the two cases. Accordingly in the present chapter, we shall consider only the spectral region between 5,000 and 7,000 angstroms. The part of the spectrum between 4,000 and 5,000 angstroms will be discussed in the chapter immediately following. As already stated, the techniques of observation enable us to cover a great range of luminosities in the spectrum, from the weakest observable to the strongest attainable. It is convenient therefore to describe the observed effects stage by stage in the same order.

First Stage.—With the tubular lamp emitting a dim red glow and the observer far away from it, the spectrum is at its weakest. The blue-violet sector is entirely absent and the red part of the spectrum also lies outside the range of visual perception. What is then actually observed is the region between 500 $m\mu$ and 600 $m\mu$. Despite the dimness of the spectrum, the greenish hue of the part that is visible is recognisable. If now the observer comes nearer the lamp, the red of the spectrum reappears and progressively gains in strength.

Second Stage.—The character of the spectrum is now totally different from that observed in the first stage. The red sector of the spectrum appears in full strength, while the green has gained both in colour and in brightness. These colours are fully saturated and are strikingly contrasted. The transition from the red to the green is fairly rapid and can be located in the spectrum with considerable accuracy. But where the two colours come closest to each other, the progressive change in hue from one to the other with the yellow between them can be readily perceived.

Third Stage.—Further conspicuous alterations in the character of the spectrum are observed when we pass from the second to the third stage. The band of yellow which separates the red from the green is now both broader and brighter. With increasing luminosity, the yellow becomes much the brightest part of the spectrum. The green and the red sectors also exhibit an altered appearance. The changes they exhibit are best described as the result of a progressively increasing superposition of the yellow sensation on the green and on the red sensations. Such superposition would result in altering the perceived colour from green to a greenish-yellow and from red to an orange. These changes spread outwards from the yellow part of the spectrum on both sides to a greater and greater extent with increasing luminosity.

Fourth Stage.—At this stage, the yellow strip in the spectrum attains great brilliance and appears as a band which is far brighter than the regions on either side of it. These latter exhibit the features already described for the third stage.

Fifth Stage.—At this stage, the yellow of the spectrum becomes extremely brilliant and also spreads out to include within itself both the green and the orange tracts of the spectrum. It has then the appearance of an intensely luminous band of an yellowish-white colour with strips of blue and of red of relatively low intensity extending outwards from it on the two sides.

It should be mentioned that the third, fourth and fifth stages can all be quickly traversed and their characteristics noted by an observer with the slit and projection lamp described earlier, merely by varying his distance from the slit or alternatively by varying the electric current through the lamp. These observations establish in a very striking fashion that both in normal circumstances and at the higher levels of illumination, the yellow of the spectrum is the dominant visual sensation and transcends all the other parts of the spectrum in its impact on the centres of perception. Likewise, the visual pigment which enables the perception of the yellow region of the spectrum is clearly the most important of them all.

COLLAGEN ANALYSIS FOR ARCHAEOLOGICAL DATING

THE value of archæological bone samples depends in large measure upon the accuracy with which they can be dated. Unfortunately, an age derived from radiocarbon dating of bone calcium carbonate is usually suspect. It is always possible that the original carbonate has been replaced by that of ground-water ; and ground-water carbonate can be of varying date. Radiocarbon dating, therefore, has been primarily carried out on charcoal found near skeletal remains.

Archæologists have long realized that collagen analysis, if it were possible, would provide a more reliable technique. About 25% of total bone material is composed of collagen, a protein which contains about 50% organic carbon. Recently W. Libby *et al.* have found a method for isolating collagen carbon for dating.

Basically, the method consists of treating a sample of the bone in a weak HCl solution. This dissolves the mineral but leaves the collagen behind. The collagen is then dried and exposed to a stream of oxygen. The oxygen combines with the carbon and forms carbon dioxide, which is then chemically purified ; it is on this form that the carbon is dated.—[*The Sciences* (*N.Y. Acad. Sci.*), 1964, 4 (6), 23.]