tions in the upper and lower jaws. Thus, I^1 signifies an upper permanent first incisor tooth; Pm_2 a lower permanent second premolar; m^2 an upper second infantile molar (to be replaced by Pm^2 of the permanent generation), and so forth. Right and left furthermore may be signified either by an additional r or l, so that M_{1r} stands for a lower right first molar, i^{2l} for a deciduous upper left second incisor. The canine as of single occurrence in the jaw-half requires no enumerative marks, so that C^r stands for a permanent upper right, c_l for a deciduous lower left canine. Symbols like these are preferably used in the description of individual teeth, deciduous or permanent, fossil or recent.

As regards their state of preservation, individual teeth may either be non-erupted, lost, pathological or in process of eruption. The following list in a summarized form accounts for these features, as also for those described above:

1 – 8, indicating the permanent teeth of an adult jaw-half in mesiodistal orientation;
I – V, indicating the deciduous teeth of an infantile jaw-half in mesiodistal orientation;

I = incisor
C = canine
Pm = premolar
M = molar
} Symbols (capitalized initials) of permanent teeth

i = incisor
c = canine
m = molar
} Symbols (small initials) of deciduous teeth

State of preservation of teeth in the dental schemes:

–, indicating non-eruption;
x, indicating post-mortem loss of tooth as shown by an empty alveolus, or a possible intra-vitam loss with a more or less obliterated alveolus or a more or less distinct gap remaining;
( ), indicating a pathological tooth, *e.g.*, (3);
○, a tooth in eruption, *e.g.*, (8).

Tentatively applying the last four symbols to the adult dental formula, the latter may individually occur as follows:

x	x	x	x	4	3	(2)	1	|	1	2	3	(4)	x	6	x	8
○	7	6	x	4	3	2	1	|	1	–	3	4	5	6	7	○

According to this formula and also using some of the other symbols, the state of dental preservation accounts in the right half of the upper jaw for a pathological I^{2r} and a missing Pm^{2r} and missing M^{1-3r}, in the left for a pathological Pm^{1l} and a missing Pm^{2l} and M^{2l}, while in the right half of the lower jaw Pm_{2r} is missing and M_{3r} in eruption, the left half accounting for a non-erupted I_{2l} and M_{3l} in eruption.

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POSSIBLE IMPLICATIONS OF REPTILIAN THERMAL TOLERANCE

INVESTIGATIONS into the thermal responses of the reptiles of southern California deserts have established a few facts that appear to be of particular interest since they suggest an alternative explanation for the sudden disappearance of their large Mesozoic predecessors.

The inhabitants of this extremely hot area show only moderate physiological adaptation to the maximum environmental temperatures to which they are subjected, achieving their survival largely through behavior in response to excessive insolation and heat.

The most heat-tolerant forms include the following diurnal lizards: *Sauromalus obesus, Dipsosaurus d. dorsalis, Uma notata, Phrynosoma platyrhinos* and *Phrynosoma m'callii.* These appear to be conspicuously thermophilous forms and yet, with ground-surface black-bulb thermometer readings as high as 87° C. common occurrences in their environment, they are characterized by optimum temperatures ranging between 37° C. and 38° C. The coastal lizards from appreciably cooler areas, *Phrynosoma b. blainvilii* and *Phrynosoma b. frontale,* as well as species from the higher or cooler desert areas, such as *Crotaphytus collaris baileyi, Crotaphytus wislizenii* and *Crotaphytus silus,* approach or equal these temperatures.

The most surprising fact relative to high temperatures is the characteristic reptilian inability to endure body heat much above the optimum, an increase of only 2° C. causing marked discomfort which seldom if ever will be tolerated voluntarily. Short exposures to higher temperatures cause death in from 60 seconds to an hour, the time element depending on ground heat, intensity of radiation, capacity for color change and volume of the lizard. Toward low temperatures these animals exhibit a far greater latitude, although 28° C. appears to be the lowest voluntarily tolerated temperature. These and other factors concerning the thermal relationships of desert lizards clearly suggest the possibility that high temperatures and increased insolation, rather than cold, may have been the chief element in bringing about the disappearance of the Mesozoic reptilian fauna, and it can be stated that if these forms were as notably susceptible to the lethal effects of high temperatures as our most heat-loving desert species of to-day, they could scarcely survive exposure to the direct sunlight of a hot summer day. Certainly it is notable that their successors were mainly homoiotherms or aquatic vertebrates, the terrestrial poikilothermous reptiles having disappeared with puzzling universality, especially from the viewpoint of encroaching low temperatures as the lethal agent.

