SCIENTIFIC COLOR NAMING OF DRUGS.*,**

BY DEANE B. JUDD[1] AND KENNETH L. KELLY.[2]

The system of color names used is one worked out by the Inter-Society Color Council at the request of the AMERICAN PHARMACEUTICAL ASSOCIATION. It is based on a logical arrangement of the colors of objects. The colors are arranged in a solid figure called the color solid (see Fig. 1), the light colors being placed near the top of the solid, and dark colors near the bottom. The hues are arranged according to angle about the central vertical axis of the solid. Weak or gray colors are placed near this gray axis; strong or saturated colors far away from it. The

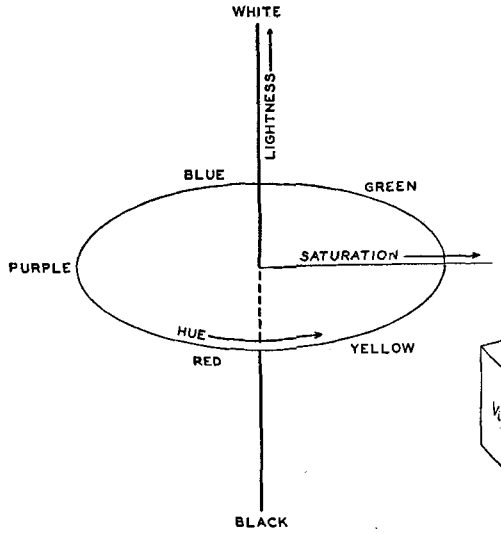

Fig. 1.—Dimensions of the color solid.

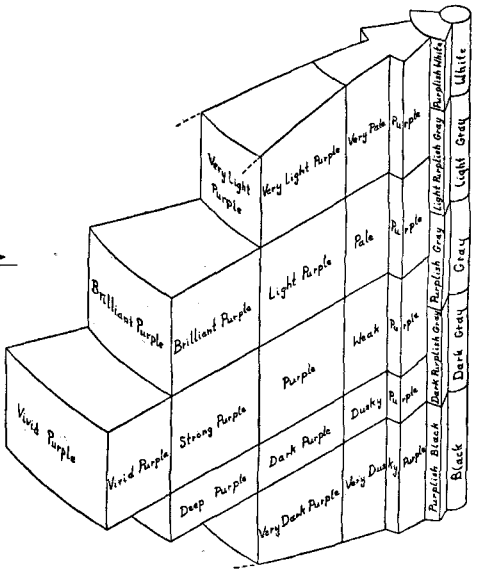

Fig. 2.—A portion of the color solid including purples, grays, black and white. This figure shows 24 of the 320 compartments, 19 being for purples, 5 for achromatic colors.

color solid has been divided into 320 approximately equal compartments and each compartment assigned a name. Figure 2 shows 24 of these compartments. All colors represented in each compartment are to be known by the same name. Since we have to deal with about ten million different object colors, it will readily be seen that not all colors will have a separate name; in fact, on the average there will be about twenty thousand colors to a single name. The most convenient number of names for describing the colors of drugs and pharmaceuticals seems, however, to be about 300. This system of color names is being applied to actual

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drugs and pharmaceuticals in the Colorimetry Section of the National Bureau of Standards under a research associateship set-up by the AMERICAN PHARMACEUTICAL ASSOCIATION.

E. N. Gathercoal is in charge of the project while the experimental work is carried out by us at the National Bureau of Standards. The work carried on is of two kinds: the colorimetry of drugs and pharmaceuticals, and the adjustment of the boundaries of the compartments to accord with the color names. At present the boundaries of the compartments are expressed in terms of the Munsell color

