

BIOLOGY

Beauty in Glass

Delicate and Lovely is the Handicraft of Frank Long Who Models for Scientists Life Under the Microscope

By DR. FRANK THONE

See Front Cover

VENETIAN princes vied with each other, in the rich, romantic days of long ago, for the services of artists who could do honor to their patrons by creating enduring beauty. In silver and gold, in bronze and in marble they wrought; in exquisite and costly gems and in the larger jewelry of mosaic wall and pavement. No material was too rare or too far for the Venetian galley fleets to seek, that the lords of the Sea-City might without stint serve the servants whom they were proud to address as "master."

But though the fingers of Venice reached from the bazaars of the East to the amber beaches of the North, from the metal-yielding hills of Spain to the mysterious ivory-rich lands of Africa, there was still one common thing that certain of the city's craftsmen were able to ennoble to full peerage with the world's farthest-brought treasure, a fragile thing that has been for generations a firm foundation-stone in the structure of the fame of Venice.

Glass.

Glass, that could rival in colors the rarest gems from India, the richest tapestries of Damascus. Glass, obedient to flame as gold was obedient under the little hammers of Cellini. Glass, translucent and glowing as the sunsets over the Adriatic. Glass, in grace and beauty of form worthy of the noble ladies who offered the goblets to fortunate guests.

Glorified

Venice took common glass and glorified it. And glass made noble addition to the glory of Venice.

In our America of these later days there is another mighty city of commerce and craftsmanship, as unlike Venice as our Industrial Age is unlike the Renaissance. It lies not by the flat sea, but stands on steep hills. Its commerce comes and goes not in stately galleys but on thundering freight trains and slow river barges. Its skies are not spread with a thousand white sails but take smoke from a thousand chimneys. Yet

for all the chasm of contrast that lies between them, old Venice and new Pittsburgh have at least one prime item in common.

Glass.

To be sure, the glass of Pittsburgh is not as the glass of Venice. The hand-wrought glass of Venice was the product of the skilled few for the wealthy few. It was the glass of aristocracy, delicate, exquisite, exclusive. The machine-wrought glass of Pittsburgh is the product of the many for the many. It is the glass of democracy, strong in great sheets, yards in area, shining in windows, in chariots such as no Renaissance prince ever knew, bulging with chemical wares such as no alchemist of old time ever dreamed of. Massive glass rivals Pittsburgh's massive steel as delicate glass once rivalled Venice's exquisitely wrought gold.

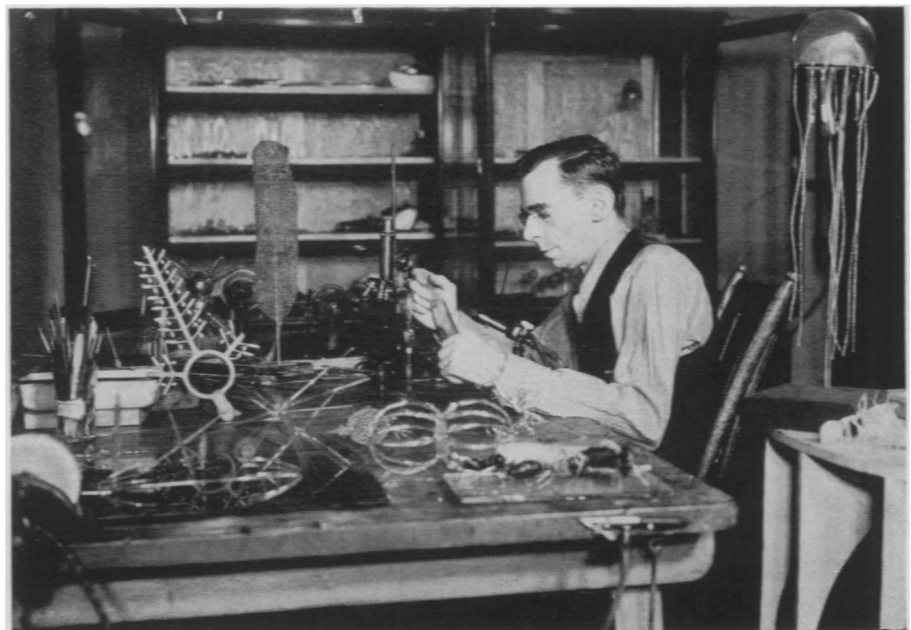
Yet even in modern Pittsburgh, the city of glass by the ton, by the trainload, the secret of delicacy, of finesse, in glass is not forgotten. Real artists in glass ply

