it was originally planned to meet, has been taken over by the Government.

THE twenty-second annual meeting of the Highway Research Board will be held on December 2, 3 and 4 at the Hotel Statler, St. Louis. It is expected that time and travel facilities will be conserved by holding this meeting immediately before that of the American Association of State Highway Officials, which occurs in St. Louis the following week.

THE American Dietetic Association will hold its twenty-fifth annual meeting at the Hotel Statler, Detroit, from October 19 to 22. All the sessions are planned to provide the dietitian with aid under the circumstances imposed by the war. Plans for increasing the number of trained dietitians available for army service as well as for civilian service will be considered.

ACCORDING to the *Journal* of the American Medical Association, an informal advisory committee for the vitamin A industry has been appointed to confer with the Office of Price Administration regarding pricing and distribution problems. The committee held its first meeting in Washington, D. C., on July 27, to discuss provisions of a proposed maximum price schedule for vitamin A oils and concentrates. The advisory panel is an outgrowth of a recent industry conference held in San Francisco between the Office of Price Administration and all branches of the industry.

A BANQUET in honor of forty successful candidates in the first annual science talent search of the Science Clubs of America, sponsored by Science Service, Washington, D. C., was held in Washington on July 15. Among some 11,000 entrants, all seniors in secondary schools in the United States, 3,200 completed competitive examinations and wrote essays on "How Science Can Help Win the War." Three hundred of these entrants won special recognition; 260 of them were given honorable mention and 40 were chosen to take a prize trip to Washington. Eighteen Westinghouse Science Scholarships of $200 each are awarded to members of this group who have rated high in tests and interviews held in Washington. Westinghouse Science Scholarships of $2,400 each are awarded to the boy and the girl receiving highest rating.

THE Rockefeller Foundation has made a grant of £1,875 towards the expenses of the Oxford Nutrition Survey during the past year and has promised a grant of £3,000 for each of the next two years. These funds will be administered by a committee consisting of the Regius professor of medicine, the Whitley professor of biochemistry, and the Waynflete professor of physiology, Sir Robert McCarrison, Sir Wilson Jameson and Dr. H. M. Sinclair. The survey is investigating economic, dietary, clinical and biological methods of assessing nutrition in man. Besides giving training in their use it is also on behalf of the Ministry of Health examining the nutrition of samples of the population.

AN Associated Press dispatch dated August 1 reports that the Battle Creek Sanitarium has now been given over to the Government and will be known as the Percy L. Jones General Hospital for war casualties. The purchase price was $2,251,100. Lieutenant Colonel Norman T. Kirk, who will be at the head of a hospital staff of 700, said that it would be remodeled into long wards accommodating 1,000 beds at the start. The first patients will arrive about October 1 from military training centers where they have contracted ailments requiring long treatment. Former guests of the sanitarium have been transferred to several large adjacent buildings to continue treatment under the direction of Dr. John H. Kellogg.

Nature states that the University of Marburg, with the support of the Behring Works, has founded an Emil von Behring prize consisting of a medal and the sum of five thousand gold marks. It will be awarded every two years for scientific work in medicine, veterinary medicine or natural science, with special reference to immunity and control of epidemics.

DISCUSSION

COLOR BLINDNESS AND BORDERLINE CASES

NEVER was there greater need for exact specification of the color capabilities of the normal and aberrant eye. What has psychology to offer? The term "color blindness" itself is a misnomer, misleading and unduly depressing, even when qualified by "partial." Actually, the testimony of cases of unilateral defect or of retinal islands of partial deficiency, as well as the evidence from the outer zones of normal retinae, indicates that in ordinary red-green "blindness" color is visible throughout the spectrum—blues and yellows in varying chromas and brightnesses (with a possible gray line at about 500 mμ).

Evidence, further, is steadily piling up of the frequency of "color weakness" and the various "anomalies" in which all four primaries and their derivatives are visible, though with the R–G pair weakened, sometimes unequally[1] (*5*, 661–702). Whether one of the pair is ever completely suppressed

[1] J. H. Nelson, "Anomalous Trichromatism," *Proceedings* Physical Society, London, 50, pp. 661–702, 1938.

without the other remains unproven. Numerous borderline cases have emerged, whether of super- or sub-sensititivity is undetermined. They fit no rubrics, and await exact measurement, for the physicist's classes, protanomalous and deuteranomalous, are purely theoretical, not descriptive. The Nagel anomaloscope and the Rayleigh equation ($xR + yG = zY$) fail to show whether one component hue is weakened or the other intensified.

