

Galaxy

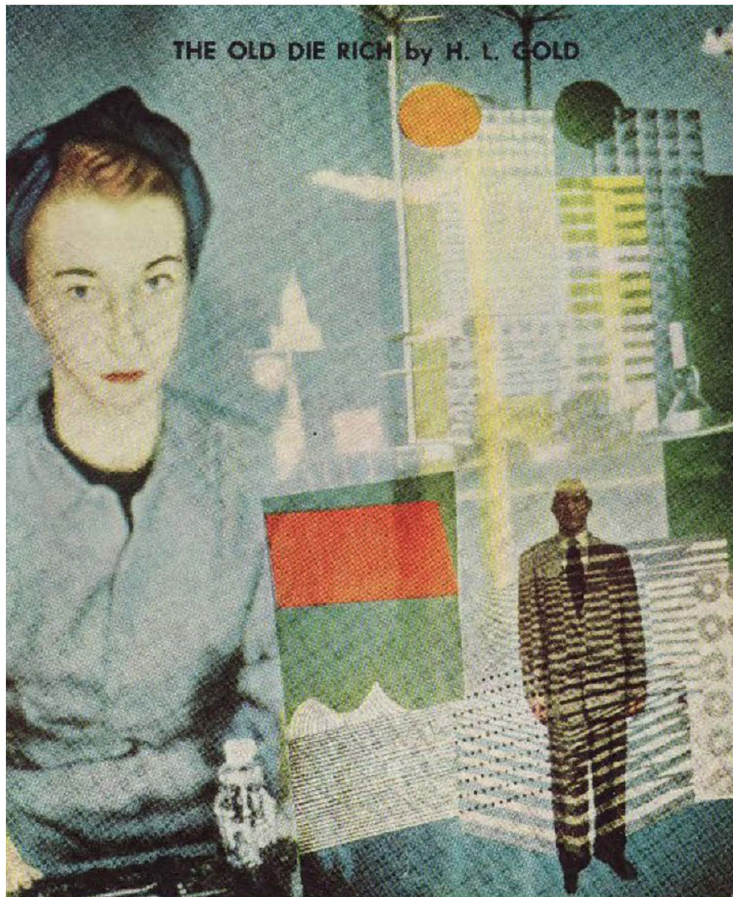
SCIENCE FICTION

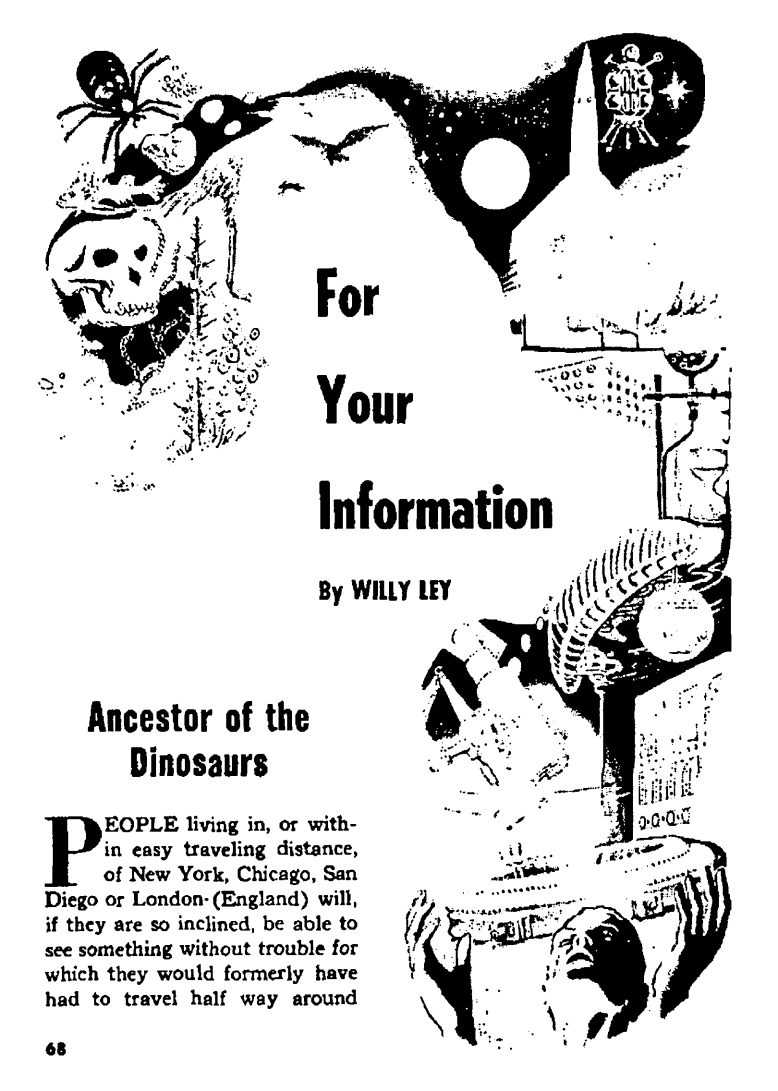
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THE OLD DIE RICH by H. L. GOLD



