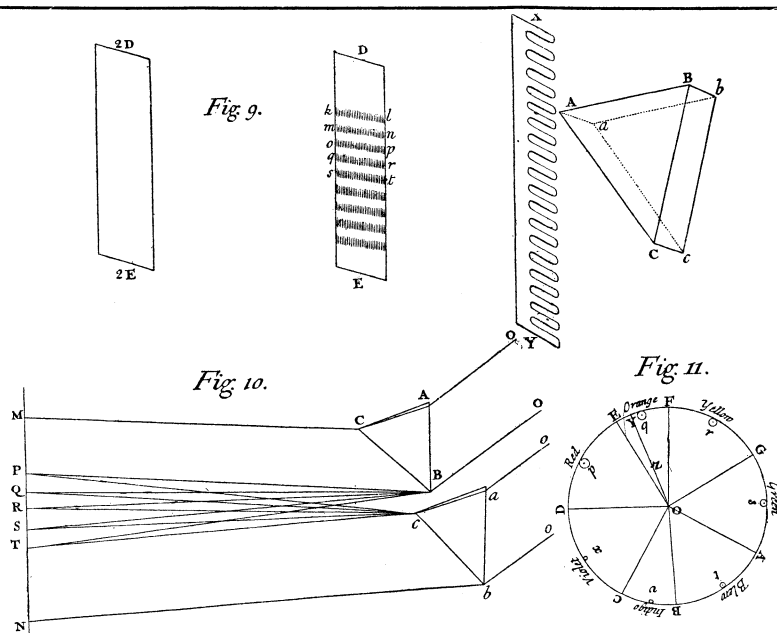


Classics of Science: Whiteness Compounded of Colours



Newton explains his arrangement for obtaining white light from two spectra: "If the most refrangible rays (blue) coming from the superior Prism take up all the space from M to P, the rays of the same sort which come from the inferior Prism ought to begin at P, and take up all the rest of the space from thence towards N"

OPTICKS: OR, A TREATISE OF THE REFLEXIONS, REFRACTIONS, INFLEXIONS AND COLOURS OF LIGHT, by Isaac Newton, London, MDCCIV.

In the following experiments Newton proved the fact, not understood in his day, that white light is composed of the several colors of the spectrum. First he combined the spectra cast by prisms, showing that colored lights mix to form white light. Next he mixed pigments to form a neutral gray, and showed that gray may be considered a shade of white.

Two prisms and a common comb with coarse teeth are needed for the first experiment. For the second, substitute modern pigments, in approximately the following proportions: chrome yellow, 3 parts; ultramarine blue, 1 part; red iron oxide, 1 part, as it is impossible to duplicate the pigments which Newton used—"Orpiment, blue Bise, Viride Aeris, and a certain purple which Painters use."

Sun's Light Compounded of Colours

Let two prisms ABC and abc, whose refracting angles B and b are equal, be so placed parallel to one another, that the refracting Angle B of the one may touch the Angle c at the base of the other, and their planes CB and cb, at which the rays emerge, may lie in directum. Then let the Light trajected through them fall upon the Paper MN, distant about 8 or 12 Inches from the Prisms. And the Colours generated by the interior limits B and c of the two Prisms, will be mingled at PT, and there compounded white. For if either Prism be taken away, the Colours made by the

other will appear in that place PT, and when the Prism is restored to its place again, so that its Colours may there fall upon the Colours of the other, the mixture of them both will restore the whiteness.

This Experiment succeeds also, as I have tried, when the Angle b of the lower Prism, is a little greater than the Angle B of the upper, and between the interior Angles B and c, there intercedes some space Bc, as is represented in the Figure, and the refracting planes BC and bc, are neither in directum, nor parallel to one another. For there is nothing more requisite to the success of this experiment, than that the rays of all sorts may be uniformly mixed upon the Paper in the place PT. . . . This is the reason of the composition by which whiteness was produced in this Experiment, and by what other way soever I made the like composition the result was whiteness.

Lastly, If with the Teeth of a Comb of a due size, the coloured Lights of the two Prisms which fall upon the space PT be alternately intercepted, that space PT, when the motion of the Comb is slow, will always appear coloured, but by accelerating the motion of the Comb so much, that the successive Colours cannot be distinguished from one another, it will appear white.

Grey Colours Compounded

Lastly, in attempting to compound a white by mixing the coloured Pow-

(Just turn the page)

Stone Age Skulls in Africa

What was the strange race of men that lived in equatorial Africa in the twilight time between the Old Stone Age and the New?

An English anthropologist, L. S. B. Leaky, who has been conducting extensive excavations in Kenya Colony, brings back with him a budget of extremely puzzling skeletal remains but refrains for the present from offering any answer to his own riddles.

Most of the bones he found at his two principal working locations, Mr. Leaky states, were badly broken, but he did find at least one skeleton in nearly perfect condition, and several good skulls. The skulls are most extraordinary. They do not resemble the skulls of the Negroes now inhabiting the locality at all, and they are very little like any Negro skulls, except that they are very narrow for their length.

Their faces, however, are high and narrow instead of being short as typical Negro faces are.

One of the most notable characteristics that marks these skulls as non-negroid in aspect is the very narrow

(Just turn the page)

CHEMISTRY

More Methanol From Wood

Double the yield of methanol, the common denaturant of alcohol, may be obtained by distillation of wood under high pressure with hydrogen. This discovery was made by P. K. Frolich, H. B. Spalding and T. S. Bacon of the Massachusetts Institute of Technology. If this process proves to be practical and profitable on a commercial scale it may be the salvation of the wood-distillation industry of America, which has been hard hit within the last two years by the importation of cheap methanol made in Germany by combining carbon monoxide and hydrogen.

