

OBSERVATIONS ON THE TEMPERATURE
of the
MONKEY IN NORMAL CONDITIONS
and under
THE INFLUENCE OF NARCOTICS.

A Thesis submitted for the Degree of D. Sc.

by

SUTHERLAND SIMPSON, M. D., Ch. B., B. Sc.

December 1902.



OBSERVATIONS ON THE TEMPERATURE OF THE
MONKEY IN NORMAL CONDITIONS AND UNDER THE
INFLUENCE OF NARCOTICS.

PART I.

Obs on ^{the} "Normal temp^t of the Monkey"

In the course of an investigation into the physiological effects resulting from the extirpation of portions of the motor cortex in one cerebral hemisphere in monkeys, it was desirable, amongst other things, to ascertain whether the temperature of the paralysed limbs was in any way affected. On looking up the chapter on "Animal Heat" by Pembrey in Schäfer's 'Text-book of Physiology', and Richet's article "Chaleur" in his 'Dictionnaire de Physiologie', in order to find out what the normal temperature of the monkey was, I discovered that very few observations had been made on the temperature of this animal. I then determined to avail myself of the material at my disposal and to collect a series of readings from the various animals which came into the laboratory from time to time. These were ordinary Macaque monkeys (Rhesus and Sinicus). They were, for the most

part, young adults but a considerable number were probably not full-grown. It was soon found that a comparatively slight amount of muscular exercise was sufficient to cause a very appreciable rise in the temperature, and to eliminate this important source of error, only quiet animals were used which would submit to the operation without struggling. The monkeys were kept in a large wire cage, twelve feet long by five feet wide by fifteen feet high, and in this they were allowed to roam about freely. A leather belt was buckled round the groin to which was attached a cord with an open loop at the free end so that they could be caught without much difficulty by means of a hook fixed to the end of a long stick. Half-an-hour before a reading was to be taken the monkey was captured and placed in a small cage. It was held on the lap of an assistant, and an accurate "one-half¹/_{minute}" clinical thermometer (Kew certificated), lubricated with olive oil, was introduced into the rectum to the depth of two inches. The thermometer was inserted to the same depth in every case as indicated by a mark on the stem. This is essential if comparable results are to be obtained. Finkler (1), for example, found in guinea pigs that on introducing the thermometer to the depth of 2.5 c.m. the mercury stood at 36.1° C., when pushed in to the depth of 6 c.m. it in-

licated 38.7° C. and at 9 c.m. the temperature was 38.9° C. In my observations the thermometer was held in position two and a half minutes. In a few cases the animals were so tame that I was able to take the temperature without assistance.

When readings were taken from the axilla, the bulb of the thermometer was pushed up as far as possible into the apex, the stem lying parallel with the upper arm which was then held gently against the side of the animal, and in this way the axilla was practically converted into a closed cavity.

In some of the earlier cases observations were also made on the temperature of the groin, antecubital fossa and popliteal space, but in these situations the thermometer was in great danger of being broken, and besides, one could not be certain that it was being applied in an exactly similar way on successive occasions. In the case of the arm, the bulb of the thermometer was pushed down into the antecubital fossa and then the limb was fully flexed at the elbow joint, the stem being caught between and held by the muscles of the forearm and **biceps**. It was applied in the same manner in the popliteal space. In both cases the variations in the readings were much greater than in the axilla and rectum. An ordinary clinical thermometer, of course, is not suitable for taking the temperature

of peripheral parts with the exception of the axilla and groin, both of which can be converted into approximately closed cavities, and my objection to taking groin readings was that each time it necessitated the removal of the leather belt or cord which was attached to the monkey's body, and this was found to be very inconvenient.

The temperature of the room was also noted. It was kept somewhere between 70° F and 80° F night and day. It was well ventilated, and the monkeys were living under conditions, so far as air-space and external temperature were concerned, as favourable as it is possible to make them in this climate.

Most of the observations were made between 5 and 6 p.m.; a few were made between 9 and 10 a.m., and between 2 and 3 p.m. respectively. In a few instances readings were taken at short intervals (sometimes every hour), in order to find out to what degree there was a diurnal variation or rhythm in the temperature. As may well be imagined, this was found to be a very laborious undertaking, and on that account it was limited to a very few cases.

The results are given in degrees Fahrenheit in tabular form as they were recorded, and from these a series of averages have been obtained from which some definite conclusions may be arrived at.

Monkey I (Macacus Sinicus) - Male, Weight 2.7 Kilos.

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
1901 Feb. 5th. 5. 30p.	Axilla Ant. foss.	103.6 -	103.0 -	103.1 102.2	102.9 102.1	Groin Popl. Sp.	103.5	74.0
Feb. 6th. 5. 30p.	Axilla Ant. foss.	104.2 103.0	104.6 103.6	104.1 103.0	104.0 103.2	Groin Popl. Sp.	104.4	77.0
Feb. 7th. 5. 30p.	Axilla Ant. foss.	104.1 102.3	103.8 102.6	103.9 102.8	104.0 103.1	Groin Popl. Sp.	103.6	76.0
Feb. 8th. 5. 30p.	Axilla Ant. foss.	101.4 100.2	101.6 100.1	101.1 100.4	101.1 100.1	Groin Popl. Sp.	101.2	74.0
Feb. 9th. 2. Op.	Axilla Ant. foss.	100.4 99.6	100.6 99.3	- -	- -	Groin Popl. Sp.	100.4	74.0
Feb. 10th. 5. Op.	Axilla Ant. foss.	102.6 101.3	102.5 101.1	- -	- -	Groin Popl. Sp.	102.0	69.0
Feb. 11th. 5. 30p.	Axilla Ant. foss.	101.8 101.0	101.4 100.2	101.3 100.1	101.1 100.4	Groin Popl. Sp.	101.4	72.0
Feb. 12th. 10. 0a.		- -	- -	- -	- -		100.6	76.0
Feb. 12th. 5. Op.	Axilla Ant. foss.	102.1 101.0	102.3 100.9	101.6 100.6	102.0 100.8	Groin Popl. Sp.	101.8	73.0
Feb. 13th. 5. Op.	Axilla Ant. foss.	100.6 -	100.9 -	100.5 -	100.8 -	Groin	100.8	72.5

I Result of exercise; to be discarded.