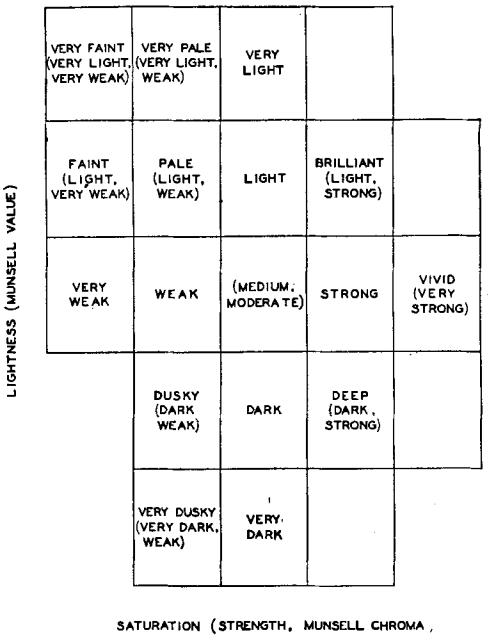

Fig. 3.—Inter-Society Color Council system of modifiers and their abbreviations.

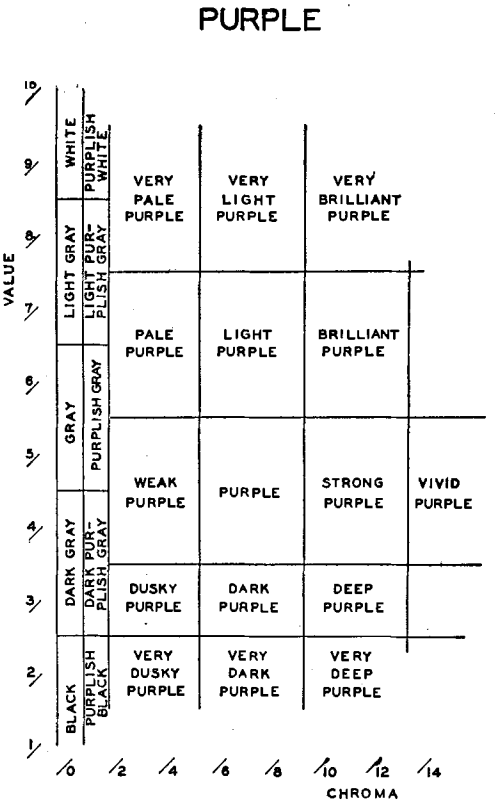

Fig. 4.—A typical chart.

systems; so the colorimetry of drugs and pharmaceuticals has consisted chiefly of comparison with the Munsell samples. This system is arranged according to the color solid and forms a very convenient way of defining the boundaries of the various compartments. Two sets of the master standards of the Munsell color system have been deposited with the National Bureau of Standards, and eventually all of the boundaries and all of the colorimetric results will be expressed in fundamental terms through spectrophotometric measurements of the master standards. Much of this spectrophotometric work has been done.

Standard methods for preparing samples of crude drugs for examination both in whole form, and in powdered form, have been worked out; and the visual com-

parison with the Munsell standards has been carried out independently by both of us. When a sample was found to have a color so near a boundary that it was not certain which name should be given to it, the comparison was usually carried out again by using a disk colorimeter. In this colorimeter, the observer sees a divided photometric field, one-half of which is filled with light reflected from the sample and the other with light reflected from a disk made up of four sectors, each sector being a Munsell standard. Comparisons made in this way are more precise because the line separating the colors to be compared is very narrow in the photometric field and because the observer adjusts the angular size of the sectors until a perfect match is obtained. This is in contrast to the less precise method of direct visual comparison with the Munsell samples in which a perfect match is rarely found, the observer in general having to estimate the notation of the sample color by visual interpolation between neighboring Munsell samples. This colorimetric work has occupied the major part of the time. The work on powdered drugs has been finished except that which refers to microscopic structures; and a good start has been made on whole crude drugs.