It may also enable the United States to meet the coming competition of the new German process of making synthetic gasoline, carbolic acid and the like from coal and steam. The investigators have found that wood may be almost completely converted into gaseous and liquid products by heating with hydrogen under a pressure of 3000 pounds per square inch, using nickel as a catalyst to assist the combination. Many of these products would be serviceable for motor fuel or might replace organic chemicals we now obtain by the fermentation of grain.

Science News-Letter, November 12, 1927

Stone Age Skulls in Africa

(Continued from page 315)

nose-opening. The average Negro, of course, has always been noteworthy for his wide nose. One of the skulls also exhibits a most extraordinarily high palatal arch. The top of the palate is 29 millimeters, or over one and one-eighth inches, above the grinding surface of the teeth. This is seven millimeters higher than the corresponding measurement in the average European mouth, and 13 millimeters higher than that in a number of Negro skulls measured locally.

Associated with the human remains were many stone arrow and spear points and bits of pottery. The workmanship corresponds in a general way with that of similar finds in Europe belonging to the transition period between the Old Stone Age when men used chipped stone implements, and the New Stone Age, when the art of a finer polished finish was discovered.

Science News-Letter, November 12, 1927

Paintings on the walls of African caves made by Bushmen in prehistoric times show that this race has since slipped back to a lower level of culture.

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SCIENCE NEWS-LETTER

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Whiteness Compounded

(Continued from page 315)

ders which Painters use, I considered that all coloured Powders do suppress and stop in them a very considerable part of the Light by which they are illuminated. For they become coloured by reflecting the Light of their own Colours more copiously, and that of all other Colours more sparingly, and yet they do not reflect the Light of their own Colours so copiously as white Bodies do. If red Lead, for instance, and a white Paper, be placed in the red Light of the coloured Spectrum made in a dark Chamber by the refraction of a Prism, as is described in the third Experiment of the first Book; the Paper will appear more lucid than the red Lead, and therefore reflects the red-making rays more copiously than red Lead doth. And if they be held in the Light of any other Colour, the Light reflected by the Paper will exceed the Light reflected by the red Lead in a much greater proportion. And the like happens in Powders of other Colours. And therefore by mixing such Powders we are not to expect a strong and full white, such as is that of Paper, but some dusky obscure one, such as might arise from a mixture of light and darkness, or from white and black, that is, a grey, or dun, or russet brown, such as are the Colours of a Man's Nail, of a Mouse, of Ashes, or ordinary Stones, of Mortar, of Dust and Dirt in Highways, and the like. And such a dark white I have often produced by mixing coloured Powders. . . .

Now considering that these grey and dun Colours may be also produced by mixing whites and blacks, and by consequence differ from perfect whites not in Species of Colours but only in degree of luminousness, it is manifest that there is nothing more requisite to make them perfectly white than to increase their Light sufficiently; and, on the contrary, if by increasing their Light they can be brought to perfect whiteness, it will thence also follow, that they are of the same Species of Colour with the best whites, and differ from them only in the quantity of Light. And this I tried as follows. I took the third of the above-mentioned grey mixtures (*see directions at the head of this article—Ed.*) and rubbed it thickly upon the floor of my Chamber, where the Sun shone upon it through the opened Casement; and by it, in the shadow, I laid a piece of white Paper of the same bigness. Then going from them to the distance of 12 or 18 Feet, so that I could not dis-

cern the unevenness of the surface of the Powder, nor the little shadows let fall from the gritty particles thereof; the Powder appeared intensely white, so as to transcend even the Paper it self in whiteness, especially if the Paper were a little shaded from the Light of the Clouds, and then the Paper compared with the Powder appeared of such a grey Colour as the Powder had done before. But by laying the Paper where the Sun shines through the Glass of the Window, or by shutting the Window that the Sun might shine through the Glass upon the Powder, and by such other fit means of increasing or decreasing the Lights wherewith the Powder and Paper were illuminated, the Light wherewith the Powder is illuminated may be made stronger in such a due proportion than the Light wherewith the Paper is illuminated, that they shall both appear exactly alike in whiteness. For when I was trying this, a Friend coming to visit me, I stopt him at the door, and before I told him what the Colours were, or what I was doing; I askt him, Which of the two whites were the best, and wherein they differed? And after he had at that distance viewed them well, he answered, That they were both good whites, and that he could not say which was best, nor wherein their Colours differed. Now if you consider, that this white of the Powder in the Sun-shine was compounded of the Colours which the component Powders . . . have in the same Sunshine, you must acknowledge by this Experiment, as well as by the former, that perfect whiteness may be compounded of Colours.

Sir Isaac Newton was born December 25, 1642 and died March 20, 1727. In 1661 he entered Cambridge University, where he spent so large a part of his life. During 1666, when the University was closed on account of the plague epidemic, Newton, then 24 years old, invented "fluxions," or the calculus, and began the study of the force of gravitation. Twenty years later, after newer data on the orbits of Jupiter and Saturn had checked his calculations, the gravitational theory was published in the *Principia*. The experiments on light, published under the title of "*Opticks*" in 1704, were presented to the Royal Society in 1672, when Newton was 30 years of age.

Science News-Letter, November 12, 1927

There are more than 300,000 oil wells in the United States.

There are 500,000 feebleminded persons in institutions in this country, and 2,000,000 more that need institutional care, says a eugenics expert.