

Some of the few exceptions to this general rule of distribution are exceedingly interesting, and throw a light upon the unwritten and even forgotten history of some of the tribes. For instance, a little colony of the great Sioux family is found in Virginia. How it became separated, crossed the mountains, and maintained itself in the midst of another family, speaking an entirely different language, suggests a very interesting topic for the study of the ethnologist. Again, all the northwestern part of the continent was occupied by the Athabascan family, very peaceable Indians. But the Apaches and Navajos of New Mexico and Arizona belong to the same family, and are among the most warlike on the continent. To their surroundings and the necessity of wresting their new home from its previous occupants and holding it, as well as to the inhospitable character of the country, may not their change of character be attributed? Another little tribe of the Athabascans is found in California.

One of the most degraded families of Indians of North America is the Shoshonean, from which the diggers come. And yet, strange as it may appear, the Moquis, more advanced toward civilization than any others of the Pueblo Indians, are Shoshonean.

One exceedingly interesting feature of the map is the great number of little families that lived in California and Oregon. Some of these comprise only a few individuals—not more than 40 or 50—and yet their languages are entirely distinct from those spoken by the surrounding tribes. In one instance, Mr. Henshaw, who has charge of the construction of the map, found in California a single man, the sole survivor of his tribe. From him enough was learned to preserve the language once spoken by his ancestors, but with his death that tongue becomes extinct.

A very curious fact in relation to the distribution of the Esquimaux is that they inhabit the coast of the Arctic regions to the exclusion of other Indians, beginning on the east shore of Greenland and following the coast line of that island around to the point furthest north inhabited by man. Then, beginning on the coast on the mainland, they occupy narrow strips on the north shores of Hudson Bay and along the northern coast of the continent to Prince William's Sound. Throughout all this immense coast line the differentiation of language is very small, so that an Esquimaux from Greenland transported to Behring Strait would, in a month, be able to speak the language of the natives there as well as though he had been born there. In striking contrast were the numerous distinct families of Indians in the valleys of California and Oregon, whose languages are so different that they could not understand each other.

This map, when published, will be accompanied by a report and discussion of the facts it discloses, and will be a very important contribution to the science of ethnology.

PHOTOGRAPHY OF THE HUMAN EYE.

By ELMER BARR, M.D., Buffalo, N. Y.

UP to the present time, so far as I am able to learn, attempts to photograph the interior of the living human eye have not yielded very encouraging results. In the *Philadelphia Photographer* of June 5, 1886, Drs. Jackman and Webster, of Coggeshall, Essex, England, give the results of their experiments. They succeeded in showing the end of the optic nerve and an indistinct outline of a part of one or two large vessels.

The chief difficulty in obtaining a photograph of the interior of the eye lies in the fact that the light reflected from the fundus consists almost entirely of red light; and it is well known that ordinary photographic plates are but slightly sensitive to red.

It occurred to me that it would be an improvement to use ortho-chromatic dry plates. With this idea I began experimenting to obtain a photograph of the interior of the living human eye, and the results are better than any others I have seen, showing the optic nerve and vessels quite well.

An ortho-chromatic dry plate is one which by a special treatment is rendered sensitive to green, yellow, and red; the aim in artistic photography being to show the true gradation of tone in a photograph of an object reflecting these colors.

I first tried commercial ortho-chromatic plates, and although more sensitive to green and yellow, such a long exposure was necessary for them to be affected by red that it was impracticable to use them.

I then began experimenting with various formulæ to obtain a plate more sensitive to red, and although the results are much better than those obtained with the commercial plates, they still fail to show the proper gradation of different depths of red, so that the large dark red vessels are not shown with their true distinctness.

The apparatus I have used is rather crude—being merely a modification of Carter's demonstrating ophthalmoscope—and doubtless better results might be obtained with specially constructed apparatus.

For a source of light an Argand gas burner is placed on one side and about eight inches from the concave reflector; an alum cell is placed before the light to intercept the heat rays. The reflector is of 7 inch focus,* and has a central opening of an inch in diameter; it is placed about 24 inches from the eye to be photographed.

About two inches in front of the eye to be operated upon is placed a lens to increase the illumination and to form an aerial image from the rays of light reflected from the interior of the eye. After many trials I decided to use a lens of 2 inch focus, as that gives good illumination and shows more of the fundus than would a lens of longer focus.

Behind the opening in the reflector is placed the camera. The arrangement I use consists of a metal tube carrying a lens, and arranged to slide within another tube having a plate holder at its end; the image is focused by sliding back and forth the tube with the lens.

The lens in the camera has a focus of only three inches, and this I think is important, for it makes a very bright image, and consequently a short exposure—six to ten seconds—is sufficient. The image formed is so small that enlargement is necessary when printing from the negative, but in this process time is not so important an element as when making the exposure,

* A reflector of longer focus would be better, as a condenser could then be used in front of the light, thus increasing the illumination.

for few persons can hold the eye many seconds without movement.