their craft there, producing many lovely things, that a Venetian noblewoman need not have despised. And one of them, at least, Frank Long of the Carnegie Museum, has turned his skill to the production of glass sculptures of things that Venetian sailors may have marvelled at when they went down to the sea in ships, and of other things that were hidden from the sight of even the wisest man of the days of the Doges.

Accuracy

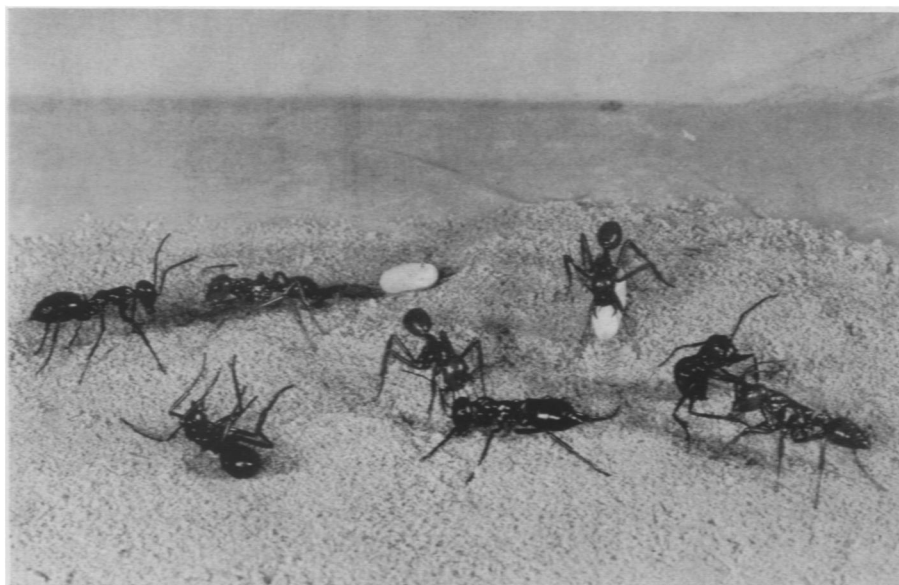
Frank Long makes in glass accurate pictures of the lesser creatures of land and sea, the beauty that floats in the water, the wonder that can be seen only when a trained eye looks through a microscope. His glass models of the unnoticed marvels of life in the common world around us are becoming objects of scientific pilgrimage.

The marvel of Mr. Long's work does not lie in anything he uses, either tools or materials. The material is nothing but common soft glass, such as is used in bottles and in old-fashioned window-panes. It is not even as high-toned as the plate glass in your motor-car windows. Most of his specimens are made entirely of pieces of this glass, molded soft and



AT WORK

An artist-scientist who works on unusual subjects, in an unusual medium: Frank Long of the Carnegie Museum, Pittsburgh, in his studio-laboratory.



BATTLE

A little war of conquest, modeled in glass. The light-colored ants are the aggressive red Amazon ant species. They are fighting the black ants and robbing their nursery, to carry off the helpless young into slavery.

welded together with a fine blow-pipe flame. The only other material he uses is Canada balsam, the sticky stuff that oozes out of fir trees; some of the more complex jobs he fastens together with this.

