

thing it should end the fears of those who encounter bats in dark rooms that the animals will strike them.

A normal bat will usually perceive and avoid an intruder by means of its sound echoes but even if a clumsy bat should alight on a person's hair, it does not become entangled, it has been found, but quickly extricates itself.

Scientists have suspected for some time that bats use their ears to guide them but this had never definitely been proved. The experiments just reported not only showed that hearing is essential for blind-flying but also gave the first proof that the apparently noiseless flight of a bat is actually accompanied by a clamor of shrill cries which the unaided human ear cannot hear.

To study these sounds the experimenters used apparatus which Prof. G. W. Pierce of Harvard's Cruft laboratory of physics developed for supersonic research. It revealed that the bat cries were loudest at 50,000 vibrations per second. This is well beyond the range of the human ear which even under favorable circumstances can rarely detect sounds with more than 20,000 vibrations a second.

Actually, bats are not blind, the Harvard biologists found, but their supersonic blind-flying system is so good they do not need to see. To prove that the sounds were required for blind-flying, the ears of bats were covered to prevent hearing and their mouths were covered to prevent them from uttering sounds.

Such animals when set free in a room hung with wires blundered helplessly into them. Yet as soon as the coverings were removed, the same bats flew skillfully and neatly avoided the wires.

On the other hand, bats fly as well with their eyes covered as they do with them open, provided the mouth and ears are uncovered. In reporting the research, the two biologists emphasized that the theory that bats were warned of the nearness of obstacles by a very delicate sense of touch in their wings, repeatedly disproved before this, but still heard occasionally, was wrong.

The supersonic cries, when translated into sounds the human ear can hear, sound like the rattle of distant machine-gun fire. Bats utter these cries at the rate of about 25 a second when flying in unobstructed space, raising the rate to about 50 a second when approaching an obstacle.

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Chocolate becomes *cocoa* when its fat content is less than 50%.

#### ASTRONOMY

# Astronomer Suggests Search For Ghosts of Universe

## Advances Theory That Supernovae After Explosion Become So Dense Any Light They Emit Could Not Leave

**A**STRONOMERS may soon be searching for ghosts if a suggestion made recently is followed.

These are ghosts of the universe, tiny images of all the stars beyond one of extremely high density. They may be produced as the star bends light rays going past in a manner comparable to the way that a camera lens bends light rays from a scene and focusses them to form a picture on the film.

Speaking before the American Physical Society, Dr. Fritz Zwicky, of the California Institute of Technology, said that such images would afford a check of his theory of the ultimate fate of the gigantic star explosions called supernovae. When one occurs, a previously inconspicuous star suddenly rises to equal a hundred million suns in brilliance.

After such an explosion, which occurs on the average only once in several centuries in any one galaxy, such as our own Milky Way system, the end result is a collapsed neutron star, according to the Zwicky theory. This would represent the lowest states of energy that matter could possess without actually turning into radiation.

Because they would be so exceedingly dense, far surpassing even the "white dwarf" stars in which a cubic inch of matter might weigh millions of pounds, they could not be seen. The force of gravity would be so great that any light they might emit would not be able to get away.

That there is an effect of gravity on light was one of the predictions of the theory of relativity of Prof. Einstein. It has been confirmed by observations of the sun, where the effect is so slight that very delicate measurements are required to detect it.

With the neutron stars so dense, light from a distant star of the normal kind passing near one would be bent through a large angle, as if through a prism, Dr. Zwicky proposes. Where the light rays that have passed all parts of the edge of the neutron star meet, an image would be formed, so the star would really act as a gravitational lens. The image would

be seen, if at all, floating in space, between us and the neutron star. Images of other stars would also be formed, so, within a small ring, there would appear, he said, "a miniature edition of all the unobscured luminous objects in the universe."

If the neutron star is close enough, and in the right position, this image might be observed, Dr. Zwicky declared, suggesting that astronomers search for such images. Even if the details could not be seen, an analysis of the light from this ghost image might reveal its character, for the spectrum would be a combination of the spectra of many different kinds of stars.

"If the neutron star theory of supernovae is correct," said the speaker, "the number of collapsed stellar remnants of supernovae in our galaxy would exceed one million, and several collapsed neutron stars may be expected within a sphere of ten light years."

Less than ten visible stars are now known to be within this distance.

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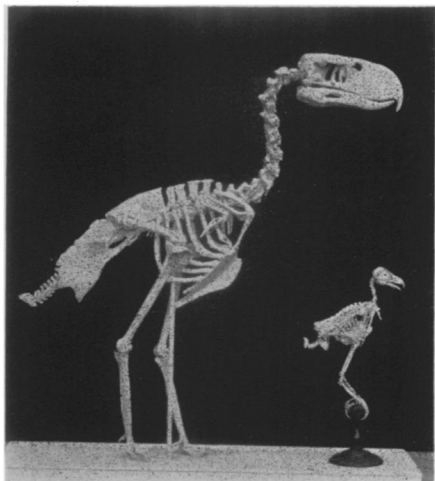
#### PALEONTOLOGY

## Find Dinosaur Neck Bone Nearly Four Feet Long

**N**OBODY could have complained about getting a piece of the neck, if there had been anyone around to make a holiday turkey out of a dinosaur whose fragmentary remains have been brought back to the American Museum of Natural History by Barnum Brown, recently returned after a season of field work in the Big Bend country of Texas. A single vertebra, or neck joint bone, is three feet across, only two inches less than four feet long, and in its present fossilized state weighs 600 pounds.

