

EVOLUTION

# Legs

## Except For Those Who Deal in Entertainment or Sport Few Give Thought to the Importance of These Adjuncts

By DR. FRANK THONE

**L**EGS are something we cannot very well get along without.

The average citizen requires two. Wholesale entrepreneurs of eye-and-ear entertainment, like Mr. George White or Mr. Earl Carroll, lease them in larger quantities. It is not uncommon for them to order up batches of two or three hundred of them, paired, carefully inspected for flaws, and in good running (and kicking) order, complete with the usual accessories. Similar specifications (except in gentlemen's sizes) are sometimes submitted by morose persons in turtle-neck sweaters at such establishments as Notre Dame, Princeton and Stanford. But most of us get along on two legs apiece.

But have you ever considered how lucky you are to have any legs to stand on? How only the elect few, among all creatures of the animate world, have any legs at all? How even fewer, among those who have legs, are equipped with underpinning of such all-round usefulness as those that support the human race—and adorn a fair half of it?

Probably not. So far as a search of the literature discloses, G. K. Chesterton is the only person who has ever thanked Santa Claus "for having put into my stockings a pair of miraculous legs." Most of us just take our legs for granted—blithely disregard them, until we think we have something to kick about. Disregarding the fact that kicking never pays—except in the cases of the aforementioned ladies of the ensemble, and perhaps those gentlemen in the backfield who receive "athletic scholarships." Really, appreciation of legs should extend beyond the first three rows of orchestra seats.

### Really Wonderful

Perhaps we might get more of a kick out of having legs if we knew what a deal of trouble has gone into the development of those twin props that take us where we want to go (accidents and

bottles not preventing), or hold us up when we merely want to stand still, with very little thinking on our part. Legs really are miraculous, as G. K. C. termed them; in the old Latin sense of something to be admired, wondered at. And nothing more remarkable about them than the long process of preparation they had to go through, before they were fit to appear on the musical-comedy stage, or the football field, or ourselves personally.

### Evolution of Legs

The Santa-Clausian suddenness with which Mr. Chesterton's legs appeared in his stockings was more due to the abruptness of his arrival at an appreciation of their usefulness and beauty, than to any magic with which legs were whisked from non-existence into full and useful being. For just as Santa Claus has to labor all year in his toyshop at the North Pole before he sets forth putting gifts into our stockings, so the slow development of many forms of life had to labor through many geologic ages before legs could be put into our stockings. One of the most fascinating of all the chapters of the great book of Evolu-

tions is the story of the Evolution of Legs.

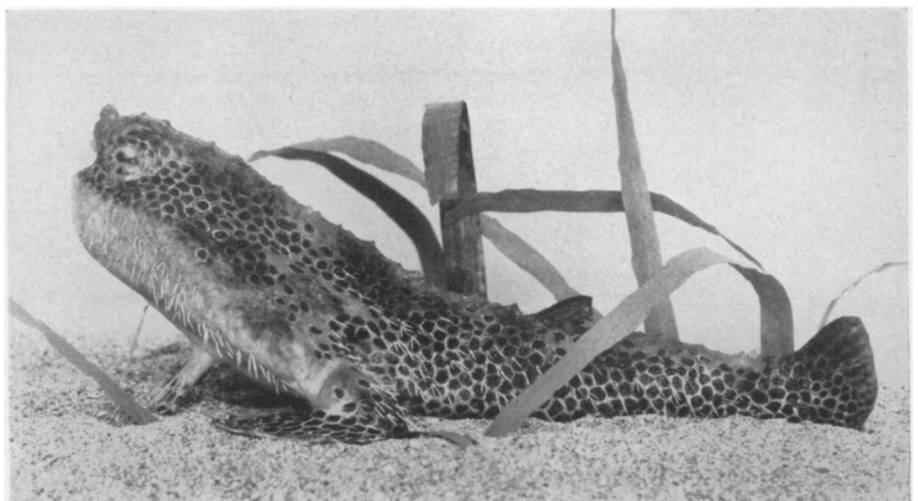
Once upon a time (to start the story as all good stories should start) none of the backboned animals had any legs at all. There weren't any but fish, that swam in the water with fins.

