

## Avicenna

### *On Nature, Book 6, Part 3: On Vision*\*

Translated by Erik Norvelle

#### Chapter IV:

A consideration of the aforementioned theories about colors and their accidents

But concerning the issues we must unravel concerning these things, one is that we must consider another opinion concerning color and light which, unless it is resolved, it will not be possible to demonstrate the firmness of our opinion according to the division.

Therefore we say that of the opinions concerning color, one is that of those who hold that the color white does not come about except by air and light or its brightness, and that the color black is from their contrary. For the color white does not come about except by translucence, when this itself is divided into extremely small parts which later are condensed: for from this it occurs to it that its surfaces receive luminance and shine; and because they are translucent, they transmit luminance from one to another; and because they are extremely small, there comes to be a continuum of sorts out of them; and because the translucent is not seen except by the color of an extraneous thing, therefore their perviousness is not seen, but the reverberations of those condensed surfaces appear to be continuous, and the entirety appears to be white. Therefore they state that because of this, the froth of water seems to be white, and snow likewise is white, since it is made of extremely tiny inanimate parts which are translucent, among which air is mixed in, and light is diffused among them. Indeed, crystals and heavy glass [R 108] are not translucent, but no matter what continuous surfaces there were of them, its perviousness would be destroyed; but, when any part of it is brought to exist by itself, it will become translucent; indeed, in the translucent which is of a larger body, when it is divided, the place where it is divided appears white.

And they also say that black causes a putative privation in the depth of the body and of the luminance and perviousness simultaneously. But a certain thinker among them posited that water is the cause of blackness, saying that, when this is moistened, it appears to have some blackness; and they say that this comes to be because water expels air, and water does not transmit luminance air, nor does luminance penetrate through it to the surface, and thus the darkness remains. And a certain thinker wished to claim that blackness is the most solid color, and the origin of colors, because it is not separated; therefore it is impossible to stain it; whiteness, indeed, occurs in the translucent because of its density. But it is not a far distance for the first opinion to result in this one: for it posits that the solidity of blackness does not transmit luminance because of what does not transmit luminance, namely the solidity of the color which reverberates from it.

But others stated that all elements are translucent and, when they are brought together, there occurs from them whiteness just as we stated, also so that that which is opposite to the vision be equal surfaces of the translucent <body>, in order that vision might

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\* This translation is based on the Latin text contained in *Avicenna. Liber de Anima seu Sextus de Naturalibus, parts I-III. Avicenna Latinus (Brill, Leiden, 1972)*. This translation is for informational purposes only, and should not be cited for the purposes of academic publications without prior comparison with the Latin text. Translation by [Erik Norvelle](#), published under a Creative Commons 2.0 Non-Commercial Share-Alike license.



penetrate them; and that blackness occurs when <the configuration> of the body which is opposite to the vision is strongly angled, so that it prohibits the transmission of luminance to the extreme which touches the vision, then these angles, although they are illuminated, luminance does not penetrate them sufficiently and therefore there comes to be darkness. [R 109]

But from all this collection of opinions, that which is most difficult for me to judge definitively, is that which states that whiteness comes to be because of luminance [*lumen*] and that black is the true color. For we know that translucent things become white when dust is ground up and mixed with air, like sesame powder which becomes white because the retention of air in itself is mixed with the perviousness which is in its nature. And we also know that black does not receive any other color in any way, as whiteness receives another color in place of whiteness because of its own perviousness, and that it is a bare subject apt <to receive other colors>; because, however, it is denuded of qualities, it itself is receptive of them, so that it is not necessary for it to lose anything for this purpose; for that which is occupied by one, does not receive another unless the first is removed. And these are those who posit that the origin of color is perviousness and non-perviousness.

But there are other thinkers contrary to these who neglect perviousness, saying that all bodies are colored, and it is impossible that any body be lacking color, but there are many pores and empty spaces in bodies, whereby the rays which come from luminous bodies penetrate through them to another part, and the rays of vision also penetrate them, and that which is beyond them will become visible.

