A NEW IDEA-EXHIBIT TO ILLUSTRATE EVOLUTION

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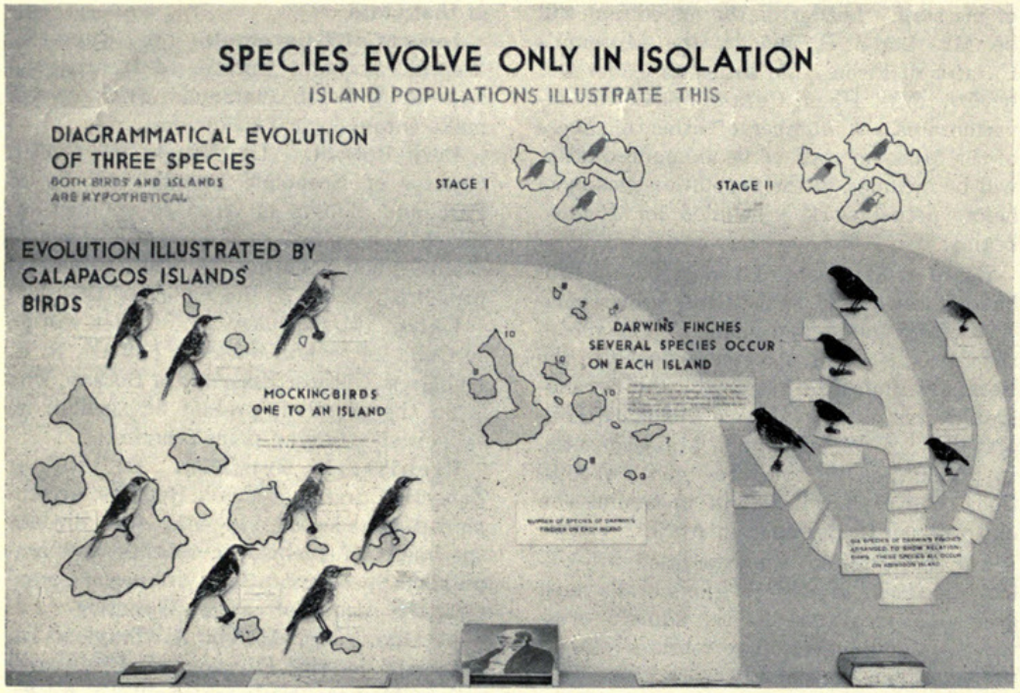
THE NEWEST exhibit placed in Hall 21 (Systematic Collection of Birds) shows how evolution works to produce new kinds of birds.

A museum is designed to deal with objects, with concrete things, called specimens. Specimens are kept, exhibited, and studied. But out of these studies emerge ideas; the ideas deal with the interpretation and with the relationships of these objects. And these ideas find their way into the exhibits.

The commonest idea expressed in bird exhibitions is that of relationships. The mounted specimens are arranged row on row, so that they are grouped in natural families, with the birds so arranged in each family that the closest relatives are next to each other. This is the main theme underlying the systematic arrangement of birds of the world in Hall 21.

We also have, in our North American series, a series of mounted birds selected with the idea of showing what birds live in a restricted area. Another idea appears in our group of restorations of fossil birds, with its glimpse of the ancestry of our present-day birds. Our exhibit "What Is a Bird" has as its central idea the differences between birds as a group and mammals, fishes, reptiles, and amphibians. Other exhibits have as their themes the birds introduced into North America and the birds exterminated in modern times. Complicated ideas can be expressed by the proper arrangement of specimens, with a minimum of words.



THE 'HOW' OF EVOLUTION

The exhibit recently installed illustrates part of the process by which new kinds of birds have come into being, are coming into being, and will come into being in the future. It is an illustration of the theory of evolution, predicated upon descent with modification.

No two birds of any kind are exactly alike; each bird shows differences. Sometimes these differences are small, discernible only on close comparison; sometimes the differences are considerable, apparent in a casual glance. Some individuals are better equipped than are others to find their food, mate, and escape their enemies. This variability is the raw material of evolution. Each year many birds die, from the weather, their enemies, or other causes. They are the less fit; the fittest survive. This is selection. Selection, working on variation, causes the population of an area to change gradually and become different.