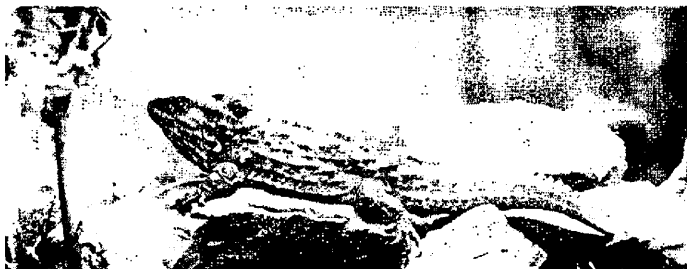


For Your Information

By WILLY LEY

Ancestor of the Dinosaurs

P EOPLE living in, or within easy traveling distance, of New York, Chicago, San Diego or London (England) will, if they are so inclined, be able to see something without trouble for which they would formerly have had to travel half way around



TUATARA

the world and possibly without success.

For the first time in many decades, the New Zealand government has permitted the export for exhibition of four Tuataras, (*Hatterias* or *Sphenodons*; in short, *rhynchocephalia*).

What do they look like? Well, like lizards, more or less dirty green in color, with an unusually large head and unusually large bright eyes in that head. Adult specimens are about 18 inches long. The ones on exhibit in the zoological gardens of the cities mentioned are young specimens which have not yet attained their full size. But they do have the spiny crest along back and tail which is the reason for the name Tuatara, a Maori word which can be translated as "spine-bearer."

It should be abundantly clear by now, because of the mention of the New Zealand government

and the Maori name of the little creature, that its home is in New Zealand. But no longer New Zealand generally.

Only a few hundred years ago, the Tuatara, it is believed, lived on both the main islands of New Zealand. The Maoris who came there from their original home islands of the Southern Pacific—they call their original home Hawaii, but it was not the Hawaii of our maps—did not bother the small lizard much. Nor did the white settlers of a hundred and fifty years ago.

But the white settlers brought animals with them—dogs, cats and pigs, all three destructive to life-forms such as the Tuatara. The pigs especially, with their habit of rummaging through underbrush and eating everything that isn't wood or stone, exterminated the Tuatara on the main islands, by eating lizards and eggs alike. All this happened



TUATARA

without the settlers being even aware of what went on, which is the main reason why so much of this article is conjecture.

I INCLINE to the belief that Tuatara, if it had ever been abundant on the South Island, would still be there. There are still large unsettled and virtually unexplored areas on the South Island, as the recent rediscovery of the bird Takahe (*Notornis*) has demonstrated.

At any event, if you want to find the present home of Tuatara on a map, you need a pretty good map. The North and South Islands of New Zealand are separated by Cook Strait. West of Cook Strait, due north of the South Island, there is a smaller island named D'Urville Island, which is still indicated on most maps. Due north of D'Urville Island there is a small rocky islet called Stephen Island, rarely seen

on any map. But it is Tuatara's home, or rather one of them, for the little saurian also occurs on a few other rocky islands along the New Zealand coast, all strictly protected.

