



# XXXVI. Observation of the blood corpuscles, or red particles, of the mammiferous animals

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four long upright hooks, in which the lower end of the chimney rests; or still better if the lamp be so originally constructed as to sustain the chimney at the required elevation without such addition, by thin laminæ of brass or iron, having their planes directed to the axis of the wick.

The proper elevation is best determined by trial; and as the limits within which it is confined are very narrow, it would be best secured by a screw motion applied to the socket on which the laminæ above mentioned are fixed, by which they and the chimney may be elevated or depressed at pleasure, without at the same time raising or lowering the wick. Approximately it may be done in an instant, and the experiment is not a little striking and instructive. Take a common Argand lamp, and alternately raise and depress the chimney vertically from the level where it usually rests, to about as far above the wick, with a moderately quick but steady motion. It will be immediately perceived that a vast difference in the amount of light subsists in the different positions of the chimney, but that a very marked and sudden *maximum* occurs at or near the elevation designated in the commencement of this letter: so marked indeed as almost to have the effect of a flash if the motion be quick, or a sudden blaze as if the wick-screw had been raised a turn. The flame contracts somewhat in diameter, lengthens, ceases to give off smoke, and attains a dazzling intensity.

With this great increase of light there is certainly not a correspondingly increased consumption of oil. At least the servant who trims my lamp reports that a lamp so fitted consumes very little if any more oil than one exactly similar on the common plan.

I have the honour to be, Sir,

Your obedient servant,

Slough, Feb. 15, 1840.

J. F. W. HERSCHEL.

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XXXVI. *Observations on the Blood Corpuscles, or Red Particles, of the Mammiferous Animals.* By GEORGE GULLIVER, F.R.S., F.Z.S., Assistant Surgeon to the Royal Regiment of Horse Guards. No. III.\*

AN account is now to be given of the blood corpuscles of several other mammalia which I have examined since the publication of my last papers; and similar communications will be continued occasionally, until the observations have been made as complete as possible, when, as already intimated, they will be presented in a systematic form, so as to

\* Communicated by the Author.

exhibit a comprehensive view of the results, particularly as regards the size and figure of the blood particles in the different subdivisions of the mammiferous animals.

It is very desirable that the blood of the larger species of the cetaceous animals should be examined; for although the corpuscles of the Mouse (13.) are bigger than those of the Horse (34.), and there is generally no relation between the size of the animal and that of its blood particles, yet they are larger in the Elephant (51.), as far as we at present know, than in any other mammal. The corpuscles of the Goat were the smallest known to physiologists before my observation of the singularly minute blood disks of the Napu Musk Deer\*.

In some instances the corpuscles are found to be a little larger in the dead than in the living animal, although they may subsequently become smaller, in consequence of the removal of their colouring matter by the serum. It will be perceived that many observations have been made on the blood after death; these have led me to ascertain that the particles are subject to modifications in size, and in some degree in shape, as compared with those of the living animal; and similar variations are often observable during life in disease. Besides the instances in which these facts are barely indicated in the preceding communications, it may be mentioned that I have seen the changes in the human blood particles. Thus in a man affected with dropsy, in connexion with granular degeneration of the kidney, some blood was drawn from a vein of the arm, and the corpuscles found to differ remarkably from those of the healthy subject. Though examined before the blood was perfectly cold, as well as after the lapse of a day, their size was singularly irregular, generally smaller than natural, having an average diameter of only 1-4400th of an inch. But as the morbid conditions of the blood corpuscles are probably more extensive and important than has been hitherto supposed, this is a novel and interesting subject for further and special inquiry; and it is merely alluded to at present as one of the many circumstances under which the size, form, and general appearance of the disks are liable to variations, which will doubtless attract the attention of pathologists now that the necessity of minute researches concerning the morbid as well as healthy fluids has been so fully recognised.

With regard to the blood corpuscles of the fœtus as compared with those of the mother, I apprehend that I have de-

\* See Dublin Med. Press, No. 27, 1839, and Annals of Nat. Hist., &c. Dec. 1839.

tected a source of error in some of the observations. The statement, therefore, formerly made (13.) is withdrawn for the present; and I hope soon to be able to give the result of another inquiry on the subject. In the mean time I may mention that in the foetal Guinea pig at the full period of utero gestation the corpuscles corresponded in size with those of the mother; and in a human foetus at the fifth or sixth month they were smaller than in the adult.

116. Mona Monkey, (*Cercopithecus Mona*), a male about a third grown. Most frequent sizes of corpuscles 1-3554th and 1-3428th. Extreme diameters, 1-5333rd and 1-2900th. Blood from the left coronary vein as well as from the different cavities of the heart. In the blood of the inferior cava vein the corpuscles were more variable in size, the extremes being 1-4800th and 1-2400th, with most numerous intermediate gradations.