Just as no two individuals are alike, no two places are exactly alike. Thus selection acts differently in each place. It follows, then, that the populations in various places will gradually become different, due to the different selection of different places. Although birds in different places may become very different, so long as the populations are in touch with each other they do not divide into species. For this crucial step to take place, for two different populations of one kind of bird to develop into two new kinds, another factor, isolation, must be present. The populations must be separated from each other.

ISLANDS IDEAL FOR STUDIES

Though all the birds of a Chicago garden are related and descended from a common ancestor, this relationship can only be inferred. They evolved so long ago, when conditions, through geographical time, were so different, that we cannot follow their relationships except through inference. But if we examine island groups where conditions are simpler, we can see more plainly how evolution works, for here the faunas are smaller and evolution in the process of operation can be charted. It was the conditions in the Galapagos Islands, the islands represented in our exhibit, that helped Darwin crystallize his ideas leading to the original formulation of the theory of evolution. And Darwin did not exhaust the interest of the Galapagos to biologists.

No natural example has quite the clear-cut decisiveness of a diagrammatic presentation. So in the Museum exhibit, instead of starting with a real example, we present first what happens on three hypothetical islands. From the distant mainland a pair of birds wandered by chance to one of these hypothetical islands, which was so far distant from the mainland that few kinds of birds had ever reached it. Competition was not keen and the birds thrived. Soon, through chance wanderings, the other two islands not too far away were colonized from the thriving population on the first island. On each of the three islands there then lived populations isolated from each other and from those on the mainland. This is the condition illustrated by Stage I.

The conditions on each island and on the mainland whence the island colony ancestors came are different. Gradually, through selection, each island population comes to

KEY TO EVOLUTION CHART

HOW SPECIES COME INTO BEING IS ILLUSTRATED BY EXAMPLES. Every individual bird differs from every other one, and each population from every other. Only where populations are isolated do they evolve into species. On island groups, where conditions are simple this is most easily seen.

UPPER RIGHT: A hypothetical example shows two early stages in speciation. Stage I: the same kind of bird has reached three islands; Stage II: through evolution each island population has evolved into a different species.

LOWER LEFT: The Galapagos Islands mockingbirds are an example of the early stage of evolution (Stage II). Long ago they came from the American mainland. In island isolation they evolved into different forms, but never more than one kind to an island.

LOWER RIGHT: When more than one species occurs on an island it is the result of successive invasions. Birds may wander occasionally from island to island. If this occurs before they have evolved into new species, they are absorbed into the populations of the island they come to. This may slow down evolution. But if it occurs after the different island populations have become species, they may start a new colony of their own species and in this isolation evolve into another species. By colonization, speciation, recolonization, etc., many species may come to live on one island, as shown by the diverse Darwin's finches.

differ more and more from its relatives. In time the populations may appear quite different. The islands are so far from the mainland that no chance wandering brings new immigrants during this period; the islands are far enough apart that the few occasional island-to-island wanderers are absorbed by the resident population, and only increase variability and perhaps slow up the evolutionary process of change.

DISTINCT SPECIES BEGIN

But sooner or later each island population becomes so different from its relatives on the other islands as to be a species. No longer would the different island populations interbreed freely if brought together. This is Stage II of our exhibit. For the sake of illustration, the head of each gray bird in Stage I has, in Stage II, been painted with a different color: one red, one yellow, and one green, to indicate that each population is different. Questions at once arise: Do stray individuals still sometimes find their way to other islands, occupied by sister-species, after Stage II of our panel is reached, and if so what happens? Also how is it that on some actual islands there are more species of birds than one?

The answer is that evolution is a continuing process. Wanderers continue occasionally, by chance, to make inter-island journeys. Formerly the wanderers were absorbed by the resident population and became part of it, but now that the three island populations have evolved into species, when these new species wander they retain their individuality and colonize anew. If a pair of red-headed birds should cross to another island at the same time, they might establish a colony of red-heads on the blue-heads' island. In this new place, separated by water from the rest of the red-heads and kept by biological characters from breeding with blue-heads, on whose island they are, they develop into still another species. The same thing is happening on the other islands and the process continues indefinitely. Many kinds of birds may come to live on each island. Thus Stage II is passed, and a complicated situation comes into being, comparable to the many related birds living in a Chicago garden—many species now living together but each evolved in isolation from its nearest relative.

How different kinds of birds come into existence has thus been illustrated in our exhibit with hypothetical examples. But the process is also demonstrated with actual examples, and the birds of the Galapagos Islands provide good ones.

ISOLATION IN THE GALAPAGOS

The Galapagos Islands are a group of oceanic islands on the equator, about 500 miles west of the South American coast. They have never had any land connection with any other land mass. The ancestors of all the land birds that live there now, and there are about 89 species and subspecies of breeding birds, have arrived as chance wanderers. The distance from the Americas is great, and for a bird species to establish itself, not one but a pair must wander. Thus it is a rare happening for a species to establish itself. The rarity of this happening is shown by the small size of the Galapagos total list of birds—108 species and subspecies compared with more than 700 from Guatemala in Central America and more than 1,500 from Ecuador, opposite the islands in South America. But this kind of colonization has happened at rare intervals.

The Galapagos mockingbirds illustrated in the lower left portion of the screen are comparable with Stage II of the hypothetical demonstration. All the mockingbirds of the Galapagos Islands are much more like each other than they are like any of the mocking-birds on the mainland of the Americas whence their ancestors came. Since the time that they arrived on the Galapagos Islands they have occupied many of the islands. In many cases, in the isolation of their island homes, they have developed or evolved into different kinds or varieties. The characters that distinguish the kinds or varieties may not be apparent to a casual glance, but by noting the distinguishing characters described on the label below each bird and then looking again at the specimens, it can be seen that one is darker or lighter, or has a longer or shorter bill, or is more or less heavily marked on the breast than the others. And careful study of the distribution of those birds by expeditions to the Galapagos Islands has proved that no more than one kind lives on any one island. These mockingbirds have been on the islands only long enough to reach Stage II, as set forth in the hypothetical example.

The Darwin finches are even more interesting. They, too, are more like each other than any one of them is like its nearest relative on the American mainland. Indeed, they have changed so much that it is doubtful what their closest relatives are. It is obvious from this that they have been on the Galapagos Islands much longer than have the mockingbirds, which still are recognizable relatives of the mockingbird-thrasher groups of American birds.

VARIATION IN FINCHES

This comparatively ancient colonization of the Galapagos Islands has also given the finches time to evolve into forms very different from each other. With the mock-ingbirds it is necessary to look closely to see that the numerous varieties are different. But the gray warbler finch, the small ground finch, the big ground finch, and the black-headed tree finch are so different that close study was necessary to demonstrate their near relationships. Also, the long lapse of time since they have arrived on the islands has enabled some to evolve separately on isolated islands, then to invade their sister-species' islands, evolve again into further species, and continue the process of colonizing, evolving, and again colonizing, until as many as ten species are found on one island, as is shown on the map in the lower center of the exhibit.

Thus we have shown how species evolve through variation providing the raw material, selection acting on this raw material to produce populations that differ from each other, and isolation of these different populations evolving into different species capable of recolonizing the territory of their related species. The new exhibit shows this process by hypothetical example and by two groups of Galapagos birds, the mockingbirds and Darwin's finches, that are actual examples of the products of such recent trains of events.

EXPEDITIONS—

(Continued from page 3)

study, in which he has been engaged for a number of years, of the basic igneous rocks found in the Adirondack mountain areas of New York state. He will conduct field studies also in New Hampshire and possibly in Massachusetts.

Central America. Mr. Paul C. Standley, Curator of the Herbarium, will leave in September on a botanical expedition to Central America. For a period of almost one year, he will continue collecting the flora of Salvador, Honduras, and Nicaragua in the areas in which he has already done preliminary work.

Seashore Mosses. Dr. Francis Drouet, Curator of Cryptogamic Botany, will collect cryptogams (mosses, seaweeds, etc.) for three months, beginning in September, in coastal areas of the Gulf of Mexico from Louisiana to Florida. He will work with both fresh and salt-water species and also with land species.

Colombia. Mr. Philip Hershkovitz, Assistant Curator of Mammals, will leave in October to spend about a year collecting mammals in Colombia.

Africa. Mr. Harry Hoogstraal, Assistant Curator of Insects, has already left to participate in the University of California African Expedition, which will conduct explorations from Cairo to Capetown or the length of the continent. He is a mammalogist-entomologist of the U. S. Navy Medical Science Group, on loan from this Museum. The Navy group is attached to the University of California Expedition and is under the direction of the Office of Naval Research.

Although acquired as far back as 1898, the Museum's model of the visible hemisphere of the moon, 13 feet in diameter, in Clarence Buckinghall Hall (Hall 35), is believed to be, by far, the largest and most elaborate representation of the moon's surface ever made.