When at home, Tuatara, slow-moving and cold-loving, eats insects, small crustaceans and other lizards, provided they are small enough. In captivity the diet is usually earthworms, but some have taken fish. The fact that they do eat fish, even though rarely, may explain why the Tuataras, very long ago, decided to set up community housekeeping with birds,—“dovey petrels,” to be precise. These marine birds nest in burrows which they dig, but the Tuataras move in on them. Whether the Tuataras elaborated upon the burrows or the petrels obligingly did it for them (as is generally assumed) is not completely known. But there is a double nest at the bot-

tom; the petrels occupy the dug-out to the left and the Tuataras the one to the right of the entrance.

It was comparatively easy to tell that Tuatara (the scientific names, as has been mentioned, are *Hatteria* or *Sphenodon*) is very rare. There was no problem in reporting where and how they live. But when it comes to the question of why zoologists and paleontologists grow dreamy-eyed at the very mention of the name, I don't have a one-sentence answer.

LET me try to explain it chronologically. Tuatara became known to science about 1830. An explorer by the name of Dieffenbach reported on its existence in a German journal. The main reason why his report is still remembered is that he gave the name *Ngarara* as the Maori name; all others reported the native name as Tuatara, Tuatera, Ruatara, or Tuatete—obviously the same word with slightly differing pronunciations.

Four years before Dieffenbach, a British scientist, Edward Gray, had published a *Note on a Peculiar Structure in the Head of an Agama*.

Of course, Tuatara is not an Agama lizard; but the report on the strange organ in its head caused some comment, and an

anatomist by the name of Günther went to work, delicately and diligently. Finally he could announce that the "structure" itself was not so peculiar, only its location on top of the head.

It was a third eye!

This was enough to give paleontologists vivid professional dreams. Once upon a time, during the Triassic period, some 175 million years ago, three-eyed reptiles were no rarity. But few of them had survived even to the end of the Triassic Period.

Here was one with that feature, still alive.

Apparently the third eye had somewhat reduced its size and activity in the course of time. It is smaller than the other two and is protected by a large transparent scale which is "set" in a circle of small opaque scales. But it is a complete eye in structure. Its connecting optical nerve is in working order and the whole is sensitive at least to light and dark. (Only the large black seaweed-eating iguana of the Galapagos Islands also has a still sensitive third eye, but it is far less well-preserved than that of *Hatteria*.)

The third or "pineal" eye alone proved that Tuatara was old. How old was established by careful, millimeter by millimeter examination of each of its features. Tuatara turned out to be the last

surviving member of a group of reptiles which bear the scientific label of *rynchocephalians* ("beak-heads"). The group was going strong during the Triassic Period. During the following period, the Jurassic, they spread considerably, but became less numerous at the same time.

One of these Jurassic *rynchocephalians* of 145 million years ago, *Homoesaurus*, looked and was so much like Tuatara that it would be hard to tell the two apart if both were still alive. The remains of *Homoesaurus* have been found in England and in Bavaria, but representatives of that type had reached Malaya and New Guinea at just about that time.

There was then a land bridge from New Guinea to New Zealand's North Island via New Caledonia. This is how Tuatara got to New Zealand. Some time afterward, that land bridge broke up into widely separated islands. Tuatara was in a place where it was safe, with nothing to bother it, until the settlers introduced pigs.

Occasionally you can read in a popular book or article that Tuatara is a surviving small dinosaur.

That is not so. The dinosaurs came *later*.

Tuatara is one of the ancestors of the dinosaurs.

THOSE CLUMSY STEPS

ROUGHLY three times every month I receive a letter in which I am informed that all space travel men lack imagination. Just because they have discovered that a rocket is the only known means for accelerating and decelerating in the vacuum of space, they want to use rockets for everything. And because they can't imagine anything else any more but liquid fuel rockets, they build rocket ships consisting of three stages, the two lower steps exclusively designed to boost the top stage up to the desired speed. Of course, the step below the third has to be much heavier and larger, and the bottom step, which has to lift all the others off the ground, must be the biggest and clumsiest of them all.