Monkey I (Continued)

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
1901								
Feb. 14th.		-	-	-	-			
9. 30a.		-	-	-	-		100.3	71.0
Feb. 15th.		-	-	-	-			
9. 30a.		-	-	-	-		99.8	77.0
Feb. 15th.	Axilla	100.2	100.1	100.3	99.8	Groin		
5. 30p.	Ant. foss.	99.2	98.6	99.0	99.1	Popl. Sp.	100.4	75.0
Feb. 16th.	Axilla	100.4	100.5	100.1	100.0	Groin		
2. Op.	Ant. foss.	100.0	99.8	99.2	99.3	Popl. Sp.	100.2	77.0
Feb. 21st.	Axilla	101.8	102.0	101.6	101.3	Groin		
5. Op.	Ant. foss.	101.2	101.2	100.3	100.5	Popl. Sp.	101.6	79.5
Feb. 26th.	Axilla	100.4	100.8	100.2	100.4	Groin		
2. 30p.	Ant. foss.	99.8	99.6	99.6	99.2	Popl. Sp.	100.2	79.0

			Mean	Max.	Min.	Range
Between 5 & 6 p.m.	7 observations	- Rectum	101.3	102.0	100.4	1.6
	7	" - Axilla	101.5	102.6	100.1	2.5
	6	" - Ant. foss.	100.5	101.3	98.6	2.7
	6	" - Groin	101.4	102.0	99.8	2.2
	5	" - Popl. Sp.	100.1	100.5	99.0	1.5
" 9 & 10a.m.	3	" - Rectum	100.2	100.6	99.8	0.8
" 2 & 3 p.m.	3	" - Rectum	100.3	100.4	100.2	0.2
	3	" - Axilla	100.5	100.8	100.4	0.4
	3	" - Ant. foss.	99.7	100.0	99.3	0.7
	2	" - Groin	100.2	100.4	100.0	0.4
	2	" - Popl. Sp.	99.3	99.6	99.2	0.4

Mean temperature of room - 74.5. Range 69 to 79.5

Monkey II (Macacus Sinicus) - Female, Weight 2.36 Kilos.

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
1901 Feb. 5th. 5. 30p.	Axilla Ant. foss.	103.0 101.8	102.8 102.0	103.0 102.0	102.9 101.8	Groin Popl. Sp.	103.0	74.0
Feb. 6th. 5. 30p.	Axilla Ant. foss.	102.6 101.8	103.2 102.0	102.8 101.6	102.8 102.0	Groin Popl. Sp.	102.8	77.0
Feb. 7th. 9. 30a.	Axilla Ant. foss.	103.8 102.0	103.2 102.4	102.9 101.6	103.1 102.2	Groin Popl. Sp.	103.2	76.0
Feb. 7th. 5. 30p.	Axilla Ant. foss.	104.4 102.0	104.9 102.1	104.0 102.8	103.8 102.6	Groin Popl. Sp.	104.2	76.0
Feb. 8th. 5. 30p.	Axilla Ant. foss.	102.9 102.0	103.0 101.8	102.7 101.4	102.8 101.8	Groin Popl. Sp.	102.8	74.0
Feb. 9th. 2. Op	Axilla Ant. foss.	101.6 100.8	101.4 100.2	101.1 100.1	101.1 100.3	Groin Popl. Sp.	101.3	74.0
Feb. 10th. 5. 30p.	Axilla Ant. foss.	102.0 101.2	102.3 101.1	101.8 100.6	101.9 100.9	Groin Popl. Sp.	101.9	69.0
Feb. 11th. 5. 30p.	Axilla Ant. foss.	102.6 102.1	102.8 101.9	101.8 100.9	102.1 101.0	Groin Popl. Sp.	102.3	72.0
Feb. 12th. 10.0a.	Axilla Ant. foss.	101.1 100.2	101.3 100.2	100.9 100.0	100.8 99.6	Groin Popl. Sp.	100.8	76.0
Feb. 13th. 5. Op.	Axilla Ant. foss.	101.1 -	101.3 -	- -	- -		101.5	72.5

I Result of exercise and not to be taken into account in making up the averages.

