen miles

from their place of birth. Just how far beyond that individuals traveled we could not determine, but as that country is hilly they got no further in swarms. Specimens in numbers are recorded from Madison, however, from a previous year's collection.

June 1, while brood III. was in the early larval stage and all the migrants had left the marsh, one of my assistants spent the night on it with instructions to capture and record every specimen that alighted on him or attempted to bite. The record is as follows:

Between the Hours	Cantator	Sollicitans
5– 6 P.M.	16	9
6– 7 "	23	19
7– 8 "	30	27
8– 9 "	13	14
9–10 "	5	7
10–11 "	1	1
11–12 "	2	0
12– 1 A.M.	1	0
1– 2 "	2	0
2– 3 "	0	2
3– 4 "	1	3
4– 5 "	14	20
5– 6 "	22	46
	130	148

It appears, therefore, that as between the two, *sollicitans* seems to have a period of rest during the middle of the night, but is much more active than *cantator,* especially in the morning hours. And the proportion is greater than shown by the figures, because the actual number of *cantator* on the meadow was as about 8 to 2 of *sollicitans.*

The advance guard of brood III. emerged from the pools June 10 and then came a series of high tides that brought killifish everywhere on the meadow and simply swept what remained out of existence. The survivals were 70 per cent. *cantator* to 30 per cent. *sollicitans* and none of these extended inland further than Short Hills, a distance of about ten miles from the marsh.

Brood number IV. was in the pools June 24, and on the wing July 3. It was a small brood, almost evenly divided between the two species, and the flights extended to Short Hills July 14 and probably to Summit as well; this latter record based upon specimens sent in at the time.

Brood V. came to maturity between July 23 and 28, consisted of 80 per cent. *cantator* and did not get beyond Irvington, about five miles away. It was small in numbers.

Brood VI. was a very large one which reached the adult stage August 13, 85 per cent. *sollicitans* to 15 per cent. *cantator.* It was the first brood in which *sollicitans* was dominant and it left the meadows almost immediately. A day after they began to emerge the highlands approaching the marsh were swarming with adults while the marsh itself was comparatively free. This brood traveled almost due west and supplied the heaviest swarm of the season for Summit and intervening places. Fully 90 per cent. of this brood left the meadow.

Brood VII. matured August 31 and was a small one, 65 per cent. *sollicitans,* 35 per cent. *cantator.* Contrary to the one before, this was a stay-at-home brood; not 10 per cent. left the meadows and none got much if any beyond North Elizabeth, only a mile or two from the marsh.

Brood VIII. was on the wing September 18, 70 per cent. *sollicitans,* and was also a stay-at-home. It was also a small one and did not get much beyond the immediately surrounding highlands.

Brood IX. was on the wing October 2, also small in size, 90 per cent. *sollicitans* and not a migrant.

Brood X. was in the pools October 12, largely *sollicitans* and most of them fell victims to fish carried up over the meadows by the early fall tides. Very few adults were observed later and there was no migration. After this breeding was irregular and while larvæ of *cantator* were found as late as November 30, it is perhaps questionable whether any of the insects reached the egg-laying condition.

The interesting point here is the difference between the broods in their tendency to migrate. The early broods always migrate freely as far as my observations extend, and whenever meadow conditions are favorable, the first

days of May find a cloud of marsh mosquitoes sweeping inland.

As the marshes are usually waterlogged in early spring and every pool clean up to the highland holds water, the hibernating eggs hatch in large proportion and the broods are large.

An interesting question arises here. The migrants are almost exclusively sterile females: the eggs from which many of them hatch have been on the marsh from early the year before, ready to hatch when opportunity offered. Is there any relation between the age of the egg and the sterility of the females resulting from them? The matter will not be easy to demonstrate because of the difficulty of securing pairings in confinement.

JOHN B. SMITH

COLOR INHERITANCE IN MAMMALS

PROFESSOR CASTLE'S interesting article in SCIENCE of January 25 clears up an important point, and renders it possible to explain certain phases of color inheritance in swine and in cattle. For the most part, his factor A, which determines the arrangement of pigment giving the agouti color, seems to be wanting in these two classes of domesticated animals. Perhaps it has been lost. It seems to be present in the wild boar of Europe, which has been used in breeding experiment by Mr. Q. I. Simpson, whose work has furnished important data for the elucidation of color inheritance in swine. In a few instances there is a tendency in certain breeds of swine for red pigment to predominate near the extremities of hairs; in the Berkshire breed occasional individuals show this tendency, and I have seen the same in crosses between this breed and Hampshires. The tendency is never well marked, so that in these animals the function A is presumably present in a weakened condition.

For the most part black and red in swine and cattle evidently behave just as they do in guinea-pigs. Aberdeen-Angus (black) cattle crossed on Herefords (red and white) give blacks. The heterozygotes bred back to Herefords give blacks and reds in approximately equal numbers. In swine, red and black each appear to present more than one type, and the various reds and blacks do not behave quite the same. Tamworths, a red breed of swine, present at least two distinguishable forms of red, namely, light red and dark red. The light becomes lighter with age, and the dark darker. Light is also dominant to dark. When light red is crossed on Chester white the progeny is red roan. Dark red crossed on Chester white gives clear white.

Most black breeds of swine, when crossed with Tamworths or Duroc-Jersey (both red), give black and red spotted, but Hampshires (black with white belt) crossed with red give the Hampshire coloring. This shows that Hampshire black and Berkshire black differ.

It is highly significant that the same color factors should exist (apparently) in guinea-pigs, rats, mice, rabbits, swine and cattle. This fact may be of great service in breeding fixed color types in farm animals.

Professor Castle's clear explanation of color types in Guinea pigs will doubtless aid greatly in comprehending the data on color inheritance in swine which the committee on animal hybrids is collecting for the American Breeders Association.

The object of this communication is not, however, to call attention to the parallel in color factors in different classes of mammals, for there is not at hand sufficient data to demonstrate a complete parallel. It is rather to call attention to a simple method of expressing the allelomorphic constitution of organisms, and one which renders it easy, when this constitution is known, to display the necessary results of a given line of breeding. We may use Professor Castle's data in illustrating the method.

The allelomorphic formula of a homozygous individual may be represented by AA, BB, CC, etc. The gametes produced by such an individual would be ABC, etc. Letting G stand for the factor which determines the agouti color, Bl for black, and R for red pigment, and letting A stand for the absence of G, B for the absence of Bl, and C for the absence of R, the formulæ for the several types of color discussed by Professor Castle would be: