Evolution of an Exhibit

Smithsonian exhibit illustrates the ideas of evolution

BY SUSAN WEST

Straight across the rotunda, on the other side of the trumpeting African elephant, there is a new exhibit at the Smithsonian Museum of Natural History. "The Dynamics of Evolution," a permanent exhibit hall that illustrates the principles of evolution, opened May 18. Not just a collection of birds or dinosaurs, rocks or plants, but a visual interpretation of complex concepts, it may be the most ambitious and unusual undertaking yet by the Smithsonian.

According to then-museum director Porter Kier, no other U.S. museum has attempted a similar project. Tucked into some corner of the paleontology hall, other museums may have a schematic drawing showing how humans may have evolved from apes or how birds evolved from reptiles, but none, says Kier, explains the basis of evolution: genetic change and natural selection.

"Evolution is the one thing that really unifies all the fields of natural history," says Kier. Recognizing that fact, six years ago the museum scientists created a plan that would make "The Dynamics of Evolution" a theoretical base for the museum's other halls. While this exhibit explains what makes evolution happen, it was decided that the other halls, when they are revamped, should offer specific examples of that process.

But genetics, natural selection, differentiation and speciation are hardly visual topics. And translating ideas most often expressed by words into specimens has been the greatest hurdle to leap.

"[People] come to look at specimens," says Kier. "So what we were trying to do was put across a concept using specimens. That is difficult and it's fraught with danger. So the emphasis on the hall has been how can we do this with specimens and using as few words as possible. That's why it's a challenge. It's the most difficult hall we've ever done and we'll ever do."

It certainly is the most beckoning. The entrance dazzles with specimens. All manner of winged creatures, shells and sea urchins by the armfuls, a matched set of tusks that embrace a hanging giraffe skin like parentheses, row after row of human skulls, fossilized tree leaves, a ram frozen in stride, cases of shrews, moles and voles, lots of lizards, even pickled dolphins pack the entryway. And suspended over all hangs the magnificent skull of a blue whale — the largest animal that has ever lived on earth.

Smithsonian Institution

Faces of humanity: Genetic variability.

The "People Tower," a 25-foot collage of human faces — examples of genetic variation — rises in the middle of the exhibit hall. A close look at a quiet woodland setting to the right reveals gruesome scenes of predation, while the soundtrack of a movie on DNA drones on about ladder structures and nucleotides. A pair of male elk — competitors for reproductive success — clash antlers while a woeful doe, a symbolic plucked daisy at her feet, awaits the results. Farther back, a polar bear and a brown bear, genetic siblings but for geographic isolation, are united once more near a sign reading "Differentiation: Continents."

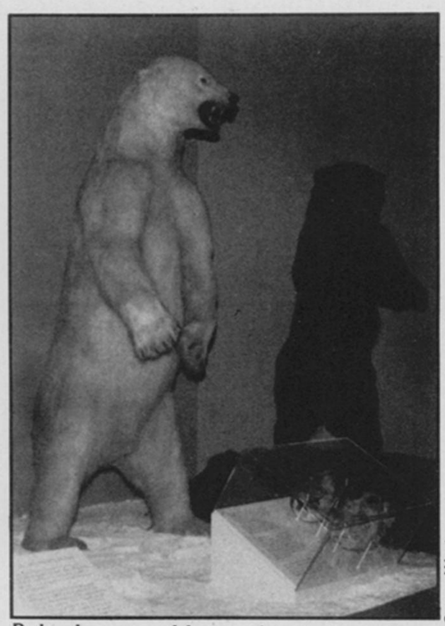
"Around you are examples of the great diversity of life on this planet," explains a placard at the entrance. "The study of the origin and development of this diversity is called evolutionary biology. This exhibit explains how most scientists think the evolutionary process works."

That simple phrase — "how most scientists think the evolutionary process works" — belies a major scientific struggle. Since the H.M.S. *Beagle* set out for the Galapagos islands in 1831 with young Charles Darwin aboard, the theory of evolution has had to survive near-constant battle. Darwin, for example, had no knowledge of genetics; he couldn't explain how characteristics were passed on or what the mechanism was that produced changes in those characteristics. And when Mendelian genetics was accepted, it seemed at first to contradict Darwin's theory. Since then, parts or all of his theory have been repeatedly attacked. One by one — vitalism, mutationism, Lamarckism — all have brandished a sword and all have been vanquished.

Unquestionably, Darwin's theory has not remained unscathed. His foundations still stand, but 120 years of science have patched on new knowledge, demolished old beliefs and raised fresh questions. The neutrality theory (SN: 2/22/75, p. 124) challenges the dominance of natural selection and emphasizes the role of genetic drift. Some researchers read in the fossil record abrupt leaps from species to species, while others claim to see only the gradual change that Darwin predicted. Allopatry — the theory that a population must be split geographically in order to develop into two species — opposes sympatry, which argues that selection can produce new species from a single population in the same location.