Monkey II (Continued)

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
1901								
Feb. 14th.		-	-	-	-			
9. 30a.		-	-	-	-		100.4	71.0
Feb. 15th.	Axilla	101.0	101.2	100.6	100.7	Groin		
9. 30a.	Ant. foss.	100.0	99.7	99.1	99.5	Popl. Sp.	100.6	77.0
Feb. 15th.	Axilla	101.4	101.8	101.2	101.4	Groin		
5. 30p.	Ant. foss.	100.1	100.7	100.0	100.5	Popl. Sp.	101.6	75.0
Feb. 16th.	Axilla	101.2	101.3	101.0	101.1	Groin		
2. Op.	Ant. foss.	100.5	100.4	100.1	100.3	Popl. Sp.	101.1	77.0

			Mean	Max.	Min.	Range
between 9 & 10a.m.	3 observations	- Rectum	100.6	100.8	100.4	0.4
	2	" - Axilla	101.2	101.3	101.0	0.3
	2	" - Ant. foss.	100.2	100.8	99.7	1.1
	2	" - Groin	100.7	100.9	100.6	0.3
	2	" - Popl. Sp.	99.6	100.0	99.1	0.9
" 2 & 3 p.m.	2	" - Rectum	101.2	101.3	101.1	0.2
	2	" - Axilla	101.4	101.6	101.2	0.4
	2	" - Ant. foss.	100.4	100.8	100.2	0.6
	2	" - Groin	101.1	101.1	101.0	0.1
	2	" - Popl. Sp.	100.2	100.3	100.1	0.2
" 5 & 6 p.m.	4	" - Rectum	101.8	102.3	101.5	0.8
	4	" - Axilla	101.9	102.8	101.1	1.7
	3	" - Ant. foss.	101.2	102.1	100.1	2.0
	3	" - Groin	101.7	102.1	101.2	0.9
	3	" - Popl. Sp.	100.6	101.0	100.0	1.0
Mean temperature of room - 74.0.			Range 69.0 to 77.0			

Monkey III (Macacus Sinicus) - Female, Weight 2.1 Kilos.

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
1901								
Feb. 5th. 5. 30p.	Axilla Ant. foss.	103.6 103.0	103.4 102.6	103.1 102.1	102.9 102.3	Groin Popl. Sp.	103.2	74.0
Feb. 6th. 5. 30p.	Axilla Ant. foss.	103.0 102.4	103.3 102.1	103.0 102.2	102.4 101.2	Groin Popl. Sp.	103.1	77.0
Feb. 7th. 9. 30a.	Axilla Ant. foss.	100.0 99.0	100.3 99.4	100.1 99.0	99.9 99.2	Groin Popl. Sp.	100.5	76.0
Feb. 7th. 5. 30p.	Axilla Ant. foss.	99.2 98.4	99.4 98.1	99.8 98.9	99.6 99.0	Groin Popl. Sp.	100.0	77.0
Feb. 8th. 5. 30p.	Axilla Ant. foss.	100.6 100.0	100.3 99.3	99.9 99.1	100.1 99.0	Groin Popl. Sp.	100.0	74.0
Feb. 9th. 2. 0p.	Axilla Ant. foss.	101.2 100.3	101.4 100.6	100.9 100.0	101.1 100.4	Groin Popl. Sp.	101.1	74.0
Feb. 10th. 5. 30p.	Axilla Ant. foss.	102.3 101.2	102.1 101.3	101.8 101.0	101.7 100.2	Groin Popl. Sp.	101.9	69.0
Feb. 11th. 5. 30p.	Axilla Ant. foss.	101.8 100.9	101.9 101.3	101.4 100.2	101.6 100.8	Groin Popl. Sp.	101.8	72.0
Feb. 12th. 10. 0a.	Axilla Ant. foss.	100.5 100.0	100.8 100.1	100.1 99.0	100.3 99.4	Groin Popl. Sp.	100.2	76.0
Feb. 12th. 5. 0p.	Axilla Ant. foss.	100.9 100.0	101.1 100.0	100.8 100.1	100.7 99.7	Groin Popl. Sp.	100.9	73.0
Feb. 13th. 5. 30p.	Axilla Ant. foss.	100.9 99.6	101.1 100.2	100.7 99.1	100.5 99.3	Groin Popl. Sp.	100.7	72.5

I Temperature abnormally high, due to muscular exercise.

Monkey III (Continued)

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
1901 Feb. 14th. 9. 30a.		-	-	-	-		99.4	71.0
Feb. 15th. 5. 30p.	Axilla Ant. foss.	102.1 101.0	102.4 101.1	102.0 100.6	102.1 101.1	Groin Popl. Sp.	102.3	75.0
Feb. 16th. 2. Op.	Axilla Ant. foss.	101.1 99.9	100.9 100.0	101.0 99.8	100.8 99.7	Groin Popl. Sp.	101.0	77.0
Feb. 21st. 5. 30p.	Axilla Ant. foss.	102.0 101.6	102.3 101.4	102.0 101.2	101.8 101.2	Groin Popl. Sp.	101.9	79.5

			Mean	Max.	Min.	Range
Between 9 & 10a.m.	3 observations	- Rectum	100.6	100.8	100.4	0.4
	2	" - Axilla	101.2	101.3	101.0	0.3
	2	" - Ant. foss.	100.2	100.8	99.7	1.1
	2	" - Groin	100.7	100.9	100.6	0.3
	2	" - Popl. Sp.	99.6	100.0	99.1	0.9
" 2 & 3 p.m.	2	" - Rectum	101.2	101.3	101.1	0.2
	2	" - Axilla	101.4	101.6	101.2	0.4
	2	" - Ant. foss.	100.4	100.8	100.2	0.6
	2	" - Groin	101.1	101.1	101.0	0.1
	2	" - Popl. Sp.	100.2	100.3	100.1	0.2
" 5 & 6 p.m.	4	" - Rectum	101.8	102.3	101.5	0.8
	4	" - Axilla	101.9	102.8	101.1	1.7
	3	" - Ant. foss.	101.2	102.1	100.1	2.0
	3	" - Groin	101.7	102.1	101.2	0.9
	3	" - Popl. Sp.	100.6	101.0	100.0	1.0

Mean temperature of room 74.0. Range 69.0 to 77.0.

11.