In spite of our limited knowledge as to the actual density of vegetation during these important times it appears probable that exposure to direct sunlight was becoming increasingly unavoidable. The vegetational changes provide evidence of increasing aridity and suggest increasingly wide spacing of the trees and the development of savanna types of country, presumably resulting in serious exposures of the larger reptiles at least, to almost direct untempered insolation.

Although no information is available it is probable that in common with the terrestrial poikilothermous vertebrates of to-day, the early Mesozoic reptiles may have relied upon a suffusion of melanin or other comparable heat-absorbing pigment for temperature regulation, a characteristic which appears to be of vital importance in the survival of desert lizards in order to achieve and control the body temperatures requisite for the normal functioning of physiological activities. The necessity for pigmentation by heat-absorbing substances would seem to have been particularly necessary if the commonly accepted concept of dense vegetation, heavy blanketing clouds and abundant water vapor existed on and above the earth's surface during Triassic, Jurassic and early Cretaceous times. With such pigmentation and lacking the capacity for color change, progressive reduction in the amount of water vapor or clouds would be accompanied by a disastrous rise in the body temperature of exposed reptiles. It is notable that desert snakes with no known capacity for color change are almost altogether either crepuscular, nocturnal or subterranean in habitat. The diurnal racers appear to survive excessive heat through their capacity for swift retreat to shade and in hot weather the trend is toward a crepuscular existence.

Additional evidence for progressively higher temperatures appears to be provided through the thermal evolutionary sequence as seen in the changes exhibited from the fishes to mammals and birds in which there is a distinct tendency toward the adoption of progressively higher body temperatures with an increasingly unfavorable susceptibility to cooling. This trend toward the optimum temperatures of complete homoiothermism and its perfection in the birds may reflect a gradual development in the environment of conditions feasible for the initial steps toward thermal control without excessive expenditures of energy due to internal-external temperature discrepancies, that is, in a gradual increase in available heat.

A much confused but apparently similar thermal-evolution relationship among plants is highly suggestive.

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SCIENTIFIC BOOKS

THE CARNEGIE INSTITUTION OF WASHINGTON AND DR. MERRIAM

Published Papers and Addresses of John Campbell Merriam. Publication No. 500, The Carnegie Institution of Washington.

Cooperation in Research. Publication No. 501, The Carnegie Institution of Washington.

MANY readers of SCIENCE doubtless noted with interest that Dr. John Campbell Merriam, president of the Carnegie Institution of Washington since 1921, had retired on December 31, 1938, in order that he might be free to devote his time to research and writing, and that the board of trustees of that institution, in appreciation of his far-sighted leadership, had appointed him president emeritus, with provision for the support of his studies.

Soon afterward the trustees also made arrangements for the publication of a testimonial volume to Dr. Merriam (Publication No. 501). Previously to this, the trustees had authorized the republication of the "Published Papers and Addresses of John Campbell Merriam"; this publication (No. 500) fills four large volumes, comprising 2,672 pages, an index, a bibliography and many illustrations. Both publications are of exceptional importance not only because they contain a great mass of valuable scientific and educational records and results, but also because they afford abundant evidence, direct and indirect, of the development of the Carnegie Institution itself under the influence of Dr. Merriam's far-reaching and constructive methods and philosophy.

Neither Dr. Merriam nor the Carnegie Institution could ever be fairly classed with those who learn "more and more about less and less"; they stand indeed at the opposite pole from that famous senior wrangler who gloried in the practical uselessness of his subject. Professor Chester Stock's appreciative article at the close of Publication No. 501 makes it clear that Dr. Merriam, a student all his life, has never ceased to extend and develop his first-hand knowledge of many sciences: botany, paleobotany, invertebrate paleontology, geology, vertebrate paleontology, archeology, anthropology and related fields; also that as an administrator he has gained such an insight into the methods and objectives of the physical sciences, history and philosophy that he has achieved far-reaching success in organizing and integrating the activities of many otherwise disconnected agencies in these diverse fields.

With this clue in hand we may thread our way with rising enthusiasm through the far-flung labyrinth of his scientific papers and addresses. However, the future historian who desires to study the earliest published writings of Dr. Merriam will be disappointed when he turns to the bibliography and reads the statement: "Not listed are several short articles between 1889 and 1891," which articles one would naturally