

the Montessori schools the teacher is comparatively free and the material is handled by the children. The activities with the Montessori material are closely related to some of the activities more or less directly useful, and in a very short time the children become independent and are able to help themselves and one another. In the Kindergarten, on the other hand, every visitor must be impressed with the fact that in spite of the marvelous dexterity of the children in manipulating the regular material, they are absolutely helpless when it comes to dressing themselves.

It is hardly to be expected that any system of education can be built up by one person and adopted as complete in itself, although enthusiasts will naturally attempt to apply the Montessori methods as sufficient in themselves. Those working with these materials will soon be able to determine whether they are not too rigid and whether the self-checking feature does not interfere with the play of the child's imagination and with the opportunity for creative work on the part of the children. It is possible that material will be devised to embody all the good features of the Montessori idea and still be capable of being put together in more than one way.

Educators are seriously studying this method and there can be no doubt that both our Kindergartens and our primary grades will be greatly modified as a result of Dr. Montessori's work, and that the gap between these two stages of the child's education will be bridged thereby. As to the application of her methods in the higher grades, we shall have to await the results of the work Dr. Montessori is now carrying on.

It is surprising that a woman of such thorough training and one who uses the scientific method as a basis for all of her work should lapse into the antiquated notions about diet and nutrition exposed in parts of her book. Thus she speaks of "nerve feeding substances" years after even the U. S. courts had found out that there are no special brain or nerve foods. Again she refers to sugar as a food for "building plastic tissue," and she recommends garlic and rue because they "disinfect the intestines and the lungs."

The translation of the Montessori book by Miss Anne E. George, which has just been published, is well worth thoughtful reading by all interested in the broader problems of education as well as by those engaged in the technical work of teaching. The chapter on discipline will be a revelation to many who hold traditional ideas on the meaning of education.

### Eye-Preserving Glass for Spectacles\*

By Sir William Crookes

SINCE March, 1909, in connection with the Glass Workers' Cataract Committee of the Royal Society, I have been experimenting on the effect of adding various metallic oxides to the constituents of glass in order to cut off the invisible rays at the infra-red end of the spectrum, and thus to prepare a glass which will cut off those rays from highly heated molten glass which damage the eyes of workmen, without obscuring too much light or materially affecting the colors of objects seen through the glass when fashioned into spectacles.

Single metals were at first tried in varying quantities to see if from the color and properties communicated to the glass they were worth further examination. Each specimen is cut and polished into a plate 2 millimeters thick. The plate so prepared is first put into the radiometer balance to find the percentage of heat cut off. It is then tested in the spectrum apparatus to ascertain the upper limit of transmission of the ultra-violet rays; next it is tested in Chapman Jones's opacity meter to estimate the percentage of luminous rays transmitted, and finally the color is registered in a Lovibond's tintometer.

The following elements were selected as likely to be worthy of further experimentation by combining the metals, two, three, or four at a time in one glass so as to enable the advantages of one to make up for the shortcomings of another: Cerium, chromium, cobalt, copper, iron, lead, manganese, neodymium, nickel, praseodymium, and uranium.

While bearing in mind that the chief object of this research is to find a glass that will cut off as much as possible of the heat radiation, I have also attacked the problem from the ultra-violet and the transparency points of view. Taking each of these desiderata by itself, I have succeeded in preparing glasses which cut more than 90 per cent of heat radiation, which are opaque to the invisible ultra-violet rays, and are sufficiently free from color to be capable of use as spectacles. But I have not been able to combine in one specimen of glass these three desiderata in the highest degree. The ideal glass which will transmit all the colors of the spectrum, cutting off the invisible rays at each end, is still to be discovered.

So far as transparency, however, is concerned, it

\*Summary in *Nature* of a paper read before the Royal Society.

will not be an unmixed advantage for the sought-for glass to be quite clear and colorless. The glare of a strong light, on white cliffs, expanses of snow, electric light, etc., is known to be injurious to the eye, and therefore a tinted glass combining good observation to the heat radiation and ultra-violet rays is the best to aim for.

For ordinary use, when no special protection against heat radiation is needed, the choice will depend on whether the ultra-violet or the luminous rays are most to be suppressed, or whether the two together are to be toned down. Ordinarily the visible spectrum is assumed to end at the Fraunhofer line K,  $\lambda 3933$ , but light can easily be distinguished some distance beyond by the naked eye. It may therefore be considered that the ultra-violet rays which are to be cut off on account of their possible injurious action are those of shorter wave-lengths than, say,  $\lambda 3700$ . Many glasses have been prepared for this purpose, all of which are opaque to rays shorter than  $\lambda 3700$ . The colors are pale green, yellow, and neutral; they transmit ample light so that a choice of tints is available to suit individual taste.

Glasses which are restful to the eyes in the glare of the sun on chalk cliffs, expanses of snow, or reflected from the sea, of yellow, green, and neutral tints, have also been prepared which have the advantage of cutting off practically all the ultra-violet rays and also a considerable amount of the heat radiation.

### Man, Monkey and Their Parasites

THE so-called specific immunity reactions which have been so extensively investigated in recent years have emphasized some unusual relationships among animal species. These have expressed themselves, for example, in the precipitin and hemolysin reactions. The serum of an animal immunized against human blood gives also a precipitate in the serum of the anthropoid apes. Similarly the hemolysins specifically developed to make human blood-corpuscles act on those of the man-like apes. The reaction at once ceases, however, in the case of the ordinary monkeys.