Monkey IV (Macacus Rhoesus) - Female, Weight 1.99 Kilos.

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
1901 Feb. 21st. 5. 30p.	Axilla Ant. foss.	102.4 101.6	102.3 101.4	102.1 101.3	102.2 101.1	Groin Popl. Sp.	102.4	79.5
Feb. 22nd. 9. 30a.	Axilla Ant. foss.	101.9 -	- -	- -	- -		101.6	79.0
Feb. 22nd. 5. Op.	Axilla Ant. foss.	102.2 -	102.4 -	- -	- -		102.2	77.0
Feb. 23rd. 2. 30p.	Axilla Ant. foss.	103.8 -	- -	- -	- -	‡	103.4	77.5
Feb. 25th. 5. 30p.	Axilla Ant. foss.	104.1 -	- -	- -	- -	‡	104.2	78.0
Feb. 26th. 5. Op.		- -	- -	- -	- -		102.1	75.0
Feb. 27th. 4. Op.		- -	- -	- -	- -		101.8	77.0
Feb. 28th. 5. Op.		- -	- -	- -	- -		102.0	78.0
Mar. 4th. 5. Op.	Axilla Ant. foss.	102.2 -	102.3 -	- -	- -		101.8	76.0

‡ On those occasions the monkey had been chased immediately before the observations were made.

Monkey IV (Continued).

			Mean	Max.	Min.	Range
Between 9 & 10a.m.	1 observation	- Rectum	101.6	-	-	-
	1	" - Axilla	101.9	-	-	-
" 5 & 6p.m.	5	" - Rectum	102.1	102.4	101.8	0.6
	3	" - Axilla	102.3	102.4	102.2	0.2
	1	" - Ant. foss.	101.5	-	-	-
	1	" - Groin	102.1	-	-	-
	1	" - Popl. Sp.	101.2	-	-	-

Mean temperature of room 77.3. Range 75.0 to 79.5.

Monkey V (Macacus Rhoesus) - Female.

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
I	1901 Feb. 21st. 5. 0p.m.	Axilla 104.4	104.5	-	-		104.4	79.5
		Ant. foss. -	-	-	-			
	Feb. 22nd. 9. 30a.m.	-	-	-	-		101.1	79.0
	Feb. 22nd. 2. 30p.m.	-	-	-	-		101.5	77.5
	Feb. 23rd. 2. 30p.m.	Axilla 102.0	102.1	-	-		101.8	77.5
		Ant. foss. -	-	-	-			

13.

Monkey V (Continued)

				Mean	Max.	Min.	Range
Between 9 & 10a.m.	1 observation	-	Rectum	101.1	-	-	-
"	2 & 3 p.m.	2	" - Rectum	101.7	101.8	101.5	0.3
		1	" - Axilla	102.1	-	-	-
"	5 & 6 p.m.	3	" - Rectum	102.1	102.2	102.0	0.2
		1	" - Axilla	102.6	-	-	-
		1	" - Ant. fossa	101.3	-	-	-
		1	" - Groin	101.9	-	-	-
		1	" - Popl. Sp.	100.7	-	-	-

Mean temperature of room - 77.5. Range - 75.0 to 79.0.

Monkey V (Macacus Rhesus) - Female.

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
1901 Feb. 21st. 5. Op.m.	Axilla	104.4	104.5	-	-		104.4	79.5
	Ant. foss.	-	-	-	-			
Feb. 22nd. 9. 30a. m.		-	-	-	-		101.1	79.0
Feb. 22nd. 2. 30p. m.		-	-	-	-		101.5	77.5
Feb. 23rd. 2. 30p. m.	Axilla	102.0	102.1	-	-		101.8	77.5
	Ant. foss.	-	-	-	-			
Feb. 25th. 5. 30p. m.	Axilla	102.4	102.8	101.9	101.8	Groin	102.1	78.0
	Ant. foss.	101.3	101.3	100.6	100.8	Popl. Sp.		
Feb. 26th. 5. 30p. m.		-	-	-	-		102.0	75.0
Feb. 28th. 5. 30p. m.		-	-	-	-		102.2	78.0

I This high temperature was the result of exercise.

Monkey VI (Macacus Rhoesus) - Male - Adult.

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
1901 Feb. 22nd. 5. 30p. m.	Axilla	103.9	103.6	-	-		103.8	79.0
	Ant. foss.	-	-	-	-			
Feb. 23rd. 2. 30p. m.		-	-	-	-		102.6	77.5
Feb. 25th. 5. 30p. m.		-	-	-	-		101.8	78.0
Feb. 26th. 5. 30p. m.		-	-	-	-		102.1	75.0
Feb. 27th. 5. Op. m.	Axilla	101.6	101.8	-	-		101.1	74.0
	Ant. fosso	-	-	-	-			
Feb. 28th. 5. 30p. m.	Axilla	101.4	101.6	-	-		100.9	78.0
	Ant. foss.	-	-	-	-			

I Due to muscular exercise.

			Mean	Max.	Min.	Range
Between 2 & 3 p. m.	1 observation	- Rectum	102.6	-	-	-
"	5 & 6 p. m.	4 " - Rectum	101.5	102.1	100.9	1.2
	2	" - Axilla	101.6	101.8	101.4	0.4

Mean temperature of room - 76.5. Range 74.0 to 78.0.

Monkey VII (Macacus Rhoesus) - Male, Weight 2 Kilos.