But, the reasoning runs, we only have to get the top stage up to proper speed. There is no need for the lower stages to develop a lot of speed, especially since they are supposed to fall back, anyway. Why not use a catapultlike or gunlike device to put some initial speed behind the top stage? The whole job would be much easier and it probably would take less fuel, too.

It almost sounds convincing. Or, rather, it may sound convincing to those who have never tackled the job.

Let's look at an actual example. There was that two-stage shot which carried to 250 miles. The upper stage was a WAC Corporal rocket. The lower stage was a V-2 rocket, which provided the upper stage with a velocity of almost precisely one mile per second at an altitude of 20 miles.

If we want to send a WAC Corporal to 250 miles without a lower stage, we then have to supply one mile per second by means of a catapult or a gun. In fact, we may have to supply a little more than one mile per second, because the catapult obviously would not be 20 miles tall and would therefore release the WAC Corporal at a lower altitude, where the air is denser and offers more resistance. The "muzzle velocity" would have to be 7000 feet per second.

The acceleration the rocket would receive in the catapult is given by the formula

$$a = \frac{v^2}{2s}$$

where a is the acceleration, s is the length of the catapult or the gun and v is the velocity at the end of the catapult—those 7000 feet per second, squared.

Just try it a few times with various sets of figures and you'll be convinced that it is not lack of imagination that makes the space travel scientists stick to multiple stages. Even if you aim

for as low a "muzzle velocity" as 2500 ft./sec., you'll find that you either need a catapult of impossible length or else that the rocket would have to sustain accelerations as high as several hundred g . If you tried the latter, you would require a very massive rocket—let's not even mention pilot and passengers—so that it emerges in one piece and in workable condition. Unfortunately, it would then also have a very poor mass-ratio.

Even with a mile-long shaft—one drilled, say, into the top of a mountain—the accelerations would still be too high for human occupants, in spite of the fact that humans can stand much higher accelerations than was believed possible as recently as eight years ago. And a tube one mile long, whether it is a vertical shaft in a mountain or a near-vertical structure up a steep mountain slope, will cost large sums of money.

What you really need, though, is an acceleration path 20 or 30 miles long; more in some cases. And the cheapest way to accomplish that is by means of lower stages.

—WILLY LEY

ANY QUESTIONS?

My son suggested that you might be able to answer my ques-

tion: "Why is there no frost on cloudy nights?" I have known this fact for years, but no one seems to be able to tell me why.

Mrs. Mary Coulson

RR 2, Box 65

Silver Lake, Indiana

The statement that there is no frost on cloudy night is generally correct; in fact, there is a proverb which says "clear Moon, frost soon," indicating the same observation. The explanation is mostly provided by the fact that the air near the ground is mostly heated by the ground. In other words, the Sun does not heat the bottom layers of the air to any appreciable extent directly. It heats the ground, which passes the heat on-by re-radiation. If, after a clear day, the night is clear, too, the heat is radiated into space. But if a cloud blanket forms at sunset, it acts like a real blanket, trapping the heat between ground and cloud layer.

There is one condition where you may have frost in spite of an overcast sky. This happens if the weather has been quite cold—around 15° Fahrenheit, for some time; usually the sky is clear, or almost so, in such weather. Then, if a warm and moist air mass moves in, it may not displace the cold air mass, but ride on top of it. Where the

moist warm air touches the cold air, the moisture will condense, forming a cloud blanket which keeps the Sun's rays out. The result is a series of cold days with an overcast sky.

Why does water expand when it is cooled below its freezing point?

Stephen Obrecht

2109 Glenway Drive S.E.

Cedar Rapids, Iowa

Water reaches its greatest density not at its freezing point, but somewhat above the freezing point, at 4° centigrade. It freezes at 0° centigrade. Above and below 4° centigrade, it has a lesser density than at that critical temperature.