What analytical test procedures are available for mass measurements of the population? For speed, the clinician leans to the *pseudoisochromatic* group: Stilling, Ishihara, Schaaff, Edridge-Green, Jensen, Rabkin—German, Japanese, French, English, American, Russian—plates displaying mosaics of color dots on a white ground, with digits or geometric figures in confusion colors. But digits (used in the first two) are unequally legible, easily confusable, dependent on accuracy of refraction and acuity and readily memorizable. True, the eighth edition of the Ishihara (following criticism in 1935 and careless publication of keys to its plates) has sidestepped some of its earlier shortcomings. But its 30 inches distance is inconvenient and ignored, throwing designs out of gear by projecting them on unintended retinal areas. It discards color-weak along with color-blind through its use of moderate chromas only, and some of its designs fail to function as expected, owing possibly to the blue-weakness of the Oriental eye; *e.g.,* the B and G digits of the familiar reversible design are misread by 25 per cent. of normals.

In certain Ishihara plates critical colors are cunningly interwoven to read one way to one type of eye, another way to another. But in the case of the plates diagnostic of so-called "red" and "green" blindness, designed to throw all cases into one or the other class according as they report the right or left digit, purplish or red—a considerable per cent. of "color blinds" read *both* or neither.

On most of the Japanese plates, however, something can be distinguished, whereas the spirits of the examinee sink steadily as blank plate after blank plate of the Stilling passes. True, the last edition of this German test, revised by Hertel, has copied some of the novelties of the Oriental and inserted a pair of diagnostic plates in R and purplish R. It contains also plates for B–Y deficiency. But the instructions are intricate and unintelligible in translation, and usually ignored by the examiner. Total scores in both the Stilling and the Ishihara are frequently misleading as to the gravity of the defect.

Combined use of the Ishihara with a few Stilling plates and Schaaff or Rabkin was recommended in 1937 by the British expert, Mary Collins,[2] for preliminary segregation of "dangerous" color defectives. But war conditions have now cut off foreign editions. In 1939–40, to meet the emergency, an improved pseudo-isochromatic test set was projected by the writer, but no printing-ink firm would guarantee the chromas and hues demanded. In 1940 the American Optical Company undertook to reproduce the most useful Ishihara and Stilling plates, but the critical chromas are often weak, the hues divergent (in the sample set examined by the writer), hence reasoning from the results of the older tests is unsafe, and no standardization of the new has to date been offered.

The Inter-Society Color Council in 1941, at the request of industrialists and clinicians, started work on a color discrimination test. Following the lead of the National Institute of Industrial Psychology of Great Britain,[3] who devised lacquered disks in R, B and Y chroma series in 1926 for serial grading and matching, R and RP series of glossy plastic chips in matched pairs, with many closely graded chromas steps from grey to medium saturation have been produced, and standardization of a "color aptitude" test is under way.

Industry meanwhile has taken the lead over psychological laboratories. The Institute of Paper Chemistry has devised its own matching tests, and the American Paper and Pulp Association has issued a monograph with many tables and curves for confusion colors.[4]

Convinced that only analytical study of thresholds of a number of hues will solve the enigmas of color vision, the writer is employing seven series of matched Munsell paper: R, B, G, BG and B chromas, and short strips of the special research 100-hue equal-chromas-and-value circle in the R's and G's, in conjunction with spectrometer and adaptometer observations. From the results, distribution curves will be plotted for color sensitivity in normal and aberrant; and the hypothesis that all degrees of sensitivity to the primaries link the congenital "color blind" with the normal-visioned be demonstrated or discredited.

Meanwhile the laboratory worker suggests that the psychologist, after consulting his Greek dictionary, scrap the non-descriptive and misleading rubrics of protanopia and deuteranopia and their derivatives, foisted on us in 1897 by the hasty generalizations and faulty experimental procedures of von Kries;[5] disavowed in 1932 by the eminent British authority on light, R. A. Houstoun,[6] and the source to-day of endless confusion and distortion of experimental observa-

[2] M. Collins, *Nature* (London), 140: 532–34 and 569–76, 1937.