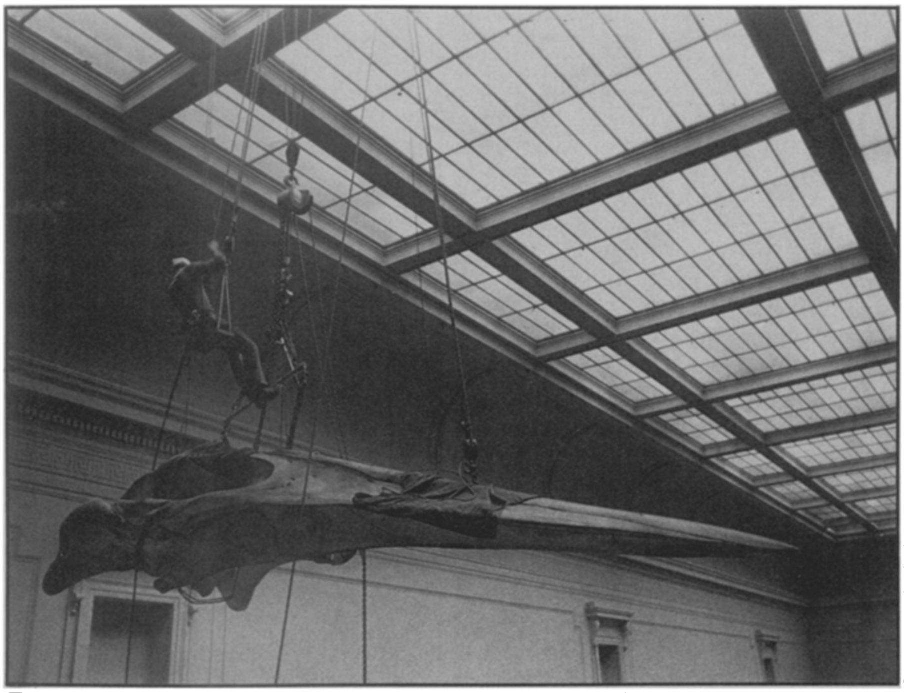
So, how to present such an embattled theory, much less illustrate it, in such a way that a person "who went through on roller skates," as Kier puts it, would come out understanding how evolution occurs?

The Smithsonian's solution is to take a general, conservative view, to present the principles to which both strong Darwinians and non-Darwinians subscribe. Many aspects — such as an explanation of the



Susan West

Polar bears and brown bears: Products of geographic isolation and differentiation.



Smithsonian Institution

The skull of a blue whale finds its place in the Smithsonian's new evolution exhibit.

Susan West

In the clash for reproductive success, the strongest survive to pass on their genes.

fossil record or the allopatry-sympatry issue — were left out because the exhibit's organizing committee felt such issues were historical or descriptive and did not fulfill the goal of depicting the processes of evolution. Some aspects clashed with individual committee-members' views, and conflicts arose about priorities — the importance of genetics compared with natural selection. Admits biologist John Burns, head of the committee, "There are some statements I don't myself subscribe to."

Nevertheless, the exhibit represents, according to Burns and Kier, a consensus of the six-member organizing committee. The hall was built on a scheme that Burns taught at Wesleyan University in Connecticut and at Harvard University. In his words, it is "very simply, reducing Darwin's thinking plus a little more to the barest essentials: that all organisms have a high potential rate of increase — this is an observation from nature — but populations, in general, tend to fluctuate around a fairly steady size. Therefore, Darwin's first conclusion is there must be a struggle for existence. Given the struggle for existence, look around and see all populations are variable and much of the variations are hereditary. Given the struggle for existence and a lot of genetic variation, then in any given environment at any particular time, some of those genetic variants must be better than others and more likely to survive, more likely to leave offspring than others, on an average, i.e., natural selection. You have to get across that environment is the agent of selection and there's a lot of genetic variability. Next thing is that the environment varies in space and time. And organisms are spread out in space and last through time and so if they have any kind of a geographic range at all they're going to be selected somewhat differently in different parts of the range, so you get differentiation across a range. Then if you fragment the range and selection can operate in different subdivisions of the population over a long enough period of time... the differentiation can go so far that you get genetically so different populations that they can't interbreed when they come back together — new species. That, in a nutshell, is what we're trying to teach in the hall."

But lecturing on such concepts is one thing, illustrating them is another. According to Kier, the committee and exhibits staff strove to use the largest, most dynamic specimens possible and to choose examples with which people would identify. As a result, population potential becomes a kitchen scene swarming with 130,000 freeze-dried cockroaches — an example of what would happen if only three generations of roaches were all to survive the struggle for existence. That struggle is depicted in the woodland scene — a hawk is pouncing on a chipmunk who is eating an acorn, tadpoles are being eaten by fish and a fish is being eaten by a crane. Genetic variability is shown in the swarm of human faces, in the myriad colors and designs of pigeons. The familiar story of the survival of the darkest-colored members of a species of moth when soot covered England's trees during the Industrial Revolution illustrates the interplay of genetic variability and the environment in natural selection. Moths that look like wasps, flies that mimic bees, flower parts that imitate the shapes of insects, plants and animals singled out for human use reveal the elaborate forms of selection. Geographic differentiation translates into the range of sizes of mountain lions across North America and the range of colors of the Anolis lizards across Haiti. The principle of geographic isolation and fragmentation of a population is seen in Darwin's classic example of the finches of the Galapagos islands and in the squirrels of the Southeast Asian islands. Finally, as in any good lecture, a summary of the subject is given: a wall-sized diagram of the evolution of the horse, showing the interaction of all the principles of evolution.

It's a great idea, creating a teaching hall, but will it play in Peoria, so to speak? "It's been a great worry for us all along," says Kier. "We were determined to do this hall. We wanted to do this hall. We've never worked so hard on a hall. Never agonized so much over what was going to go into this hall. I think it will work. But you never can tell. You never know." Despite Kier's fears, tangible signs of success are already showing. Says acting director James Mellow: "There are a lot of footprints on the carpet — that's one measure of success." □