		Right Axilla	Left Axilla	Rectum	Room
1901					
Feb. 22nd.	5.30 p.m.	102.4	102.2	102.2	79.0
" 23rd.	5.30 p.m.	-	-	101.8	77.5
" 25th.	5.30 p.m.	-	-	101.6	78.0
" 26th.	5.30 p.m.	102.2	102.4	102.4	75.0
" 28th.	5.30 p.m.	-	-	102.1	78.0
Mar. 4th.	5.30 p.m.	101.6	101.8	101.3	79.0
" 5th.	9.30 a.m.	-	-	100.8	78.5

15.

Monkey VII (Continued)

			Mean	Max.	Min.	Range
Between 9 & 10a.m.	1 observation	- Rectum	100.8	-	-	-
" 5 & 6 p.m.	12	" - Rectum	102.0	102.5	101.3	1.2
	6	" - Axilla	102.0	102.4	101.6	0.8

Mean temperature of room - 77.8. Range - 75.0 to 79.0.

Monkey VII (Macacus Rhoesus) - Male, Weight 2 Kilos.

		Right Axilla	Left Axilla	Rectum	Room
1901					
Feb. 22nd.	5. 30 p. m.	102. 4	102. 2	102. 2	79. 0
" 23rd.	5. 30 p. m.	-	-	101. 8	77. 5
" 25th.	5. 30 p. m.	-	-	101. 6	78. 0
" 26th.	5. 30 p. m.	102. 2	102. 4	102. 4	75. 0
" 28th.	5. 30 p. m.	-	-	102. 1	78. 0
Mar. 4th.	5. 30 p. m.	101. 6	101. 8	101. 3	79. 0
" 5th.	9. 30 a. m.	-	-	100. 8	78. 5
" "	5. 30 p. m.	102. 2	102. 3	101. 8	78. 0
" 6th.	5. 30 p. m.	-	-	102. 5	77. 0
" 7th.	5. 30 p. m.	-	-	101. 9	79. 0
" 8th.	5. 0 p. m.	-	-	102. 3	76. 0
" 9th.	5. 30 p. m.	101. 8	101. 8	102. 1	78. 0
" 10th.	5. 30 p. m.	101. 6	101. 7	101. 5	78. 5

Monkey VIII (*Macacus Rhesus*) - Female - Not full grown.
Very Docile.

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
1901								
Feb. 22nd.	Axilla	102.5	102.4	-	-			
5. 30p. m.	Ant. foss.	101.3	101.6	-	-		102.1.	79.0
Feb. 25th.		-	-	-	-		101.4	78.0
5. 30p. m.								
Feb. 26th.	Axilla	102.1	102.5	102.1	101.9	Groin	102.2	75.0
5. 30p. m.		-	-	-	-			
Feb. 28th.	Axilla	101.9	102.2	-	-		102.1	78.0
5. 30p. m.	Ant. foss.	100.3	100.8	-	-			
Mar. 4th.		-	-	-	-		101.8	79.0
5. 30p. m.								
Mar. 5th.		-	-	-	-		101.5	78.5
5. 0p. m.								
Mar. 6th.		-	-	-	-		101.1	77.0
5. 30p. m.								

16.

Monkey VIII (Continued)

			Mean	Max.	Min.	Range
Between 5 & 6p. m.	11 observations	- Rectum	101.7	102.2	101.1	1.1
	5 "	- Axilla	102.1	102.6	101.1	1.5
	3 "	- Ant. foss.	101.1	101.6	100.3	1.3
	1 "	- Groin	102.0	-	-	-

Mean temperature of room - 80.0. Range - 75.0 to 79.0.

Monkey VIII (*Macacus Rhesus*) - Female - Not full grown.
Very Docile.

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
1901								
Feb. 22nd.	Axilla	102.5	102.4	-	-			
5. 30p. m.	Ant. foss.	101.3	101.6	-	-		102.1.	79.0
Feb. 25th.		-	-	-	-			
5. 30p. m.		-	-	-	-		101.4	78.0
Feb. 26th.	Axilla	102.1	102.5	102.1	101.9	Groin	102.2	75.0
5. 30p. m.		-	-	-	-			
Feb. 28th.	Axilla	101.9	102.2	-	-			
5. 30p. m.	Ant. foss.	100.3	100.8	-	-		102.1	78.0
Mar. 4th.		-	-	-	-			
5. 30p. m.		-	-	-	-		101.8	79.0
Mar. 5th.		-	-	-	-			
5. Op. m.		-	-	-	-		101.5	78.5
Mar. 6th.		-	-	-	-			
5. 30p. m.		-	-	-	-		101.1	77.0
Mar. 7th.		-	-	-	-			
5. 30p. m.		-	-	-	-		101.9	79.0
Mar. 8th.	Axilla	101.1	101.2	-	-			
5. 30p. m.		-	-	-	-		101.4	76.0
Mar. 9th.	Axilla	102.6	102.4	-	-			
5. 30p. m.	Ant. foss.	101.1	101.3	-	-		102.1	78.0
Mar. 10th.		-	-	-	-			
5. 30p. m.		-	-	-	-		101.6	78.5

Monkey IX (Macacus Rhoesus) - Male - Not full grown.

