

plants and animals and often affording a basis for specific distinctions.

In the late Dr. Charles Mohr's 'Plant Life of Alabama,'* which deals more exhaustively with geological features than any state flora previously published, these superficial sands are designated as 'Ozark sands' (doubtless named for Ozark, Ala.), a term which I have not seen used elsewhere. This formation is only mentioned three or four times in the work, however; so Dr. Mohr perhaps failed to perceive its important bearing on the distribution of the flora. If the 'Ozark sands' should ever be regarded as distinct from the typical Columbia, the superficial sands of South Georgia would of course be classed with them.

On my travels during the past summer frequent use was made of Mr. McGee's map (accompanying his monograph already mentioned) of the areal distribution of the Lafayette and Columbia formations, which I found to be remarkably accurate (in Georgia, at least), considering the small scale on which it is drawn and the large amount of territory covered by its author. Most of the discrepancies between the map and the observed conditions were naturally found in those regions never explored by Mr. McGee or any other geologist.

With a good series of maps, especially topographic maps, of the southeastern coastal plain it would not be difficult to trace with considerable accuracy the areas covered by the Lafayette and Columbia formations, but no topographic maps of any considerable portion of the coastal plain of Georgia have yet been made, and the data for them are as yet very meager. It is not even possible to get level notes from all the railroads in South Georgia, and the same condition doubtless exists in the corresponding portions of the adjoining states.

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INSTINCT IN SONG BIRDS. METHOD OF BREEDING
IN HAND-REARED ROBINS (*MERULA*
MIGRATORIA).

ON June 17, 1902, a pair of robins (*Merula migratoria*) confined in a large room with some

* 'Contr. U. S. Nat. Herb.' Vol. 6, 1901.

hundred and fifty other birds, of various sorts, hatched eggs which had been laid for some twelve days. This pair of robins were birds about four years old, and were what are known as hand-reared birds. I had taken them when very young from wild parents and raised them by hand.

On examining the nest after the second day I found there was only one young bird. It appeared to be perfectly healthy and normal, and so matters went on until the fourth day. On the morning of the fourth day I found the young robin had disappeared from the nest, but the female bird was still brooding. It now occurred to me to substitute two wild young, rather older, from a nest of robins that had been hatched out of doors in the yard. I introduced these two young birds to the parent birds, with some remonstrance on their part, but within five minutes of the time when I placed them in the nest the old birds were feeding them, and were apparently as solicitous for them as if they had been their own. At the close of the day, the substitution having been accomplished early, and I having watched the birds closely, it appeared to me that only one of the two young birds was being fed, and I took the other from the nest to rear it by hand.

Both young birds are now going about, beginning to fly, learning to eat unaided, etc., I feeding one, and the male parent robin feeding the other.

The following comments suggest themselves to me:

To go back in the history of the parent birds, they were birds that were taken from a nest in May, 1898, and were naked and blind, probably not more than three days old when adopted. The usual method of procedure which I have employed in rearing wild birds by hand is to take an entire brood and nest, and keeping the young birds as undisturbed as possible, to do practically as near what the old birds do as is attainable.

It is unnecessary to suggest that the parent birds I am speaking of are healthy and vigorous, because the very fact that they have bred in captivity seems to determine this. A word seems essential to their method of nest-build-

ing. All the robins that I have in captivity, some sixteen or seventeen in number, of which three or four pairs breed annually, are unable to build a nest-structure, though furnished with every facility, except under particular conditions which I am about to relate. They have been unable apparently to erect a nest of the conventional robin type. The trees in the room in which they are confined seem to present every kind of fork and crotch and angle of branch that robins select out of doors for nest sites. After watching these birds for two years in their efforts to build nests, when they were supplied with every material, the *mud* for the *cup* and all kinds of *grasses* and *rootlets* for the foundation and superstructure, I found that apparently they were unable to formulate a nest that would stay together. I therefore provided them with small circular baskets, which were at once taken possession of, and generally the process of nest-building was as follows: They selected various grasses and rootlets, and after much work, covering a period of some three or four days, they lined the baskets in a manner that seemed to them satisfactory, when they proceeded to lay eggs and go through the ordinary and regular processes of robins' lives during the breeding season. However, in most cases they were so much interfered with by the other birds at large in the room with them that they failed to succeed in hatching their eggs; or, if they did hatch them, the young were destroyed by other birds whenever an opportunity was given.

It is rather difficult in such a heterogeneous company to determine exactly what transpires; but this is about the case: They do not attempt to build any *cup of mud* in such a nest as I have indicated, but the particular pair of robins in question did not put a *mud floor* in the basket. I was unable to see them feed or take care of the very small young robin which I observed in their nest and which was their own progeny, during its early infancy; but when I substituted the foster-children, as I may call them, that were older than the young bird, all the operations of feeding and taking care of the young were apparent. The female bird brooded the young ones for periods of

from fifteen minutes to an hour, while the male bird constantly brought her food for the young. He also *removed all excrement as it was evacuated* and carried it at least ten feet away from the nest, and generally farther. Twice I saw him eat the excrement after he had laid it on the floor. I have watched robins carefully out of doors; and so far as I am able to judge, these robins in captivity went through all of the actions and attained all the results that robins attain with broods out of doors. It is not a little singular that they neglected, or that I fancied they neglected, to take care of one of the young ones, and that their attention was entirely concentrated on a single bird. All of these actions that I have recorded must have been instincts awakened by the various stimuli which precede instinctive acts, for no education by imitating the acts of older birds was possible.

It is also interesting in this connection to record the fact that another pair of robins breeding, or attempting to breed, under similar conditions, so far as I know have failed to lay eggs, or their eggs have been stolen by other birds after they were laid. However, the female parent is incubating and is fully as '*broody*' as any hen would be under like circumstances. That is, I may go up to the nest where she sits, and it is absolutely necessary for me to take her from the nest by force if I wish to see what is beneath her. At such times she bites my finger and fights, and when removed from the nest, utters all the alarm cries and notes that a bird out of doors does when disturbed.

The special point to bear in mind in considering the foregoing records is the fact that all of the birds in question were hand-raised—birds that cannot have gained anything by experience or education from acts performed by their parents; and all of their doings that I have recorded I suggest are in the line of pure instinct.

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A NEW SHORT METHOD OF MULTIPLICATION.

THE following method of multiplication has been tested by several years' constant use and