The plates employed are extra rapid dry plates. They are rendered ortho-chromatic by bathing for one minute in a solution of erythrosin, washed well under the tap, and allowed to dry. They must not be used until dry, but as soon after drying as possible, as they keep but a short time.

The erythrosin bath I make as follows:

Erythrosin.....	1
Distilled water.....	1,500
Solution silver chloride in ammonia (gr. xxv-3j).....	$\frac{1}{2}$
Stronger ammonia.....	1
Mix.	

In developing I use the pyro and ammonia developer, and pour on the bromide and ammonia first, to prevent fogging. Ferrous oxalate developer may be used if the plates are first soaked 30 seconds in

Potassium bromide.....	gr. lx
Ammonia.....	3ij
Water.....	3vj

Development is commenced in the dark, but after it is well started, a red light may be used in which to finish the operation.

The image is so small that details cannot be seen by a weak light, so that the operator must judge by the general appearance of the image and by the length of time of development—five to ten minutes—as to when the process is complete.—*Amer. Jour. of Ophthalmology.*

A New Catalogue of Valuable Papers

Contained in SCIENTIFIC AMERICAN SUPPLEMENT during the past ten years, sent *free of charge* to any address. MUNN & CO., 361 Broadway, New York.

THE SCIENTIFIC AMERICAN Architects and Builders Edition.

\$2.50 a Year. Single Copies, 25 cts.

This is a Special Edition of the SCIENTIFIC AMERICAN, issued monthly—on the first day of the month. Each number contains about forty large quarto pages, equal to about two hundred ordinary book pages, forming, practically, a large and splendid *Magazine of Architecture*, richly adorned with *elegant plates in colors* and with fine engravings, illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Costs, Bills of Estimate, and Sheets of Details.

No other building paper contains so many plans, details, and specifications regularly presented as the SCIENTIFIC AMERICAN. Hundreds of dwellings have already been erected on the various plans we have issued during the past year, and many others are in process of construction.

Architects, Builders, and Owners will find this work valuable in furnishing fresh and useful suggestions. All who contemplate building or improving homes, or erecting structures of any kind, have before them in this work an almost *endless series of the latest and best examples* from which to make selections, thus saving time and money.

Many other subjects, including Sewerage, Piping, Lighting, Warming, Ventilating, Decorating, Laying out of Grounds, etc., are illustrated. An extensive Compendium of Manufacturers' Announcements is also given, in which the most reliable and approved Building Materials, Goods, Machines, Tools, and Appliances are described and illustrated, with addresses of the makers, etc.

The fullness, richness, cheapness, and convenience of this work have won for it the *Largest Circulation* of any Architectural publication in the world.

MUNN & CO., Publishers,
361 Broadway, New York.

A Catalogue of valuable books on Architecture, Building, Carpentry, Masonry, Heating, Warming, Lighting, Ventilation, and all branches of industry pertaining to the art of Building, is supplied free of charge, sent to any address.

Building Plans and Specifications.

In connection with the publication of the BUILDING EDITION of the SCIENTIFIC AMERICAN, Messrs. Munn & Co. furnish plans and specifications for buildings of every kind, including Churches, Schools, Stores, Dwellings, Carriage Houses, Barns, etc.

In this work they are assisted by able and experienced architects. Full plans, details, and specifications for the various buildings illustrated in this paper can be supplied.

Those who contemplate building, or who wish to alter, improve, extend, or add to existing buildings, whether wings, porches, bay windows, or attic rooms, are invited to communicate with the undersigned. Our work extends to all parts of the country. Estimates, plans, and drawings promptly prepared. Terms moderate. Address

MUNN & CO., 361 BROADWAY, NEW YORK.

THE

Scientific American Supplement.

PUBLISHED WEEKLY.

Terms of Subscription, \$5 a year.

Sent by mail, postage prepaid, to subscribers in any part of the United States or Canada. Six dollars a year, sent, prepaid, to any foreign country.

All the back numbers of THE SUPPLEMENT, from the commencement, January 1, 1876, can be had. Price, 10 cents each.

All the back volumes of THE SUPPLEMENT can likewise be supplied. Two volumes are issued yearly. Price of each volume, \$2.50 stitched in paper, or \$3.50 bound in stiff covers.

COMBINED RATES.—One copy of SCIENTIFIC AMERICAN and one copy of SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, \$7.00.

A liberal discount to booksellers, news agents, and canvassers.

MUNN & CO., Publishers,

361 Broadway, New York, N. Y.

TABLE OF CONTENTS.