Indeed, we say that the first opinion is thusly, but not in continuous and conjoined bodies: for color does not appear except in their density; for when they are conjoined and made wet, whiteness is removed from it to that which is conjoined and dry. And indeed gypsum is not white because of the grinding which reduces it into tiny parts, but because decoction makes it such that, when it is wetted and later dried, it will be more strongly white because of the combination which occurs to it. But that which this demonstrates to us is that, if the action of fire does nothing to gypsum other than to facilitate grinding, then much facilitation of grinding which produces extremely tiny parts would produce this same action in gypsum and calcium and similar substances; and whatever grinds thusly to produce a powder and later with water is made into a paste, will become white like gypsum; but this is not the case. And indeed effecting <the grinding of> something easily crushed sometimes produces the result we have mentioned, but this is not the cause of whiteness coming to be.

Again, we posit that in gypsum this comes about just as we have said: but not all whiteness comes about in this way. And indeed with eggs, when cooked, the clear white becomes opaque and white, and it is impossible to say that fire will add rarefaction and dispersal to it (for indeed it does not add anything to it in any way except constriction), nor that air enters it and is mixed with it. And indeed when the egg is cooked it becomes heavier, and this occurs because of the air which is separated from it. Secondly because, if there were air there and it were mixed into its humor and whiteness were to be produced there, it would require a larger space.

Again, the medicine that quacks produce and call “milk of virgins” is made from oil in which crystallized litharge is cooked until it is dissolved, and then is filtered until the oil becomes translucent and white, and it is mixed with water in which old alum is mixed and filtered many times until it is like tears; but if it is produced negligently, the complexion that is desired will not be achieved. Indeed, when these [R 111] two waters are mixed, the translucent dissolved crystallized litharge coagulates, and is highly white, like sour milk, and then it is dried. And this does not occur thusly because the translucent thing there is that to which a division occurs: crystallized litharge, indeed, was dispersed and dissolved in the oil, and neither were there present many translucent particles which, coming together, would be bound fast; but it is necessary that the dispersion become greater because of the old alum-water, nor also does a mixture occur with these things and the external air in any way; for this does not occur except by some manner of permutation. Therefore, according to my opinion, not all whitening occurs as these thinkers say.

But if whiteness is nothing other than light, and blackness is nothing other than that which they say, then blackness and whiteness will not ever combine except in one manner. But the proof of this is that white is converted into black in three ways. One is first in the slightly grey, and this progression is pure: for if there were a pure progression, it would first arrive at slightly grey, and then to grey, and then so long until black comes to be, because this, proceeding in one way, does not cease by degrees reaching blackness alone, until pure blackness comes to be. Another way is from slightly red, to red, and then to black. The third is from greenness, then to blue, and then to black. And in these modes there cannot be diversity except from the diversity of that from which the middle colors are composed. For if there were not there anything but white and black, and there were not in the origin of whiteness anything but light, then it will be impossible that they differ in this way, or that they proceed in composition of whiteness and blackness except in just one way, in which there will be no other diversity but according to more or less alone; and these diverse ways would not exist.

For if there exist diverse ways, it will be necessary that there exist there some mixture of something which is neither whiteness nor blackness, and it will be necessary that there be a mixture of a visible thing. But among things there is nothing which is posited to be visible, which is neither whiteness nor blackness nor a composite of these, except light, according to <the thinker> who posited light to be something other than these: if his theory is refuted, [R 112] there will not be able to come to be a permutation of color in diverse modes. But if it this permutation were possible, it will be necessary that there be there a third visible thing besides whiteness and blackness. But this third visible thing cannot exist, unless we posit light to exist as well as color. And according to this theory, it will be possible for colors to be composed, and when white and black were mixed per se, there would be a procession along the way of slight grayness. But when light is mixed with blackness and there was <something like> a cloud over which reverberated <...> like black smoke which is mixed with fire, there will be redness if blackness were dominant, or there will be lemon-yellow if the blackness is overcome and there were there present a superabundance of shining whiteness; indeed, if the lemon-yellow were mixed with black and there was no brightness in their parts, green would occur; and altogether when blackness is more hidden and whiteness more manifest, redness will come to be from the converse. Therefore, if blackness were dominant in the first case, a dark color will result; indeed if blackness were dominant in the

second case, it would be of the color of leek leaves; but if it were greater and greater, there will result an intense greenness that has no name. But if there is mixed in whiteness, there will result the color of the wood lily; but if to this lily color there were mixed black with a small amount of red, blue will result; but if to the red blue is mixed in, carmine will result.