117. Sooty Monkey, (*Cercopithecus fuliginosus*), a female about half-grown. All the following diameters very frequent, 1-3600th, 1-3428th, 1-3368th, and 1-3200th. Extreme sizes 1-5333rd and 1-3000th. Blood from the left ventricle of the heart.

118. Patas or Red Monkey, (*Cercopithecus ruber*), a female, nearly full-grown. The disks most commonly 1-3330th of an inch in diameter; extreme sizes, 1-4000th and 1-3000th. Blood from the pulmonary artery and vein, a few hours after death.

119. Crown Monkey, (*Cercopithecus pileatus*), a male about two-thirds grown. The following the most common sizes: 1-3635th, 1-3600th, and 1-3423rd. Extreme diameters, 1-4800th and 1-2900th. Blood from a prick of the forehead.

120. Vervet Monkey, (*Cercopithecus pygerythrus*), an adult male, 1-3309th, 1-3429th, and 1-3552nd common sizes; extreme diameters 1-4000th and 1-2900th of an inch. Blood from a wound at the end of the tail.

121. Dog-faced Baboon, (*Cynocephalus anubis*?) a female about half-grown. The dried corpuscles 1-3600th, 1-3530th and 1-3428th generally; extreme diameters 1-4000th, and 1-3000th. In the serum there were several disks exactly of the same magnitude, besides many of smaller size, viz. about 1-5333rd of an inch in diameter.

The blood was procured from a wound of the tail, and examined in less than two hours afterwards. The shrinking of some of the corpuscles in their own serum is well exemplified. In another dog-faced Baboon (1.) the corpuscles were a little larger; but as in that instance the blood was obtained from

the animal a day or two after death, the variation is within the limits that may occur in the same species.

122. Black-backed Papio, or Indian Ape, (*Papio melanotus*), a male. Common diameter of corpuscles 1-3482nd of an inch; extreme sizes 1-4570th and 1-2666th. Blood from the axillary vein after death.

123. Wanderoo Monkey, (*Papio silenus*), a full-grown male. Frequent sizes of corpuscles 1-3600th, 1-3552nd, and 1-3270th of an inch. Extreme diameters 1-4570th and 1-2666th. Blood from the left ventricle of the heart.

124. Chameck Spider Monkey, (*Ateles subpentadactylus*), a female about two-thirds grown. The following diameters most frequent: 1-3790th, 1-3600th, and 1-3429th of an inch. Extreme sizes 1-4920th and 1-2900th. Blood from a prick of the fore hand.

125. Black Spider Monkey, (*Ateles ater*), an adult male. All the following sizes very common: 1-3429th, 1-3528th, 1-3555th, 1-3600th, 1-3693rd and 1-3792nd. Extreme diameters 1-4555th and 1-3000th. Blood from a prick of the fore hand.

126. Weeper Monkey, (*Cebus apella*), a female nearly full-grown. 1-3600th, 1-3554th, 1-3429th, and 1-3368th; most common sizes. Extreme diameters 1-4800th and 1-2666th of an inch. Blood from a prick of the fore hand.

The measurements slightly smaller than afforded by the corpuscles of *C. capucinus* (5.), but as the blood was procured from a dead specimen of the latter, the discrepancy is not greater than may be often observed under similar circumstances in one species.

127. Squirrel Monkey, (*Callithrix sciureus*), a male about two-thirds grown. The following sizes all very frequent: 1-3790th, 1-3693rd, 1-3600th, and 1-3552nd. Extreme diameters, 1-4800th and 1-3200th. Blood from a prick of the nose.

The blood of the Toque Monkey (81.) was obtained from the heart of a dead specimen. The corpuscles, procured from a wound in the tail, of a healthy full-grown male afforded the following measurements, viz. dry, 1-3764th, 1-3600th, and 1-3552nd. In the serum many disks of the same magnitude were observed, besides a large quantity of smaller size, viz. from 1-6000th, to 1-5333rd of an inch, though the blood was carefully secured in a small glass tube and examined within an hour after it was taken from the animal.

128. The Mole, (*Talpa Europæa*), recently killed, smallest disks about 1-5000th, the largest about 1-4000th of an inch. Blood from the heart.

For this observation I am indebted to Dr. Davy.

129. Grisly Bear, (*Ursus ferox*,) a female about half-grown. Most common diameters 1-3340th and 1-3552nd of an inch. Extreme sizes 1-4570th and 1-3000th. Blood from a prick of the nose.