	PAGE
I. ARBORICULTURE.—Flowering Trees and Shrubs.—By W. GOLD-RING.—The <i>Cerasi</i> , <i>Cercis</i> , and other flowering shrubs.—Their availability and general qualities.—4 illustrations.....	10388
II. ARCHITECTURE.—Elements of Architectural Design.—By H. H. STATHAM.—Conclusion of this treatise, touching on the general arrangement of buildings.—13 illustrations.....	10392
III. BIOGRAPHY.—Caleb Cope.—Obituary notice of the president of the Pennsylvania Horticultural Society.....	10396
Sir Humphry Davy.—The works of the great scientist, with biographical note and portrait.—1 illustration.....	10396
IV. BOTANY.—Evolution in the Plant Kingdom.—By JOHN M. COULTER.—A plea for evolution drawn from the vegetable kingdom....	10396
V. CHEMISTRY.—A New Apparatus for the Determination of Sulphur Compounds in Illuminating Gas.—Drehschmidt's apparatus and process described and illustrated.—1 illustration.....	10395
The Chemical Composition of Pearls.—Analyses of molluscan pearls and comparison with so-called mammalian pearls.....	10395
VI. CIVIL ENGINEERING.—The New Port of Havre.—Detailed account, with illustrations, of improvements in the French seaport.—3 illustrations.....	10375
The Tay Viaduct.—The principal dimensions and general data of this structure.—Its construction and difficulties in its building....	10377
VII. ELECTRICITY.—New Automatic Fire Alarm.—Apparatus for sounding an electric bell on an increase of temperature.—2 illustrations.....	10383
Saunders' Lightning Guard.—A very effective protector, one which proved efficient when others failed.....	10383
VIII. ETHNOLOGY.—Distribution of the North American Indians.—Recent work of the U. S. Geological Survey, including a systematic study of the subject.....	10389
IX. MECHANICAL ENGINEERING.—The Chalk Age of Mechanical Engineering.—By J. F. HOLLOWAY, of New York.—A vivid picture of the engineering practices of days gone by, and lives of the old-time apprentices, and the contrast between former and modern engineering.....	10376
X. METALLURGY.—Notes on American Foundry Iron.—An English review of the qualities of different American pig irons.....	10384
XI. MINERALOGY.—Artificial Production of Pharmacolite.—A new mineral synthesis lately accomplished by M. DUFEY.....	10386
Asbestos.—By FRANK ALFRED ROGERS.—A review of the history, occurrence, and properties of this curious mineral.....	10379
Origin of the Names of Minerals.—Some curious instances of mineralogical etymology.....	10384
XII. MISCELLANEOUS.—A Cotton Centenary.—The approaching centenary of the first successful crop of Sea Island cotton.....	10381
The International Glasgow Exhibition.—A graphic account of the exhibition in the Scotch metropolis.—1 illustration.....	10378
XIII. NAVAL ENGINEERING.—The New Cable Steamship <i>Amber</i> .—A new vessel for laying and repairing ocean cables, embodying the last improvements in this class of ships.—1 illustration.....	10378
XIV. PHOTOGRAPHY.—Composite Portraiture.—Some highly ingenious suggestions regarding the improvement in this class of work.....	10381
Photography of the Human Eye.—By ELMER BARR, M.D.—A contribution to the photographic study of physiology; details of plates and developers.....	10380
XV. PHYSICS.—Class Experiments.—Description of some experiments in natural philosophy from the University of Glasgow.—3 illustrations.....	10385
Instruments for Recording and Reproducing Speech.—An interesting paper by ALEXANDER GRAHAM BELL recently read before the Fortnightly Club, describing the last advances in this line of work.....	10383
XVI. TECHNOLOGY.—Cement from Waste Product Lime.—By J. S. RIGBY.—A very valuable and suggestive paper, aiming at the utilization of waste lime from chemical processes.....	10380

Useful Engineering Books

Manufacturers, Agriculturists, Chemists, Engineers, Mechanics, Builders, men of leisure, and professional men, of all classes, need good books in the line of their respective callings. Our post office department permits the transmission of books through the mails at very small cost. A comprehensive catalogue of useful books by different authors, on more than fifty different subjects, has recently been published, for free circulation, at the office of this paper. Subjects classified with names of author. Persons desiring a copy have only to ask for it, and it will be mailed to them. Address,

MUNN & CO., 361 Broadway, New York.

PATENTS.

In connection with the *Scientific American*, Messrs. MUNN & Co. are solicitors of American and Foreign Patents, have had 42 years' experience, and now have the largest establishment in the world. Patents are obtained on the best terms.

A special notice is made in the *Scientific American* of all inventions patented through this Agency, with the name and residence of the Patentee. By the immense circulation thus given, public attention is directed to the merits of the new patent, and sales or introduction often easily effected.

Any person who has made a new discovery or invention can ascertain, free of charge, whether a patent can probably be obtained, by writing to MUNN & Co.

We also send free our Hand Book about the Patent Laws, Patents, Caveats, Trade Marks, their costs, and how procured. Address

MUNN & CO.,

361 Broadway, New York.

Branch Office, 622 and 624 F St., Washington, D. C.