The tools he works with are equally simple—a few sticks of carbon, a pair of tweezers for pinching up points and sharp edges in the soft glass, a gas burner and a small blowpipe for picking out and directing a delicate tongue of flame where he needs it.

The colors of the animals and plants he images forth are right in the glass itself. That makes for permanency such as no painting could boast. Coloring glass is an art that began in Egypt, and has continued to be perfected through Greco-Roman and Medieval times, down to the present day. So Mr. Long has as flexible a choice of colors at command as any artist can mix on his palette.

Standard Forms

His work is further simplified by the number of standard shapes and sizes of glass rods, tubes, sheets, and other pieces available—and by the very convenient fact that in nature most shapes are modifications or combinations of the same basic forms. Legs are basically rods, wings are flat sheets, heads, eyes, eggs are spheres or ovoids, antennae and bristles are threads. So the artist first makes the basic shape and then pushes and pulls, bends and molds, until the nature-modification is faithfully reproduced.

For vari-colored organs or their combinations, he uses different colored pieces, welding them together in the blowpipe flame or gluing them together with the Canada balsam. Of course he welds wherever he can, for those joints are permanent. But in some close corners the use of the flame would melt something that has already been set up, so here he must use the adhesive gum.

World of Water

So much for Frank Long's artistic technique. His scientific models he chooses from all the world, though it is true he has rather a preference for the microscopic world of the waters. On his worktable he has a microscope always at hand. He puts on the slide a drop of water containing the tiny plants or animals he wants to depict in glass. He focuses the instrument, takes a quick and searching look. Then like a painter turning to his canvas he quickly puts in some quick strokes, pushings, pinchings, on the soft glass he is holding above the flame. Then another look, and more moldings and modelings. Then a selection of a new piece of glass of different color, as he comes to a differently colored part of the creature. Finally, the long, delicate, difficult job of putting the parts together. Then, with a new masterpiece mounted, labeled, and set in its place in the museum, on to new worlds to conquer in glittering glass.

Some of the glass models in other museums are already famous. But Mr. Long has chosen a number of natural

models in fields other museum artists in glass have not yet touched. One group is a series of common things that we meet as daily annoyances, not suspecting the beauty that may be out of common eyesight-range on a bit of mouldy bread or a spoiled orange. For the common moulds are fungi, related to mushrooms and puffballs but lower in the evolutionary scale and simpler in structure. As seen under the microscope, and as depicted in the large in Mr. Long's glass, they consist of branching white threads, bearing here and there oddly-shaped but beautiful clusters of the tiny brown reproducing bodies, or spores.

Still Lower

Even lower in the scale of life, but having a rare beauty nevertheless, are the strange creatures that biologists call the slime-moulds, or more learnedly the myxomycetes or mycetozoa. These things are at the very bottom of the scale of life. They live in damp places in woods and gardens. Most of their lives they are simply formless masses of slimy stuff, like spilled mucilage; though they are often brightly colored in reds, oranges, yellows. But when time for reproduction comes, they form little cylinders of lace, no bigger than a wheat grain but of such delicate workmanship that not even a Flemish lace-maker with her flying bobbins could hope to imitate them. One of these, magnified to more than a foot in height, has been immortalized in glass by Frank Long.

But it is in the microscopic and near-microscopic life of the water that the Pittsburgh artist seems most to delight. The skeletons and shells of one-celled animals and plants intrigue him. Perhaps appropriately so, for many of them are themselves made of silica, which is a prime ingredient of all common forms of glass. He has done, for example, some beautiful large-scale reproductions of one-celled animal skeletons. One of these, shown on the front cover, surmounts an openwork globe of interconnected shining threads with a spiny spire that surely belongs on a fairy palace in Siam—if they have fairies in Siam. Siamese, surely, is his model of a desmid, a one-celled water plant that always has two evenly balanced halves to its shell, as though it were made against a mirror.