Now if you will look at any ordinary fish, you will see that he has two kinds of fins. On his back like sails, and maybe underneath him like a keel, on the midline of his body, are unpaired fins. Besides these, there are paired fins, one pair forward, near his gills, the other pair aft, about three-quarters of the way back to his tail. They are where his arms and legs would be, if he had any.

These paired fins serve the fish as up-and-down rudders, water brakes, lifters after the manner of an airplane's wings, and perhaps in other ways. They are, quite definitely, implements for working in the water.

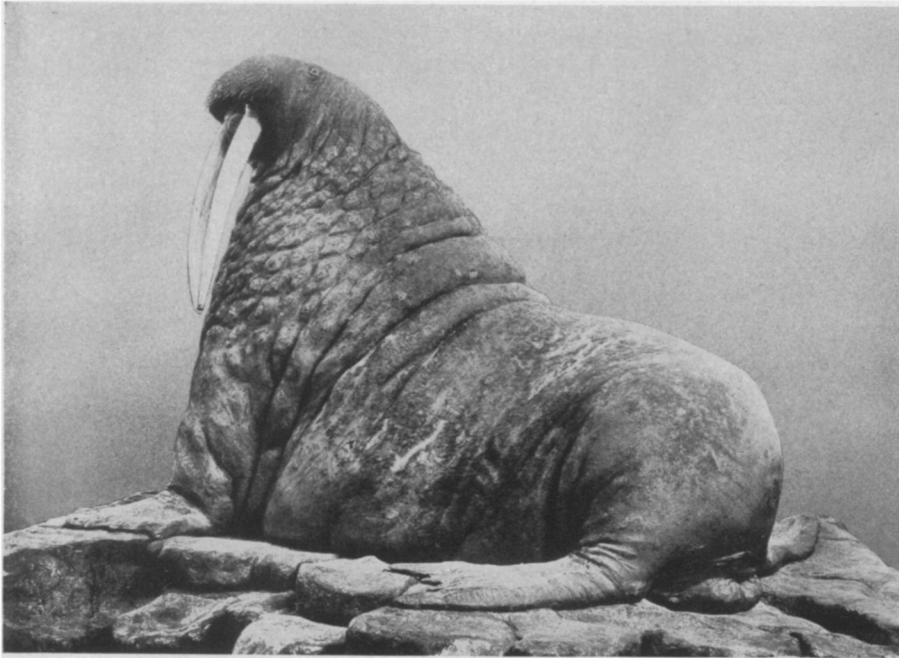
### For Bottom Walking

Yet out of them developed the beginnings of legs. Some fish are lazy, and like to spend a good deal of time loafing on the bottom. They may not even want to get up and swim when a short distance has to be traversed, but content themselves with wriggling and humping themselves along on the mud or



### BEGINNING OF LEGS

*Among the fish, there are some like this batfish whose fins are so developed as to serve roughly the purpose "bottom-walking" along the mud and sand of the water's floor.*



#### BEING LOST AGAIN

*When the mammal goes back again to the sea as has the walrus pictured here, his legs return again to the fin-like flippers reminiscent of his evolutionary ancestors.*

sand. In this "bottom-walking" the paired fins prove themselves useful.

Some fish of this kind come ashore, splashing around in the shallow tide pools or even leaving the water entirely and traveling short distances overland. A few can get along out of the water for fairly extended periods, and clamber up the slanting stems of bushes, hunting for insects. These are the famous tropical climbing perch, about which such remarkable legends of tree climbing have grown up.

Some time in past ages (very long-past ages—350 million years ago at least) some of these shoregoing fish more or less stayed ashore—and vertebrate life on land began. It was not a very proud, high-society kind of life; nothing but some crawling, long-tailed things more or less like our present-day salamanders and mudpuppies. But it did have legs.

#### Not Steppers

These first things with legs, and also the earliest lizard-like reptiles that followed them, were decidedly not high-steppers. In fact, they could hardly be called steppers at all. All the poor, short, formless, spraddled-out limbs could do was push the animals through the sand and slime, much as their immediate predecessors, the paired fins of

the venturesome fish, had done. We find such primitive legs on amphibians and reptiles still—legs that stick out mostly sidewise, and find it very difficult to get under the body, lift it up, and actually run. The troubles of an angry alligator, which can make a short fast rush on his toes but cannot keep it up, are neatly illustrative of the limitations of this type of legs.