For stuffing, there could have been shellfish on the same scale. The party found oyster shells six inches wide and fourteen long, and there was one clamshell forty inches in diameter.

Dr. Brown, with his companions Dr. Erich M. Schlaikjer of Brooklyn College



### TERROR BIRD

The modern eagle skeleton at the right will give you an idea of how huge was the five-foot-tall flightless terror bird that stalked through South America from about 22,000,000 until 2,000,000 years ago. This restoration is on exhibition at the Field Museum of Natural History.

and Roland T. Bird of the American Museum, found evidences that the sauropod dinosaurs (they of the fat-bellied, long-necked, long-tailed variety) persisted in this part of North America for millions of years after they had disappeared from their more familiar stamping grounds in what is now the northern Great Plains and Great Basin areas. Possibly the Big Bend had a more favorable climate for them then, with deep swamps rich with lush vegetation—it is cactus and chaparral country now.

Dr. Brown also found evidence bearing on a long-debated question of how these immense reptiles got about. It has sometimes been conjectured that even their massive legs could not support them, but that they rested their bellies on the ground, like lizards or alligators.

A beautifully preserved slab of rock bearing imprints of all four of a sauropod's feet shows no belly-trail. It appears to have been putty-like mud at the bottom of a shallow lake when the huge saurian walked across it, his ponderous bulk partly buoyed up by the water. This also has been one of the hypotheses regarding sauropod locomotion. Dr. Brown secured a slab bearing these footprints, which has been shipped to the American Museum. It is 29 feet long and 7 feet wide, and bears the prints of all four feet. A similar slab was excavated and presented to the University of Texas. All told, the expedition brought back 22 tons of fossil specimens.

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### POLITICAL SCIENCE

# Counter-Plan for Small Nations Urgent Need of Democracies

## Federation Under Protection of Democratic Powers Urged for Units Geographically or Culturally Akin

DEMOCRACIES urgently need a counter-plan for bringing order out of chaos in smaller nations of Europe, if they are to checkmate the Nazi intent to enslave a great part of the continent.

Presenting this crucial problem to the American Historical Association, meeting in New York, Prof. Oscar Jaszi of Oberlin College advocated a federation of smaller units culturally and geographically connected, such as Danubian, Balkan, and Baltic federations under protection of strong democratic powers.

The only other prospect for Europe's minority problems, economic worries, and educational future will be to become part of a planned economic system imposed by Germany to further her own economic goals, he pointed out.

"Whereas the Nazis are going on," he added, "to establish the new economic structure with blood and iron, with playing off one nationality group against the other, it is appalling to see that the leading democracies in their death struggle were unable to offer even a theoretical plan for making an end to the Central European chaos.

"If this attitude should continue, they must be regarded as conservative, nay, reactionary forces opposed to the Nazi revolution."

Modern Thailand (Siam) is attempting an economic and social revolution to strengthen its position in the troubled Far East, Dr. Kenneth P. Landon of Earlham College, Richmond, Ind., reported to the historians.

Chinese and Europeans are being dislodged from monopolizing business and industry in Thailand, he stated. Only Thai people may be butchers, drive taxis, or engage in many other lines of work. The government operates a silk factory, sugar factory, oil refinery, textile mill and other plants.

Thai people, who formerly scorned commercial careers for their sons, are now given the ideal of the business man to admire. If the nationalistic program is successful, said Dr. Landon, the Thai will become a business people.

Prestige of the military has risen with the tide of nationalism, he finds, replac-

ing ill-repute which used to be attached to conscriptive service. The government is itself in the hands of military men, and military budgets have greatly increased.

Thailand's economic and social revolution is a direct outcome from free government and national spirit, said Dr. Landon, contrasting progress the Thai are making with the condition of colony neighbors who depend for good government on controlling powers.

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### ENTOMOLOGY

## Can't Trap Mosquitoes With Scents or Lights

WHAT makes a mosquito come and bite you? Dr. Kenneth B. M. Crooks of Hampton Institute has been trying to find out, but so far without much success, he reported before the meeting of the Entomological Society of America.

It wasn't just curiosity that impelled Dr. Crooks. If something can be found that attracts mosquitoes as powerfully as cheese attracts mice or catnip lures cats, it can be used as a bait for insect traps. Other insect pests are being trapped with considerable success nowadays, using lights of various colors, attractive odors, and so on.

Among the things used in the experiments were human blood and body secretions, soiled clothing, etc., as well as more than 300 kinds of odorous chemicals, perfumes, several diverse wavelengths of light, and differences in temperature and humidity. Numbers of mosquitoes, of four different species, attracted by any of these, Dr. Crooks reported, were "disappointingly small." Mosquito traps therefore do not look very promising.

An interesting by-product of the investigation was the discovery that mosquitoes apparently can "see" ultraviolet radiation, which is invisible to human eyes. The insects were repelled by it, as well as by several visible colored wavelengths.

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