Unbelievably complex is a model, of many hundred parts, that Mr. Long has made of a small crustacean, relative of the larger lobsters and crayfish. The creature itself is rather incredible, for what are legs and (*Turn to page 218*)

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claws on the larger creatures of its kin are in this one mere stubs ending futilely in bristles. But its antennae or feelers have grown out of all proportion, into long, beaded horns, with many long, whiplike branches. And at the other end of the creature are eight fantastic appendages that look like feathers—as if this creature of the sea had ambitions for the air!

But Frank Long does not confine his efforts to single specimens. Community life in the animal world catches his eye and his swift fingers picture scenes among our lesser cousins.

The simplest community, perhaps, is a colonial jellyfish. Here, strung along a winding cable of living stuff (represented in the model by a bent glass tube) are a dozen or more many-armed little animals. Each lives its own life, unable even to approach its neighbor; yet all share in peaceable communism one gas-filled float at the end of the string, that keeps the whole little community near the surface.

A more settled sea-community is shown in a bottom grotto of sea-anemones. Despite their name and their flower-like appearance, sea-anemones are animals. Their "petals" are really clutching fingers, wherewith they seize their prey when it swims too close.

Of all Mr. Long's pictures in glass, perhaps the one with the largest element of drama is a battle scene between two tribes of ants. The story is old, perhaps one of the best known in all natural history, and for that very reason most relished by the crowds of museum visitors. We see the onset of the attackers, fierce red Amazon ants. The defenders, black ants, fight valiantly for their home, but with their weaker jaws are no match for the raiders. The Amazons carry off their helpless young to be enslaved.

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ARCHAEOLOGY

False Teeth Are Fitted to A Million-Year-Old Ape

Dental Plate Designed for Research Not for Use Is Shown to Scientists at Symposium on Early Man

FALSE teeth for a million-year-old ape were exhibited before prehistorians attending the International Symposium on Early Man at the Academy of Natural Sciences in Philadelphia.

It's ages too late to do the snaggle-tooth primate any good now, of course. But the beautifully made dental plate, including natural fossil teeth belonging to the real ape, serves the greater purpose of revealing man's evolution from ape-like form.

Discovery of jaws and teeth of a fossil ape found in the Siwalik hills of India opened up this new evidence on man's ancestry, Dr. William K. Gregory and Dr. Milo Hellman, of the American Museum of Natural History, told the Symposium.

Lower molar teeth of the Indian ape grew to form five cone-like points or cusps. As the cusps grew to mature size, grooves formed between them in shape of V or Y lines. This pattern of tooth is called the Dryopithecus pattern.

Dr. Gregory says: "We think they represent the kind of molar teeth that belonged to the common ancestor of apes and man."

The common ancestor himself is still a missing link in evolution. But teeth of the Indian ape are so significant that the two specialists in anatomy said:

"We have in progress a re-study of the entire problem of origin of the dentition."

The ape's teeth are much below man's level, the scientists reported. But the subtle changing of the pattern in various

fossil apes and men traces evolutionary history. In man the Y-shaped groove has changed to a cross line between the four cusps that remain in advanced types.

Teeth of the Indian ape, discovered by two different expeditions and exhibited thousands of miles apart in the Indian Museum and in Yale University, are now proved to belong to the self-same individual ape.

When Dr. Hellman, former dentist, now anthropologist, tried to fit the fourteen teeth discovered, he saw that they belonged together, and that enough teeth were represented for him to make a dental-plate reconstruction of the ape's mouth. The portion of the teeth found by the Yale expedition are to be presented to the Indian Museum, so that the set may be kept there complete.

Evolutionary evidence carried by man in his teeth, the two anatomists believe, shows that early men of the Old Stone Age were structural ancestors to the curious types of Neandertal man on the one hand, and to modern man, *Homo sapiens*, on the other.



TEETH FOR AN APE

Dr. William K. Gregory, shows the plate containing fossil teeth of an ape.

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