A considerable amount of time has been spent on the arbitrary adjustment of boundaries between compartments to make the names fit the colors. To give an idea of what sort of consideration is involved, it will be necessary to tell more about the Inter-Society Color Council system of names on which the work has been based. In general, the color name consists of a noun indicating the hue (such as green, red, blue or purple) combined with one or more adjectives to indicate what kind of a blue or purple the color is. Thus, the adjective will tell whether it is a light or dark purple, a strong or weak one. If it were both light and strong, the combination "light, strong" would be thought of; but this has been shortened to the single adjective, brilliant. Similarly, the combination "dark, strong" has been shortened to the adjective, deep. Figure 3 shows all of the abbreviated modifiers. The adjectives, very weak, faint and very faint, are used only for orange and yellow-orange. Note how it is possible to tell the nature of a color difference directly from the adjectives, and also that if it is necessary from a legal standpoint to know whether a substance is dusky purple or weak purple, the boundary is definite and will be completely specified beforehand. Figure 4 shows the present boundaries for purple in terms of Munsell value and chroma. This is a vertical section through the center of the solid shown in Fig. 2. It is typical of the application of the modifiers to colors of one hue, except that for red, orange and yellow a more complicated system is required to permit the introduction of the hue names, brown and olive, which refer to dark colors. Note that the very weak purples are not identified as purples, but rather as purplish white, purplish gray or purplish black; this is the typical method.

All of the boundaries between the names of the same hue and between the different hues have been adjusted to accord with our ideas of what is appropriate. This system of boundaries has been put through more than twenty revisions as our ideas of the appropriate names have become more crystallized. In making these twenty revisions account has been taken of fifty or sixty suggestions from many sources and nearly all of the suggestions resulted in improvement. Only a few suggestions have been contradictory so that it was necessary to choose between them. The time is now approaching when it will be necessary to make the final

adoption of boundaries, and we have increasing confidence that further chance for definite improvement of the names by adjustment of the boundaries is slight. It is hoped, however, to enlist the aid of those who are interested in the color names used in the description of drugs and pharmaceuticals to give the present tentative systems of boundaries a final check before adopting it.

A summary of the work on powdered crude drugs has been prepared. This summary gives for each powdered drug the color name now included in the National Formulary monograph, then it gives the color name or names found from the present tentative system together with the number of samples examined. Copies of this summary are available now to all who wish them.[1] Criticism is invited of the color names yielded by the present system. If, for example, you believe from your knowledge of drugs that the term, weak Olive-Green, would be a more accurate description of Adonis than pale Olive-Brown, we hope that you will so inform us. New color names cannot be added to the system, but the boundaries can be adjusted so that another of the listed names could be applied to a given drug. Our judgment as to appropriate names has been based a good deal on the present names to be found in the National Formulary. The aim is to make available a system of color names having legal and scientific standing and, at the same time, a system which will accord with present usage of color names as much as possible. Criticisms will help to do this. They should be submitted either to the AMERICAN PHARMACEUTICAL ASSOCIATION or to the National Bureau of Standards where they will receive our interested attention.

DRUG EXTRACTION. XVII. MODIFIED REPETITION DIACOLATION.*[,1]

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Using powdered belladonna root, experiments have been conducted to determine the efficiency of a modified repetition diacolation process as compared with the U. S. P. XI percolation and fractional percolation processes for making fluidextracts.

HISTORICAL REVIEW.

Introduction of Repetition Diacolation.—In 1930, H. Breddin (1) of Germany described a repercolation process which he called "repetition diacolation." He reported that by this method he obtained 300 Gm. of fluidextract from 300 Gm. of menstruum and 300 Gm. of drug. Glass tubes about one-half meter in length and 3.3 cm. in width were employed as percolators. To conserve alcohol, water was used in each tube toward the end of the percolation to displace the menstruum held by the marc. The 300 Gm. of drug were divided into three 100-Gm. portions. The first portion of drug was extracted with 200 Gm. of menstruum, the first 50 Gm. of percolate being reserved. The next 150 Gm. of percolate and 50 Gm. of

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[1] This paper is based on part of a dissertation presented to the Graduate Council of the University of Florida by C. L. Huyck, in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

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