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
1901								
Feb. 22nd.	Axilla	102.8	102.6	102.4	-	Groin		
5. 30p. m.	Ant. foss.	102.2	101.9	-	-		102.8	79.0
Feb. 26th.	Axilla	104.3	104.5	-	-		104.0	75.0
5. 30p. m.		-	-	-	-			
Feb. 27th.		-	-	-	-		101.6	78.0
5. 30p. m.		-	-	-	-			
Mar. 4th.	Axilla	101.9	102.1	-	-		102.0	79.0
5. 30p. m.		-	-	-	-			
Mar. 5th.		-	-	-	-		101.3	78.5
5. Op. m.		-	-	-	-			
Mar. 6th.		-	-	-	-			

Monkey IX (Continued)

			Mean	Max.	Min.	Range
Between 5 & 6 p.m.	9 observations	- Rectum	101.8	102.3	101.2	1.1
	4 "	- Axilla	102.2	102.5	101.9	0.6
	3 "	- Ant. foss.	101.3	101.5	101.1	0.4
	1 "	- Groin	102.1	-	-	-
	1 "	- Popl. Sp.	100.9	-	-	-

Mean temperature of room - 77.7. Range - 76.0 to 79.0.

Monkey IX (Macacus Rhoesus) - Male - Not full grown.

		Right Arm	Left Arm	Right Leg	Left Leg		Rectum	Room
1901								
Feb. 22nd.	Axilla	102.8	102.6	102.4	-	Groin		
5. 30p.m.	Ant. foss.	102.2	101.9	-	-		102.8	79.0
Feb. 26th.	Axilla	104.3	104.5	-	-		104.0	75.0
5. 30p.m.		-	-	-	-			
Feb. 27th.		-	-	-	-		101.6	78.0
5. 30p.m.		-	-	-	-			
Mar. 4th.	Axilla	101.9	102.1	-	-		102.0	79.0
5. 30p.m.		-	-	-	-			
Mar. 5th.		-	-	-	-		101.3	78.5
5. Op.m.		-	-	-	-			
Mar. 6th.		-	-	-	-		102.3	77.0
5. 30p.m.		-	-	-	-			
Mar. 7th.	Axilla	102.5	102.4	102.2	101.9	Groin		
5. 30p.m.	Ant. foss.	101.3	101.1	101.1	100.8	Popl. Sp.	102.0	79.0
Mar. 8th.		-	-	-	-		101.6	76.0
5. 30p.m.		-	-	-	-			
Mar. 9th.		-	-	-	-		101.2	78.0
5. 30p.m.		-	-	-	-			
Mar. 10th.	Axilla	102.3	102.2	-	-		102.1	78.5
5. 30p.m.	Ant. foss.	101.3	101.5	-	-			
Mar. 11th.	Axilla	102.0	102.4	-	-		101.8	77.0
5. 30p.m.	Ant. foss.	101.3	101.5	-	-			

Monkey X (Macacus Rhoesus) - Male - Very Quiet.

		Right Axilla	Left Axilla	Rectum	Room
<u>1901</u> <u>May 14th.</u>	<u>5. 30p.m.</u>	-	-	101.8	70.0
" 15th.	5. 0p.m.	101.6	101.3	101.3	68.0
" 16th.	5. 0p.m.	-	-	101.8	67.0
" 17th.	5. 0p.m.	-	-	101.2	69.0
" 18th.	5. 0p.m.	-	-	102.0	70.0
" 19th.	9. 30a.m.	101.8	-	101.8	70.0
" "	5. 0p.m.	-	-	101.5	68.0
" 20th.	9. 30a.m.	-	-	101.1	68.0
" "	5. 30p.m.	102.3	102.2	101.8	67.5

18.

Monkey X (Continued)

			Mean	Max.	Min.	Range
Between 9 & 10a.m.	6 observations	- Rectum	100.7	101.8	99.8	2.0
	2	" - Axilla	100.8	101.8	100.3	1.5
" 5 & 6 p.m.	11	" - Rectum	101.6	102.0	101.2	0.8
	3	" - Axilla	101.9	102.3	101.3	1.0

Mean temperature of room - 68.0. Range - 67.0 to 70.0.

Monkey X (Macacus Rhoesus) - Male - Very Quiet.

		Right Axilla	Left Axilla	Rectum	Room
<u>1901</u> <u>May 14th.</u>	<u>5. 30p.m.</u>	-	-	101.8	70.0
" 15th.	5. 0p.m.	101.6	101.3	101.3	68.0
" 16th.	5. 0p.m.	-	-	101.8	67.0
" 17th.	5. 0p.m.	-	-	101.2	69.0
" 18th.	5. 0p.m.	-	-	102.0	70.0
" 19th.	9. 30a.m.	101.8	-	101.8	70.0
" "	5. 0p.m.	-	-	101.5	68.0
" 20th.	9. 30a.m.	-	-	101.1	68.0
" "	5. 30p.m.	102.3	102.2	101.8	67.5
" 21st.	9. 30a.m.	-	-	100.4	67.0
" "	5. 30p.m.	-	-	101.6	68.0
" 22nd.	9. 30a.m.	-	-	101.0	67.0
" "	5. 30p.m.	-	-	101.9	67.5
" 23rd.	9. 30a.m.	100.3	100.4	100.1	70.0
" "	5. 30p.m.	-	-	101.4	69.0
" 24th.	9. 30a.m.	-	-	99.8	70.0
" "	5. 30p.m.	102.1	101.9	101.8	68.0

Monkey XI (Macacus Rhoesus) - Male - Weight 1.98 Kilos.

		Right Axilla	Left Axilla	Rectum	Room
1902.					
Jan. 18th.	12. 30p.m.	100.4	100.2	100.4	60.0
" 31st.	5. 0p.m.	-	-	100.8	77.0
Feb. 1st.	" "	-	-	101.1	
" 4th.	" "	101.0	101.2	100.8	77.0
" 5th.	" "	-	-	101.2	76.0
" 6th.	" "	102.1	101.9	102.0	77.0
" 7th.	" "	102.2	102.0	101.8	76.0
" 14th.	" "	101.8	101.9	101.4	71.0
" 21st.	" "	-	-	101.4	68.0
" 22nd.	2. 0p.m.	-	-	101.2	70.0
" 25th.	5. 0p.m.	-	-	101.8	74.0

Between 2 & 3p.m.	1 observation	- Rectum	Mean 101.2	Max. -	Min. -	Range -
" 5 & 6p.m.	9	" - Rectum	101.4	102.0	100.8	1.2
	4	" - Axilla	101.8	102.2	101.0	1.2

Mean temperature of room - 73.0. Range - 60.0 to 77.0.