#### Next the Jump

But it wasn't long before the land animals were able to gather their legs under them, and in a world where "jump quick!" was the rule if you wanted your dinner—or would avoid being some one else's dinner—a large block of the citizenry were quite literally on their toes all the time. It began before the mammals appeared, with quadruped reptiles of all kinds, most conspicuous of course being the monster four-legged dinosaurs. And the mammals in their day have been ever more on their toes. Even the massive-framed beasts like elephants and hipopotamuses stand on their toes—though because of their ponderous body-weight their toes, ankles and legs have to be very thick and strong. When you're as big as an elephant you can't hope for tapering legs and gracefully curved calves. Such things are for gazelles.

The limit of this business of "getting on your toes" has been reached by the

hoofed mammals, especially the horse family. One toe after another has been lifted off the ground, in the striving for ever greater speed and agility, until now the descendant of the once five-toed Little Eohippus runs his earthly course upon his middle toenails.

#### Then Bipeds

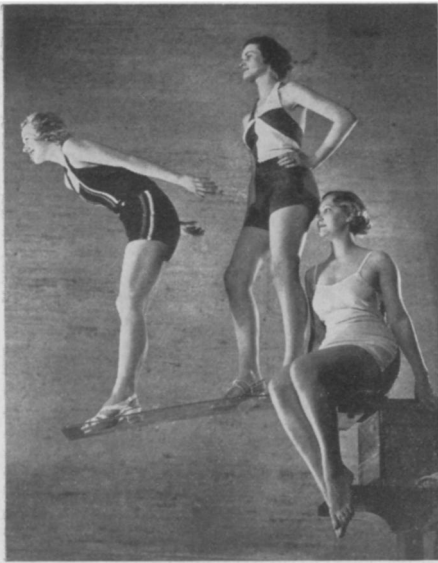
While some animals were getting up on their toes, others were going a point further, and getting up on their hind legs—and that is where we come in. The idea of biped locomotion seems to have been invented at several different times, and by several different groups of animals. Away back in amphibian times, frogs and toads went into the hopping business, which takes most of the firm of legs for the hind members of the firm. There were plenty of biped dinosaurs, some of them among the biggest and fiercest of the flesh-eaters, like the tyrannosaur group. Birds are bipeds without exception. There are no end of two-legged animals among the mammals.

Two different lines of two-legged animals have been developed: the leapers and the runners. The two kinds turn up in practically all groups of animals. Frogs are typical leapers in the lower groups, kangaroos among the more top-lofty mammals. Tyrannosaurs were probably runners; ostriches and men certainly are.

This business of getting up on our hind legs has been an exceedingly important factor in our whole evolution. By lifting the forelimbs clear of the ground, the new posture freed them from the unremitting job of holding up the front end of the body, and gave them a chance to experiment with all kinds of other things: stuffing food into the face, slugging your enemy or making love to your mate, or just "monkeying around" with a stick or stone and thus beginning the endless inquisitiveness into "what's this good for?" that is the ultimate basis of all science and all invention.

#### Then the Face

So long as our front feet stayed on the ground, our eyes could not be lifted to the heavens. We were too busy putting our snout down, feeding on grass like Nebuchadnezzar. Once we stood up and stayed up, we could "pull in our nose" and develop something more like a real face. We could get our eyes around in front and look at things out of both of them at once. With the re-



### VALUED

*In the fields of sport and entertainment, human legs are recognized important assets—not just taken for granted as they are in everyday life.*

orientation of our head bones, we could grow a brain able to answer the endless questions shot at it by our endlessly "monkeying" hands.

There are a whole lot of things we have to thank to our legs.

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*Science News Letter, February 22, 1936*

### CHEMISTRY

## Fireproof Wood Approved By Fire Underwriters

**F**IREPROOF lumber—dream of man since the ancients suggested soaking timber in vinegar to prevent burning—is at last a reality.

The laboratories of the National Board of Fire Underwriters in Chicago have placed their seal of approval on chemically treated red oak and maple, which cannot be burned in a practical sense and is an obstacle to the spread of fire instead of path for its travel.

