list with twenty of these reptiles on about 250 miles of paved roads; Georgia is second with fourteen on 158 miles of various types of highway.

While the number of individuals as well as species of vertebrate animals here catalogued as having met their fate from speeding motor cars on well-surfaced roads is not extraordinary in consideration of the distance over which the records were made and the diversity of the topography encountered, it can not be denied that the combination of automobiles and good roads go hand in hand and constitute important regulatory factors in the abundance and distribution of at least certain types of animal life throughout the country.

The complete list of twenty-three identifiable species of vertebrate casualties encountered on this trip follows, together with other individuals which, in passing, it was not possible to determine further than the larger taxonomic groups.

	AMPHIBIANS	
1.	Frogs and toads	6
	REPTILES	
2.	Painted terrapin	5
3.	Tortoise	1
4.	Miscellaneous turtles	19
5.	Garter snake	2
6.	Blue racer	1
7.	Black snake	1
8.	Bull snake	8
9.	Rattlesnake	1
10.	Miscellaneous snakes (may include some of above)	43
	BIRDS	
11.	Sparrow hawk	1
12.	Other hawks	1
13.	Domestic fowl	23
14.	Mourning dove	1
15.	Crow	2
16.	English sparrow	21
17.	Mockingbird	1
18.	Miscellaneous birds (may include some of above)	17
	MAMMALS	
19.	Opossum	2
20.	Fox squirrel	1
21.	Thirteen-lined spermophile	2
22.	Norway rat	2
23.	Pocket gopher	1
24.	Cottontail rabbit	7
25.	Domestic pig	1
26.	Striped skunk	1
27.	Domestic dog	2
28.	Domestic cat	6
29.	Miscellaneous mammals (may include some of above)	20
	MISCELLANEOUS VERTEBRATES	
30.	Probably includes amphibians, reptiles, birds and mammals	35
	Total	234

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INTERPRETING THE GRAND CANYON

THE informal expositions by specialists of the natural phenomena of geology and life impressively illustrated at the Grand Canyon, which were instituted last summer by the National Park Service, with the cooperation of the Grand Canyon committee of the National Academy of Sciences, are being continued during the current season. Dr. Douglas Johnson, professor of physiography at Columbia University, now at Grand Canyon, will, by invitation of the director of the National Park Service, be followed in June by Professor John P. Buwalda, head of the department of geology at the California Institute of Technology, and by Dr. Harold Bryant, director of the educational and research division of the Fish and Game Commission of California. Dr. Herbert E. Gregory, director of the Bishop Museum in Hawaii, one of the leading students of Grand Canyon geology and geography, may continue the program later in the summer.

With the object of aiding the tourist to a better understanding of the origin of the Grand Canyon, the geologic history of the region and the zonal distribution and environmental adaptations of the life, the methods that are being worked out by the National Academy Committee, under the chairmanship of Dr. John C. Merriam, consist primarily in the preparation of exhibits *in situ*, such, for example, as footprints, plant impressions, marine shells, fault contacts, contact conglomerates, etc., so exposed or arranged with reference to one another as to stimulate observation and correct deduction on the part of the visitor as to the conditions under which the fossil organisms lived, their burial in place of growth, the former continuity of the strata from side to side of the Canyon, changes in the sequence of life from the bottom upward in the series of sedimentary deposits, the contrasts in the life that at different times occupied the region, the relative antiquity of the formations crossed in descending the Canyon walls and the agencies of erosion still acting with stupendous power, as seen in the sand-laden river and the rolling boulders in or along its channel.

Geological and paleontological specimens taken from or connected with the different field exhibits form part of a small collection in the observation station built under the auspices of the committee on outdoor education of the American Museums Association, with the cooperation of the academy committee and the support of the Laura Spelman Rockefeller Memorial. The station, designed by Herbert Maier

and Dr. Merriam, and located on Yavapai Point, is an achievement in architectural propriety as well as in fitness for its definite object. Yavapai, one and one third miles from Grand Canyon station, is particularly scenic and it commands views of the Bright Angel, the Yaki and the Tonto trails. It directly faces the splendid lateral canyon of Bright Angel Creek. The equipment and preparation of exhibits under the direction of the Grand Canyon committee of the academy has been supported financially by the Carnegie Corporation.

Conforming to the idea of aiding the visitor to develop an understanding of the scientific problems through his own observation, the work of the specialist consists largely of short informal talks at the observation station, on different phases of Canyon history and Canyon life. During these expositions reference is made to the exhibits *in situ,* which, like the rushing river, are in view from the station and may be seen very distinctly by means of telescopes ranged along the parapet. The speaker enlarges and helps to extend the discoveries of the layman. A relief model of the Canyon and the hand specimens brought from the field exhibits for nearer view are useful in the explanatory discussions.

The exhibits *in situ* are nearly all located either near one of the trails or within easy reach by short lateral trails. They are so arranged and prepared that the observer can hardly fail to develop on his own initiative the conclusion that the very remarkably distinct and highly varied footprints in a sandstone ledge of the red Supai series, for example, pass onward along the plane of deposition far beneath the towering plateau to the south; that the landscape in which the animals lived extended across the Canyon, where again the same kinds of animals were wandering about; that the environment was one of relative aridity at the particular time, molds of salt crystals being seen in the sun-cracked shales, and that vast lapses of time and great changes of level of the land and of animal and plant life took place during the interval represented by the strata in the Canyon walls.

In order better to aid the tourist, it has been found necessary for the expositors themselves to learn more about the Canyon. This has led to a number of investigations of problems of the history, extinct life, physiography, metamorphism, structure, etc., of the region. A more detailed study, with mapping, of the faunal zones and their characteristics is being made by Vernon Bailey, who is now at the Grand Canyon with Mrs. Florence Merriam Bailey.

The keenly appreciative interest of the tourists last summer proved not only the unique advantages of conducting such educational work in the impinging presence of stupendous examples of the natural phenomena under consideration, but also that the tourist who visits these places is psychologically peculiarly responsive to the impressive demonstrations spread before him by nature. The occasion is particularly fitted both for developing a conception of the processes of nature and for the growth of his philosophy of life.

DAVID WHITE

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A STANDARD MICROCINEMATOGRAPHIC APPARATUS

IT has been proved by many investigators and lecturers that the motion picture camera has been used advantageously as an instrument for recording experiments as well as for demonstration. The advantages of demonstration are obvious and have been explained repeatedly perhaps better than can be done here. There are still investigators, however, who have not yet realized the great possibilities of the motion-picture camera in research laboratories.

The greatest value of the motion picture as applied to science lies in its domination of time, for by its use it becomes possible to analyze thoroughly motions which are too fast or too slow to be perceived with the naked eye. Very rapid movements photographed with the slow motion camera and very slow movements taken with the time lapse camera are translated into perceptible speeds.

Another point in favor of the use of the motion-picture camera is the ease with which *microscopic* phenomena may be shown to large audiences. By means of the microfilm, composed of a series of photographs of successful experiments, it is possible to present, at a moment's notice, the best examples and results of research work. Microprojection as sometimes used in classrooms is limited in its application because it can be used only for low power, it requires much time for the preparation of material and equipment, the subject of the experiment does not always act as it should and the lecturer is often obliged to work the apparatus himself, a procedure which requires considerable skill. Many experiments can hardly be duplicated and the microprojection apparatus is expensive.

The application of microcinema to research work offers great opportunities. The microcinema camera is used here as an automatic recording instrument which takes successive photographs of a subject at certain time intervals which, of course, are determined from the actual speed and the projection time to be desired. This camera records microscopic phenomena during an unlimited period of time and it catches,