Monkey XII (Macacus Rhoesus) - Female, Very Tame.

Most suitable for temperature observations.

		Right Axilla	Left Axilla	Rectum	Room
1902.					
Jan. 20th.	9. 30a. m.	101. 2	101. 1	100. 9	65. 0
" 20th.	4. 30p. m.	101. 8	101. 6	101. 3	68. 0
" 21st.	9. 30a. m.	100. 1	100. 3	100. 1	76. 0
" 21st.	5. 0p. m.	101. 6	101. 5	101. 1	77. 0
" 22nd.	9. 30a. m.	-	-	100. 4	74. 0
" 22nd.	5. 30p. m.	-	-	101. 6	72. 0
" 23rd.	9. 30a. m.	100. 2	100. 3	99. 8	74. 0
" 23rd.	5. 30p. m.	101. 9	102. 1	102. 0	75. 0
" 24th.	9. 30a. m.	-	-	100. 3	74. 0
" 25th.	9. 30a. m.	-	-	101. 1	77. 0
" 25th.	5. 30p. m.	-	-	101. 8	75. 0
" 26th.	9. 30a. m.	100. 5	100. 8	100. 3	74. 0
" 26th.	5. 30p. m.	101. 4	101. 8	101. 4	74. 0
" 31st.	5. 0p. m.	101. 1	101. 2	101. 2	78. 0
Feb. 1st.	" "	103. 9	104. 0	103. 7	77. 0
" 2nd.	" "	-	-	102. 9	78. 0

Monkey XII (Continued)

		Right Axilla	Left Axilla	Rectum	Room	
1902.						
Feb.	3rd.	5. Op. m.	103.5	103.2	103.4	76.0
"	5th.	" "	102.3	102.6	102.4	76.0
"	6th.	" "	-	-	102.6	77.0
"	7th.	" "	-	-	103.0	76.0
"	15th.	" "	-	-	103.2	71.0
"	17th.	" "	-	-	103.0	72.0
"	18th.	" "	-	-	102.6	70.0
<p>The readings taken from Feb. 1st. to Feb. 18th. (inclusive) are abnormally high, due to the fact that the animal was suffering from coryza. These will be omitted from the averages.</p>						
"	19th.	5. Op. m.	101.7	101.8	101.5	70.0
"	20th.	" "	101.7	101.9	101.6	74.0
"	21st.	" "	101.7	101.4	101.4	68.0
"	22nd.	2. Op. m.	101.3	101.2	101.1	70.0
"	25th.	5. Op. m.	102.0	102.2	101.9	74.0
"	28th.	" "	101.4	101.6	101.4	71.0

Monkey XII (Continued)

		Right Axilla	Left Axilla	Rectum	Room
1902.					
Mar.	3rd. 5. Op.m.	-	101.5	101.3	70.0
"	4th. " "	-	102.0	101.8	77.0
"	5th. " "	-	102.3	102.1	76.0
"	7th. " "	101.2	101.4	101.2	70.0
"	10th. " "	102.1	102.2	101.8	70.0
"	12th. " "	101.6	101.9	101.6	73.0
"	13th. " "	101.6	101.7	101.6	73.0
"	14th. " "	102.3	102.3	101.9	72.0

Monkey XII (Continued)

			Mean	Max.	Min.	Range
Between 9 & 10a.m.	7 observations	- Rectum	100.4	101.1	99.8	1.3
	4 "	- Axilla	100.6	101.2	100.1	1.1
" 2 & 3 p.m.	1 "	- Rectum	101.1	-	-	-
	1 "	- Axilla	101.2	-	-	-
" 5 & 6 p.m.	25 "	- Rectum	101.6	102.1	101.0	1.1
	21 "	- Axilla	101.8	102.3	101.1	1.2

Mean temperature of room - 72.0. Range - 65.0 to 78.0.

Monkey XII (Continued)

		Right Axilla	Left Axilla	Rectum	Room
1902.					
Mar.	3rd. 5. Op.m.	-	101.5	101.3	70.0
"	4th. " "	-	102.0	101.8	77.0
"	5th. " "	-	102.3	102.1	76.0
"	7th. " "	101.2	101.4	101.2	70.0
"	10th. " "	102.1	102.2	101.8	70.0
"	12th. " "	101.6	101.9	101.6	73.0
"	13th. " "	101.6	101.7	101.6	73.0
"	14th. " "	102.3	102.3	101.9	72.0
"	16th. " "	-	-	101.3	74.0
"	18th. " "	101.9	102.1	101.8	75.0
"	20th. " "	-	-	102.1	72.0
"	28th. " "	102.1	102.1	101.6	70.0
"	30th. " "	101.4	101.2	101.0	72.0

Monkey XII (Continued)

This table shows the effect of active muscular exercise on the temperature. The temperature was taken in the usual way after the animal had been resting for half-an-hour; it was then set free and chased through the large cage in which it was kept for a longer or shorter period, at the end of which the temperature was again observed.