"Practically noncombustible and non-flammable" is the verdict of the laboratory after months of testing in real fires and under rigidly controlled conditions.

Walls and floors of the fireproof wood act as fire-stops, prevent the passage of fire and confine a conflagration to its point of origin.

The approval report also notes that the fireproofing properties last throughout the life of the timber.

The successful fireproofing is effected by a method not unlike that used in the treatment of telegraph poles, railroad ties, fence posts, etc., with creosote for protection against decay, except that incombustible salts are used in the case of the fireproofed lumber. The technique of the process is exacting, as its success depends largely upon getting just the correct amount of salts into the wood as a greater or lesser amount fails to give the desired results. Protexol Corporation of Kenilworth, N. J., is the manufacturer.

Properties of the fireproof lumber other than its fire-resisting qualities were also investigated. Its workability was found to be equal in every way to that of untreated lumber. Its ability to take paint and varnish is not altered, its appearance is unchanged and its weight is only slightly greater than that of untreated material.

In the tests conducted at Underwriters' Laboratories actual fire conditions were created. Whole floors of the fireproofed lumber, and others of untreated lumber, were subjected to a roaring inferno in gas-fired furnaces especially designed for such work. Through windows the behavior under fire of the fireproofed and the untreated floors was observed and compared by one group of engineers, while a hundred feet away other engineers recorded the temperatures of the floors by means of meters connected with thermocouples.

The fireproofed floors came from the furnace at the completion of the tests blackened and charred on the exposed surface but intact and otherwise sound, having successfully stood as a barrier against the fire.

Test floors were repeatedly washed to determine the lasting quality of the fireproofing. For thirty days an automatic machine scrubbed them with cleaning compound, flushed with clear water and dried the surface every thirty minutes.

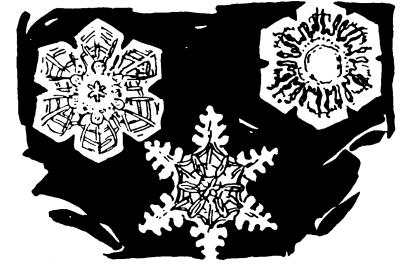
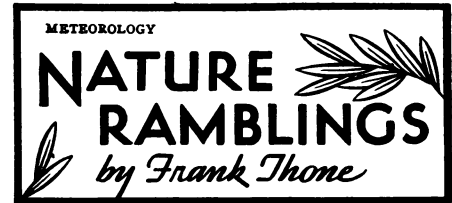
*Science News Letter, February 22, 1936*

## ORADIO

February 25, 3:15 p. m. E.S.T.  
WEATHER — WHETHER OR NO —  
Dr. W. J. Humphreys of the United States Weather Bureau.

March 3, 3:15 p. m., E.S.T.  
PLANT GROWTH SECRETS — Dr. P. W. Zimmerman of the Boyce Thompson Institute for Plant Research, Inc., Yonkers, N. Y.

In the Science Service series of radio discussions led by Watson Davis, Director, over the Columbia Broadcasting System.



### Miracles of Unlikeness

See Front Cover

**S**NOW has fallen over wide reaches of our country; deeper than it has lain for years it now lies from Washington to Maine, from the Canadian border to the Ohio. A cold wave of record-breaking length and intensity brought it and piled it up, and continued cold kept it from melting away. Lighter than feathers by the handful, in the aggregate it totals a tonnage that can be expressed only in figures of astronomical magnitude.

And if the total number of tons of snow is almost beyond calculating, what shall be said of the total number of flakes? Each so tiny that it can just be seen with the naked eye, so light that its weight will hardly disturb the most delicate of scientific balances, the numbers of these tiny white bits of frozen water, even on a square mile or an acre, let alone more than half a continent, simply baffling any attempt at imagining.

Yet it is highly probable that each separate flake that has fallen all winter, or in all past winters since the world has known snow at all, has been absolutely unique, wholly without an exact twin anywhere or at any time.

It is not possible, to be sure, to make a categorical denial that any two snowflakes ever have been alike. That would mean that one would have to take every snowflake that has ever fallen and compare it with every other snowflake—a feat impossible to the limits of absurdity.

But it is possible to assert, with the records all in your support, that nobody ever found a snowflake exactly like any