Richardson (Jos. G.)

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[Extracted from the American Journal of the Medical Sciences for Janua.

ON THE IDENTITY OF THE RED BLOOD CORPUSCLES IN DIFFERENT RACES OF MANKIND.

By JOSEPH G. RICHARDSON, M.D.,
MICROSCOPIST TO THE PENNSYLVANIA HOSPITAL.

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Exact measurements of the red blood disks of man and of those of the ox, pig, cat, horse, deer, and sheep (from which I contend the human blood globules can with certainty be discriminated) have acquired so much importance through recent discussions upon the diagnosis of blood stains, that I trust the subjoined investigations will prove valuable to the medical and legal professions.

I present in them the commencement of an extended series of observations upon the identity or diversity of blood corpuscles from the genus Homo in different races and under various conditions of sex, age, habits of life, hygienic influences, disease, etc., and also of those from the animals enumerated under similarly diverse circumstances; they constitute moreover some of the first medical results of our Centennial Exhibition, which by attracting to Philadelphia visitors from every quarter of the globe has rendered it possible for me to procure well-authenticated specimens of blood from many different nations.

The samples were each procured by myself from the individuals mentioned (sometimes only through much persuasion), by puncturing a finger with the quick stab of a cataract needle, pressing out a small amount of blood, applying a clean slide to the apex of the drop, and then spreading out the portion of fluid which adhered to the glass, with the end of another slide, according to Prof. Christopher Johnson's excellent method.

The measurements were all made with a $\frac{1}{25}$ immersion objective and by the aid of a cobweb micrometer eye-piece, giving when thus combined a power of 1800 diameters. The value of the degrees of the eye-piece micrometer with this objective, at the cover correction employed, was determined by a stage micrometer kindly compared for me by my friend Col. J. J. Woodward, of Washington, D. C., with one carefully tested by the standard in the U. S. Coast Survey Office, and which he has pro nounced practically correct.

Instead of measuring all corpuscles, deformed or otherwise, in two directions, as proposed by Dr. Woodward (*Phila. Medical Times*, vol. vi. p. 457), I prefer to determine the size of unaltered, *i. e.*, circular cor-

s only. By this plan, which I believe is that of our highest authority ... the subject, Prof. Gulliver, we obtain the dimensions of nearly normal ...l elements, such as are exhibited in Dr. Woodward's beautiful photograph of fresh blood (*Army Med. Museum*, No. 861, new series), where, as in fluid preparations, but little variation in size exists among the corpuscles; and escape being misled by pathological specimens similar to those displayed in photograph No. 836, of the same invaluable series.

Since the chief cause of marked variation in magnitude as well as of distortion in shape among blood disks spread out upon glass is, I think, their mutual attraction and repulsion during the process of drying, my investigations were made upon portions of slides where the corpuscles were very sparsely disseminated, and then, to secure the most infallible accuracy for my deductions, as the preparation was moved along, I measured *every isolated circular red disk*, which came into the field of the microscope. In doing this I cautiously avoided recording those which manifested even slight departures toward an oval form, and by several experiments learned that the deviation corresponding to a transverse diameter of 1–3030 and a conjugate of 1–2857 of an inch was recognizable by a single glance.

One hundred corpuscles in each specimen were measured and the dimensions as I read them off in millionths of an inch noted down generally by an assistant. These memoranda, with the preparations to which they refer, are carefully preserved for examination by any experts who may desire to convince themselves respecting the substantial foundation of fact whereon I base the following conclusions:—

Drop 1. Obtained Oct. 11, 1876, from Mr. I., member of the Japanese Centennial Commission. Average diameter 1–3212 of an inch, maximum 1–2777, minimum 1–3737. Of the 100 corpuscles, 8, or 8 per cent., were less than 1–3448 of an inch; 10 per cent. were more than 1–3030, and the remaining 82 per cent. were between these two sizes.

Drop 2. Senor F. C., æt. 30, born in Valencia, member of Spanish Commission. Average 1–3226, maximum 1–2777, minimum 1–3571. Eighty-nine per cent. ranged between 1–3448 and 1–3030 of an inch in diameter, whilst 6 per cent. fell below the former and 5 per cent. exceeded the latter magnitude.

