From the above, together with the facts of distribution and significance of vertical pupils in reptiles, the writer does not hesitate to make the following statement: rods are to be expected, either to the exclusion of cones or in combination with them, in all Boidae, in all Viperidae[1] and in such Colubridae as have vertical pupils. Rods should be present in the Amblycephalidae and in *Xenopeltis*, but will probably not be found in any round-pupilled Colubrid.[2]

Most ophidian *species* are diurnal Colubrids, but most ophidian *families* are, bodily, nocturnal and have vertical pupils. Thus, in spite of the generalization seen in the literature, it is probable that rods are very wide-spread in snakes and that, from the phylogenetic standpoint, it is the pure-cone retina which represents the major departure from the beaten path.

GORDON L. WALLS

MUSEUM OF ZOOLOGY
UNIVERSITY OF MICHIGAN

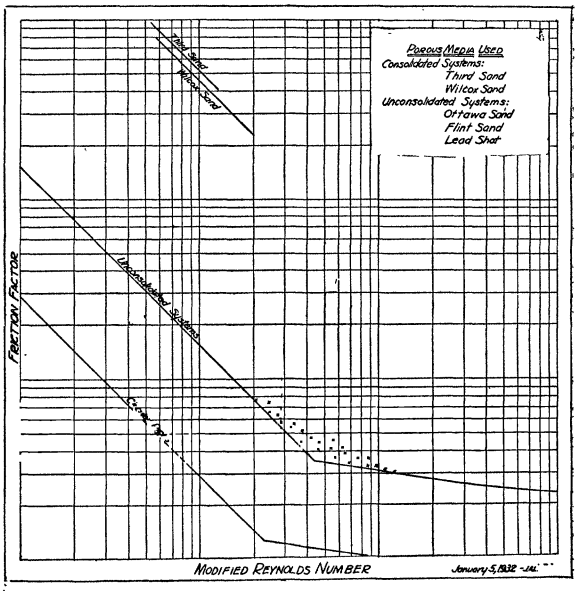
A NOTE ON THE FLOW OF FLUIDS THROUGH POROUS MEDIA

THE flow of fluids through porous media is being studied intensively in the Petroleum Research Laboratory of the Mineral Industries Experiment Station at The Pennsylvania State College.

Over 200 tests of the flow of water, air and crude petroleum through Ottawa sand, graded flint sand and six sizes of lead shot have been made as well as a few of the flow of water through consolidated sandstones. Of the latter, samples from cores of the Wilcox sand of Oklahoma and the Third sand of Venango County, Pennsylvania, were used.

The data have been correlated with the flow of fluids in circular pipes[1] by plotting a modified Reynolds number against a friction factor. Points so plotted for all systems of unconsolidated material define within the region of viscous flow a straight line parallel to that for circular pipes. Chilton and Colburn[2] recently found this to be true for columns packed with broken solids many times greater in mean diameter than the sand systems used in this work. A break in this line, or rather a region of change, is found with sand systems for large Reynolds numbers exactly as is the case for circular pipes corresponding to the change from viscous to turbulent flow.

It is remarkable that the flow of water through the consolidated sands studied so far, defines a straight line on this chart for each sand parallel to the lines for circular pipe and unconsolidated systems. The displacement evidently must be due to differences in composition and degree of consolidation of the sands. The illustration shows the type and relative displacement of the curves.



These experiments indicate that it may be possible to calculate energy relationships, permeability of oil-sands to fluids and similar factors germane to the production of petroleum from the properties of the fluid and the reservoir rock.

The investigation of the flow of fluids through consolidated porous systems is being studied in greater detail in this laboratory.

GEORGE H. FANCHER
JAMES A. LEWIS

MINERAL INDUSTRIES EXPERIMENT STATION,
THE PENNSYLVANIA STATE COLLEGE

1 Except possibly the primitive genus *Causus*, which some writers state to have a round pupil and to be partially diurnal.

2 Certain of the round-pupilled Elapines, such as *Naja* sp., may prove to have rods. The Cobras and their allies are in a state of confusion as regards their light-habits, as described by various authors. Even the matter of pupil-shapes in many Elapines is unsatisfactory, for authors who have observed living specimens disagree as to whether the pupil is round or a vertical slit!

1 Walker, Lewis and McAdams, "Principles of Chemical Engineering," 2nd ed., p. 87, McGraw-Hill Book Co., Inc., 1927.

2 Chilton and Colburn, *Ind. Eng. Chem.*, 23, 913–19, 1930.

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