[3] W. O'D. Pierce, "The Selection of Colour Workers." London: Isaac Pitman and Sons, 1934.

[4] American Paper and Pulp Association, "Color Blindness." Appleton, Wisconsin, 1941.

[5] E. Murray, *Am. Jour. Psychol.*, 42: 117–127, 1930.

[6] R. A. Houstoun, "Vision and Colour Vision." London: Longmans, Green and Company, 1932.

tions. The old term "color blind" may well go with them.

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WARTIME SCIENTIFIC MANPOWER PRODUCTION

IN recent numbers of SCIENCE[1] there have appeared communications which manifest the growing demand for complete utilization of scientifically trained personnel. Through the facilities provided by the National Roster of Scientific and Specialized Personnel studies of the problems associated with utilization and assignment have been and are being studied and allocations are being made in various fields of science. The Roster is not simply an organized card file; it is proceeding as rapidly as possible in determining needs and allocating supply.

The problem it is considering at present is the mechanism by which we can supplement dwindling reserves in scientifically trained men. The process of robbing the universities to supply technically trained manpower has been carried to dangerous limits which, if pursued further, will result in the elimination of the future supply. The war has now progressed a sufficient length of time for us to realize that temporary expedients are not sufficient and that a long-range view will be necessary for the continuous replacement of scientific personnel which must be accomplished if we are to win this war.

The period of temporary expedients has enlisted the services of too great a number of scientists who are now removed from their main purpose of producing an adequate supply for future needs. This situation is inevitable at the beginning of an emergency but must now receive the thought and planning necessary for its correction.

The pressure of public and professional opinion must be impressed upon the individual to make each think of the best that he can produce for the total national good. This involves a critical self-analysis removed from social and patriotic glamor motives which almost inevitably sway the principles on which such a decision must be made. This inventory of service should have as its keystone the idea of production of an increasingly large number of scientific personnel. The schools, colleges and universities have compacted and revised their conventionalized schedules to make possible the earlier and steadier training which should produce new scientifically trained men in the minimum time and at that age when their scientific knowledge is most easily adapted to the armed services.

This war is dominantly one of ideas. It can be successfully waged only by the complete use of brains and technological *knowledge* combined with mechanical instruments of war. Peace-time methods impose artificial limitations upon production of new scientists which in view of the continuing urgency must be removed. Independence of thought and action form a requisite part of any such program—each man represents a newly modified model as he leaves the academic production line. On that production line must be applied the most skilful teaching which science has ever had. Formulae which have been rigidly adhered to must be reevaluated and discarded if they can not be fitted to new conditions. Each man on the instruction assembly line must treat his product with respect to its own particular idiosyncrasies—the assembly line expert will not exercise his own. Standards and inspections must be rigid with a degree of flexibility at all other points. It is here that real teachers are needed, and it is here that the common methods of rote instruction must give way.

Standardization of many science courses has proceeded almost to the point of freezing their content and the methods of approach. This process must be revised and unfrozen in every case in which the new needs are evaluated in the light of increased production. Emphasis must be reapplied. To-day as never before broad and fundamental patterns of factual synthesis must be placed before the receptive minds which are to be scientifically trained.

The personal inventory mentioned above must be made in the light of this statement. The breach in curricular walls and the abolition of conventional schedules have left many an academic scientist in a state of emotional upheaval resulting in a sense of lost personal security. The insecurity so produced has immediately been transferred according to a principle of human nature which antedates scientific technology, for in times like these other pastures always appear greener and old responsibilities can always be sidetracked by the assumption of new ones. It is this factor which makes many scientists feel that they should be actively engaged in war work of a recognized variety when deep in their hearts they realize that their duties in their own environment are much more important to national welfare. It is harder to fight on the home front without official recognition than to transfer to other and perhaps different fields in which service may be less effective.

The universities have taken the only standpoint that could be taken in this emergency: they have unstintingly contributed their manpower and laboratory facilities. They too, must recognize that their essential purpose in national welfare is production of an increasing number of men trained to think. They must conserve their teaching manpower if this is to succeed.

The devastation of science departments by armed

[1] SCIENCE, 95: 2472, 507–8, May 15, 1942; *Ibid.*, 96: 2479, 16, July 3, 1942.