A recent writer remarks that embryology, paleontology and comparative anatomy may have taught the same general facts, but it comes as somewhat of a shock to many to realize that man's kinship to the monkey goes so far as a "blood relationship." Few persons are as yet aware of the fact that this relationship of man by no means applies to all of the monkey tribe, but only to that group including such examples as the chimpanzee, orang, gorilla and gibbon, and not to the more common monkeys of the *Macacus* type. This subtle distinction shown in the various serum reactions is of unusual scientific interest. V. L. Kellogg, entomologist of Leland Stanford Junior University, has furnished a new and somewhat startling kind of evidence of the relationship of man to the anthropoid group of apes in distinction from others of the monkey tribe. It is based on the contention that the host distribution of the wingless, permanent skin parasites (ectoparasites) of the higher animals, including birds and mammals, is governed more by the genetic relationships of the hosts than by geographic range or any other environmental condition.<sup>1</sup> If this is correct the kinds of permanent ectoparasites found on individuals will indicate in some measure the genetic relationships of the hosts.

According to Kellogg<sup>2</sup> the wingless, permanent ectoparasites of birds and mammals are of two groups, namely, the biting lice, *Mallophaga*, feeding on the feathers and hair, and the sucking lice, *Anoplura*, feeding on blood. Certain mites (*Acarina*) may perhaps also be assigned to this category of permanent wingless parasites, but the fleas cannot be, for they hop on and off their host, and all their immature life is non-parasitic and wholly apart from their future hosts. The *Mallophaga*, of which nearly two thousand species are now known, occur chiefly on birds, while the *Anoplura*, of which less than a hundred are known so far, are confined to mammals. No biting lice have been found on man or on any anthropoid.

Sucking lice of species representing two genera, *Pediculus* and *Phthirus*, occur on man. Representatives likewise have been found on the anthropoid gibbons and chimpanzee. The other tailed monkeys which, in contrast with the man-like apes, are shown by the "blood relationship" tests to be unrelated to man, harbor parasites of entirely distinct genera. The resemblance of man to his simian cousins crops out in this most unexpected fashion.

How these remarkable affinities of host and parasite are preserved is not easy to explain. The California entomologist responsible for the facts recited states that he has often become, in the course of collection, the temporary host of various bird- and mammal-infesting

<sup>1</sup> Kellogg, V. L.: Distribution and Species-Forming of Ectoparasites, *Am. Naturalist*, 1913, xlii, 129.

<sup>2</sup> Kellogg, V. L.: Ectoparasites of the Monkeys, Apes and Man, *Science*, 1913, xxxviii, 601.

biting lice, but these parasites all seemed as anxious to escape as he was to have them do so. And they did escape; or, if they did not, they died in a few hours. There is, indeed, an extraordinarily exact fitting of parasite to host in the case of biting and sucking lice. It is hard to understand—to quote Kellogg—of just what details this fitting consists, beyond the more obvious structural and morphologic differentiations. The essential fitting is far more subtle. It is a fitting to the host's physiology as well as to its epidermal structures.—*Journal American Medical Association*.

### The Temperature of Arc Lamps

M. Lummer has just concluded a series of experiments to see if really carbon boils like water; that is to say, if the temperature of ebullition increases when the pressure augments. According to M. Violle, the temperature of the electric arc, in the crater, is the temperature of the volatilization of carbon. The temperature of the crater of the positive carbon may be estimated at 4,000 degrees, that of the negative being from 600 degrees to 700 degrees lower. If the temperature depends upon the pressure it would be possible by increasing this latter to augment the temperature of the arc far beyond the present temperatures. The quantity of light produced would also be greater. The experiments undertaken by M. Lummer seem to prove that it will be possible to arrive at a greater luminous intensity.—*Chemical News*.

We wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

We also have associates throughout the world, who assist in the prosecution of patent and trade-mark applications filed in all countries foreign to the United States.

MUNN & Co.,  
Patent Solicitors,  
361 Broadway,  
New York, N. Y.

Branch Office:  
625 F Street, N. W.,  
Washington, D. C.

## SCIENTIFIC AMERICAN SUPPLEMENT

Founded 1876

NEW YORK, SATURDAY, DECEMBER 27, 1913

Published weekly by  
Munn & Company, Incorporated, Charles Allen Munn, President  
Frederick Converse Beach, Secretary and Treasurer  
all at 361 Broadway, New York

Entered at Post Office of New York, N. Y., as Second Class Matter  
Copyright 1913 by Munn & Co., Inc.

### The Scientific American Publications

Scientific American Supplement (established 1876) per year \$5.00  
Scientific American (established 1845) . . . . . 3.00  
American Homes and Gardens . . . . . 3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

*The purpose of the Supplement is to publish the more important announcements of distinguished technologists, to digest significant articles that appear in European publications, and altogether to reflect the most advanced thought in science and industry throughout the world.*

### Table of Contents

	PAGE
Shall We Have Bridges or Tunnels?—By G. F. Kunz...	402
Modern Pickling Machines.—By Frank C. Perkins.—3 illustrations .....	404
Metal Finger Guards as Safety Devices for Machine Operators.—1 illustration .....	404
The Geological Role of Thorium .....	404
The Internal Combustion Motor for Railways.—By F. W. Lancaster.—5 illustrations .....	405
A Few Miscellaneous Accidents .....	407
The Speed of Nervous Impulse in Plants.—By Prof. J. C. Bose.—14 illustrations .....	408
The Establishment of a Race of White Canaries.—By Maud S. Martin .....	410
What is the Montessori Method?—By Sidonie Matzner Gruenberg.—8 illustrations .....	412
Eye-preserving Glass for Spectacles.—By Sir William Crookes .....	414
Man, Monkey, and Their Parasites .....	414
Index .....	415-416