130. Badger, (*Meles vulgaris*,) an old male. All the following sizes very common: 1-4128th, 1-4000th, 1-3973rd, 1-3810th, and 1-3693rd. Extreme diameters 1-5333rd and 1-3200th of an inch. There were besides some of the very small circular particles as in the genus *Sciurus*. Blood from the integuments of the thigh.

131. Common Jackal, (*Canis aureus*,) an old male. The corpuscles, dried quickly, afforded the following measurements: 1-4000th, 1-3764th, and 1-3840th most frequently, the extreme sizes being 1-4800th and 1-3200th of an inch. In the serum, examined within two hours after they were obtained, 1-4800th was the most common diameter, and the extreme sizes 1-6000th and 1-3200th. Disks of the last, or largest size, as well as of 1-3555th, were not unfrequent, generally collecting together quickly into rouleaux, from which it was seen that the thickness of the edges of these corpuscles was 1-14,000th of an inch. The smaller particles, though much more abundant, did not arrange themselves together by their flat surfaces, and indeed could hardly be seen edge-wise.

The blood was obtained freely from a puncture in a vein of the hind leg; and the above facts are merely mentioned as exemplifying the variations which may often be observed in the corpuscles only a short time after the blood has been removed, with every care, from various mammals.

132. African Civet Cat, (*Viverra civetta*,) adult male. 1-4615th, 1-4360th, 1-4000th, and 1-3552nd of an inch all frequently observed. Extreme sizes 1-6000th and 1-3200th. The corpuscles in this instance, therefore, very variable in magnitude. Blood from a prick of the tail.

In another adult male, after death, the corpuscles were also extremely variable in size, as the following were all common, viz. 1-5333rd, 1-4760th, 1-4500th, 1-4412th, 1-4365th and 1-4000th; the extreme measurements being 1-6000th and 1-3200th of an inch. Blood from the different cavities of the heart, from the coronary veins, and from the portal vein.

133. Javanese Ichneumon, (*Herpestes Javanicus*,) a full-grown male. All the following sizes common: 1-4800th, 1-4924th, 1-5142nd, and 1-5120th. Extreme diameters 1-6000th and 1-4000th. Blood from a wound at the end of the tail.

134. Chetah or Hunting Leopard, (*Felis jubata*,) an adult

female. All the following sizes common : 1-4365th, 1-4268th, 1-4173rd, and 1-4000th. Extreme sizes 1-5333rd and 1-3555th of an inch. Blood from a prick of the nose.

135. Alexandrian Rat, (*Mus Alexandrinus*, albino, var.,) an adult male. 1-4173rd, 1-4000th, 1-3810th, and 1-3764th, very common sizes. Small corpuscles 1-4800th; the large 1-3200th. Edges of disks 1-14,000th of an inch thick. Blood from a vein of the hind leg.

136. Coendu or Ring-tailed Porcupine, (*Syntheres prehensilis*,) a full-grown male. Common diameters 1-3428th, 1-3309th, and 1-3600th. Extreme sizes 1-4570th and 1-2460th of an inch. Blood from a cut at the end of the tail.

Error in the last paper (No. 2.) p. 108, l. 28, for Haller, read Harvey.

XXXVII. *Contributions to Electricity and Magnetism. No. III. on Electro-magnetic Induction. By JOSEPH HENRY, LL.D., Prof. of Natural Philosophy in the College of New Jersey, Princeton\*.*

INTRODUCTION.—SECTION I. *Conditions which influence the induction of a Current on itself.*—SECTION II. *Conditions which influence the production of Secondary Currents.*—SECTION III. *On the Induction of Secondary Currents at a distance.*—SECTION IV. *On the Effects produced by interposing different Substances between the Conductors.*—SECTION V. *On the Production and Properties of induced Currents of the Third, Fourth and Fifth Order.*—SECTION VI. *The Production of induced Currents of the different Orders from ordinary Electricity.*—NOTE *on the investigations of Professor Ettingshausen.*

1. **S**INCE my investigations in reference to the influence of a spiral conductor, in increasing the intensity of a galvanic current, were submitted to the Society, the valuable paper of Dr. Faraday, on the same subject, has been published, and also various modifications of the principle have been made by Sturgeon, Masson, Page, and others, to increase the effects. The spiral conductor has likewise been applied by Cav. Antinori to produce a spark by the action of a thermo-electrical pile: and Mr. Watkins has succeeded in exhibiting all the phænomena of hydro-electricity by the same means. Although the principle has been much extended by the re-

\* From the Transactions of the American Philosophical Society, vol. vi, having been read Nov. 2, 1838.