Drop 3. Mr. A. M., about 38 years of age, born in Verviers, Belgium Delegate. Average 1–3203, maximum 1–2777, minimum 1–3846. Eighty-eight per cent. ranged between 1–3448 and 1–3030, whilst 7 per cent. fell short of and 5 per cent. exceeded these sizes.

Drop 4. Herr E. G., about 40 years old, born in Zurich, member of Swiss Commission. Average 1–3203, maximum 1–2857, minimum 1–4000. Eighty-two per cent. ranged between the above-named limits, while 7 per cent. fell short of, and 11 exceeded them.

Drop 5. R. E., æt. 29, born in Constantinople, member of Turkish Commission. Average 1–3197, maximum 1–2777, minimum 1–3846. Eighty per cent. ranged between the limits mentioned, whilst 4 were less and 16 more than these measurements in their diameter.

Drop 6. J. P. R., æt. 25, born in Copenhagen, *attaché* of Danish

Commission. Average 1–3257, maximum 1–2857, minimum 1–
Eighty-two per cent. between limits mentioned, 12 below and 6 above t.

Drop 7. Herr G. K., æt. 27, born in province of Vladimir, member Russian Commission. Average 1–3190, maximum 1–2857, minimum 1–3571. Ninety-one per cent. between above-named limits, 2 below, and 7 above them.

Drop 8. C. H., æt. 35, born in Christiania, *attaché* of Norwegian Commission. Average 1–3252, maximum 1–2857, minimum 1–4000. Eighty-six per cent. fell between sizes named, 10 below, and 4 above them.

Drop 9. Dr. J. L., æt. 33, born in Kongsbacka, member of Swedish Commission. Average 1–3254, maximum 1–2777, minimum 1–3737. Eighty-two per cent. fell between sizes named, 13 below, and 5 above them.

Drop 10. Sig. V. F., about 35 years old, born in Bologna, member of Italian Commission. Average 1–3272, maximum 1–2777, minimum 1–4000. Eighty-three per cent. of the measurements lay between dimensions above stated, 10 fell below, and 7 surpassed them.

Drop 11. M. P. P., æt. 67, born in Bordeaux, member of French Commission. Average 1–3239, maximum 1–2777, minimum 1–3737. Eighty per cent. were found to be within the limits specified, 12 fell beneath, and 8 exceeded them.

Drop 12. I. L., æt. 52, dark mulatto, born in Delaware, U. S. Average 1–3229, maximum 1–2857, minimum 1–3856. Eighty-three per cent. fell within limits noted, 11 below, and 6 above them.

Drop 13. E. M., æt. 48, Cherokee Indian, born in Florida, U. S. Average 1–3215, maximum 1–2857, minimum 1–4000. Eighty-three per cent. fell between limits stated above, 10 fell below, and 7 exceeded them.

Drop 14. J. R., æt. 40, white male, born in Pennsylvania, U. S., of English parentage. Average 1–3191, maximum 1–2777, minimum 1–3846. Eighty-five per cent. came within limits mentioned, 6 fell below, and 9 above them.

Combining these deductions, we find that of the whole 1400 corpuscles each separately measured, the average was 1–3224 (.007878 mm.), the maximum 1–2777, and the minimum 1–4000 of an inch; 1158 or 83 per cent. measured between 1–3448 and 1–3030 of an inch in diameter, and consequently under a power of 200 would appear about the same magnitude; 118 or about 8 per cent. were less than 1–3448, and 124, or nearly 9 per cent. were more than 1–3030 of an inch in diameter. The total number of corpuscles 1–4000 of an inch across was 6, or less than one-half of one per cent. The total number 1–2777 of an inch in diameter was 10, or less than one per cent.

The somewhat smaller averages of the Italian, Swedish, and Norwegian specimens are perhaps due to slight accidental variations in spreading out the layers of blood for examination, and cannot be accepted, at least without further research, as indicative of either personal or national peculiarities.

Such minute differences indeed must be expected with our present methods of observation, and it seems to me that, taken as a whole, my results powerfully confirm the Scriptural declaration, that the Lord "made of one blood all the nations of the earth."