And in this way colors can be composed, and the same goes for the mixing of colors or composition of bodies. <...> but it is already known that blackness does not get transmitted to other colors by reflection of the color black in any way, so that indeed it would be necessary that from green colors or red colors nothing be reflected except whiteness, and from the black parts nothing would result, especially when they are weak and worn down. [R 113] But if they say that these things would be seen to shine when mixed, the response to this will be that from the mixture there comes to be an action and a passion and, by means of that mixture, there come to be quality. And it makes no difference whether this comes to be by art or nature, although nature can effect a combination which is in the manner of permutation, while art can only produce mixture, and perhaps after this nature will produce some permutation. And indeed nature can attenuate the combination which is in the mode of mixture and grinding into minute parts, while art cannot achieve so much: and indeed there are infinite actions of nature in dividing and composing in potency and act, while art cannot elicit into act anything which is latent in those. Therefore it is now demonstrated that it is most certain that whiteness in things is not light.

But we do not negate that air has some disposition to whitening, but not in the way that they state, except that it effects a combination which whitens. Similarly, we cannot say that all the whiteness of sesame powder is as they state, but it is from combination: for air makes a white color not only because of mixture, but also because of permutation. But if their theory were solid, it would happen that a white or colored thing be slowly weakened until its density were carried away, so that it would be translucent or slightly translucent. But this is not so.

But that which they say, i.e. that black is not receptive of other colors, either they want to say this from the concept of permutation or else from staining. But if they want to state this on the basis of the concept of permutation, they are already in error: for what convinces them is youth and the grayness of old age. But if they understand this in terms of staining, this is from the disposition of closeness, not of a quality. But it is not far off that that which is black not become black except when [R 114] there is present a virtue of penetrability and retention and constriction, i.e. so that it be mixed and penetrate and inhere; and that the whiteness which is in things be different from that in their nature, and thus whiteness cannot invade blackness and penetrate it and adhere to it, although also this is not impossible; for when they spread in ceruse or in something similar via some way of penetrating and dissolving the blackness which is in it, whiteness is produced.

But the second opinion is not easy to hold, unless we posit the existence of vacuum. And indeed in regards to the pores which they mention, they must either be full of a body or else empty. But if they are full of a body, the body itself will either be translucent because of the pores which it has, or else it will not have pores (and this is different from what they say), or else it will be terminated by vacuum and the postulation of the existence of vacuum will necessarily result; but vacuum does not have existence. Therefore these say that not all pores

are apt for transmitting luminance unless their position is straight and without curves, so that rays may be transmitted in a straight manner by them. Therefore let us make a white spear either of crystal or of translucent white sapphire; <let> these pores which are in them be straight and translucent, and let us posit that they are along the length, and the same along the breadth, and thus they will either be transverse or from whatever part you want. Therefore how will there be straight pores which are transverse to other straight pores, so that there will not be tortuous curves from the part which you inspect? Therefore it necessarily will occur that from some parts there is a difference of straightness, and there will exist [R 115] parts which do not have pores in the straight lines which they claim to go straight to the eye, or else the entire body will be empty, and this is impossible. Therefore it is necessary that when there are diverse places in the translucent thing, their perviousness will vary for you altogether. Next, how will there be a disposition of the body in which there are so many pores and emptiness that its color is hidden, so that it will appear almost to be without color, when the thing itself has in itself color, and it would not cover over the color of another thing which is behind it, nay more, when it transmits that which is behind it? But if the thing itself hides its own color, it will not do this except by that which is nearly nothing. Therefore the pores which are in it will be much more than the plenum which is in it. But how will this construction of sapphire come about, when the thing itself is nothing but vacuum? But if a man made in the sapphire three or four holes and then squeezes with slight strength, he can break it. Therefore this opinion is false.

Therefore, colors have being, and their being is not because they are light, nor is light their appearance, although that which they are <when> in act does not occur without light; for the translucent has being; and that is what we intended to demonstrate up to this point. But it remains next to say how the disposition of seeing comes about, on which also depends the demonstration of how light is transmitted by the translucent.