This is of great biological importance. If water below zero centigrade—ice—were heavier than liquid water, all ice that forms would sink to the bottom of rivers and lakes. During a long and severe winter, the lakes and most rivers would be solidly filled with ice from the bottom up, presumably destroying many life-forms in the process. Since the ice floats on top, it forms an insulating layer, keeping the water below liquid so that aquatic life-forms can survive.

Some time ago I heard that if a person stays in a completely

darkened room long enough to allow his irises to open completely, he'll be able to see by so-called "black" or ultraviolet light, but that every object he sees will seem to be displaced a certain angular distance from its actual position. Can you shed any light (black or otherwise) on this?

Bert Avera

Box 345

Fairhope, Alabama

It is not true that everybody can see ultra-violet after he has been in the dark long enough for his eyes to attain maximum sensitivity. It is true that *some* people can see ultra-violet and they don't even have to stay in a dark room—the main point is here that the intensity of ordinarily visible light must be low enough so that the u-v is not "drowned out" completely. The ability to see u-v seems to be restricted to light-eyed people who are still fairly young; the ability seems to be lost with age. I don't know whether an age limit has been actually established. As a rule of thumb, a person over 30 years of age is too old for that.

But the idea of an angular displacement is wrong. Everybody can "see" ultra-violet via his camera. If there were such a displacement, all pictures taken in light with much u-v in

it (sunlight, for example) would be fuzzy or have double outlines. I admit having seen photographs with fuzzy or double outlines, but the u-v had nothing to do with that.

I have read that the Northern Lights are caused by Sun spots. If so, why are they seen only in the north? Would they be seen on other planets?

Mildred Moore

116 William Street

Hightstown, N. J.

The Northern Lights are caused by solar activity (Sun spots), but they are not restricted to the north. They appear in the regions of the magnetic poles, which are reasonably close to the geographical poles. Scientific terminology is *aurora borealis* for those near the geographical North Pole and *aurora australis* for those near the geographical South Pole.

The second portion of the question is especially interesting; it would be nice if we could be sure. To the best of my knowledge, no aurora has ever been seen in the Martian atmosphere, but quite a number of astronomers believe that aurorae may have been seen in the Venusian atmosphere. Venus, going around the Sun inside the orbit of Earth, shows decided phases like the Moon.

It happens that far more of the sickle points is visible than can be accounted for geometrically. Also, the outline of the sickle is sometimes "bumpy." These irregularities do not necessarily have to be caused by aurorae, but they may be.

In the July 1951 issue of the American Scientist, George Gamow writes: "Recently this theoretical conclusion (Weizsäcker, Kuiper et. al.) found confirmation in the actual discovery of planetary systems near two close stars. Please explain.

*Joe Low
620 Holland
Lakewood, Colo.*

When you ask me to explain Dr. Gamow's statement, I take it that you are looking for confirmation of his assertion that planets of other stars are known. They are. To phrase it as carefully as possible, one has to say that star systems comparatively near in space to our own sun are known to have non-luminous companions of planetary mass. They have not been seen so far—their existence is known because they influence the movement of their suns, which we can measure.

The suns in question are bi-

narries or double stars, two suns moving around their common center of gravity. Once this motion has been established, we are able to predict the relative positions accurately. But by careful study of photographs taken over a number of years, it turned out that the positions did not check precisely. There had to be at least one more body, not registering on the plates, to account for this.

Several such suspicious cases had been under investigation for some years when K. Aa. Strand of Sproul Observatory (Swarthmore College) announced in 1942 that the double star 61 in Cygnus had a companion of planetary mass, 16 times as massive as Jupiter and moving around its sun once in 4.9 years.

Only a few months later, the Leander McCormick Observatory of the University of Virginia announced a similar dark companion of the system 70 in Ophiuchus. The period of this object is 17 years and its mass 10.5 times that of Jupiter.

Naturally, only very large dark companions can be found by this method. But it is logical to expect smaller planets where there are large ones.