	Right Axilla	Left Axilla	Rectum	Room
1902				
Feb. 28th. 5. Op.m.	101.4	101.6	101.4	71.0
After 15 minutes chase	103.2	103.6	103.6	"
Mar. 3rd. 5. Op.m.	-	101.5	101.3	70.0
After 10 minutes chase	-	103.1	102.8	"
Mar. 4th. 5. Op.m.	-	102.0	101.8	77.0
After 10 minutes chase	-	103.1	102.8	"
Mar. 5th. 5. Op.m.	-	102.3	102.1	76.0
After 10 minutes chase	-	103.5	103.3	"
Mar. 7th. 5. Op.m.	101.2	101.4	101.2	70.0
After 30 minutes chase	104.8	104.8	104.6	"
Mar. 10th. 5. Op.m.	102.1	102.2	101.8	70.0
After 20 minutes chase	103.4	103.5	103.0	"
Mar. 12th. 5. Op.m.	101.6	101.9	101.6	73.0
After 45 minutes chase	104.9	105.1	105.1	"
-very tired, panting.				

Monkey XIII (*Macacus Rhoesus*) - Female, Small Active animal, - probably not an adult.

		Rectum	Room
1902.			
Feb. 7th.	5. Op.m.	102.0	76.0
" 15th.	" "	100.2	71.0
" 17th.	" "	101.6	72.0
" 18th.	" "	101.7	70.0
" 19th.	" "	101.9	70.0
" 20th.	" "	101.2	74.0
" 21st.	" "	100.8	68.0
" 22nd.	" "	99.1	70.0
" 25th.	" "	101.7	74.0

between 5 & 6p.m. 9 observations - Rectum Mean Max. Min. Range
 101.1 102.0 99.1 2.9

Mean temperature of room - 72.0. Range - 68.0 to 76.0.

Monkey XV (*Macacus Rhesus*) - Female
Small active animal.

		Right Axilla	Left Axilla	Rectum	Room
1902					
Mar. 20th.	4. 30p.m.	102.0	102.2	101.4	72.0
"	24th. 5. Op.m.	102.6	102.4	102.0	72.0
"	25th. 5. Op.m.	102.0	102.1	101.6	70.0

Monkey XVI (*Macacus Rhesus*) - Female
Small active animal.

		Right Axilla	Left Axilla	Rectum	Room
Mar. 17th.	5. Op.m.	-	102.5	102.1	70.0
"	19th. " "	-	101.8	101.6	72.0
"	20th. " "	-	101.7	101.4	72.0

Monkey XVII (*Macacus Rhesus*) - Male

		Right Axilla	Left Axilla	Rectum	Room
Mar. 17th.	5. Op.m.	102.0	101.9	101.4	70.0
"	18th. " "	101.9	102.3	101.6	70.0
"	19th. " "	102.0	101.7	101.1	72.0

Monkey XV (Continued)

			Mean	Max.	Min.	Range
Between 5 & 6p.m.	3 observations	- Rectum	101.7	102.0	101.4	0.6
	3	" - Axilla	102.2	102.6	102.0	0.6

Mean temperature of room - 71.0. Range - 70.0 to 72.0.

Monkey XVI (Continued)

			Mean	Max.	Min.	Range
Between 5 & 6p.m.	3 observations	- Rectum	101.7	102.1	101.4	0.7
	3	" - Axilla	102.0	102.5	101.7	0.8

Mean temperature of room - 71.0. Range - 70.0 to 72.0.

Monkey XVII (Continued)

			Mean	Max.	Min.	Range
Between 5 & 6p.m.	3 observations	- Rectum	101.4	101.6	101.1	0.5
	3	" - Axilla	102.0	102.3	101.7	0.6

Mean temperature of room - 71.0. Range - 70.0 to 72.0.

Monkey XVIII (Macacus Rhoesus) - Male

This was a large well developed animal but very fierce. It struggled wildly when an attempt was made to take its temperature. One reading is recorded merely to show that it is necessary to select animals which remain quiet while the temperature is being taken.

		Rectum	Room
1902 Mar. 15th.	2. Op.m.	104.5	71.0

Monkey XIX (Macacus Rhoesus) - Small female, very active but quiet.

		Right Axilla	Left Axilla	Rectum	Room
1902 Mar. 15th.	2. Op.m.	-	101.4	101.1	71.0
"	17th. 5. Op.m.	102.1	102.3	101.8	70.0
"	18th. " "	-	101.6	101.2	70.0

28.

Monkey XIX (Continued)

			Mean	Max.	Min.	Range
Between 2 & 3 p.m.	2 observations	- Rectum	101.4	101.7	101.1	0.6
	2	" - Axilla	101.6	101.9	101.4	0.5
"	5 & 6 p.m. 9	" - Rectum	101.8	102.1	101.2	0.9
	9	" - Axilla	102.3	102.6	101.6	1.0

Mean temperature of room - 72.0. Range - 70.0 to 74.0.

Monkey XVIII (Macacus Rhoesus) - Male

This was a large well developed animal but very fierce. It struggled wildly when an attempt was made to take its temperature. One reading is recorded merely to show that it is necessary to select animals which remain quiet while the temperature is being taken.

		Rectum	Room
1902 Mar. 15th.	2. Op.m.	104.5	71.0

Monkey XIX (Macacus Rhoesus) - Small female, very active but quiet.

		Right Axilla	Left Axilla	Rectum	Room
1902 Mar. 15th.	2. Op.m.	-	101.4	101.1	71.0
"	17th. 5. Op.m.	102.1	102.3	101.8	70.0
"	18th. " "	-	101.6	101.2	70.0
"	19th. " "	-	102.5	101.9	72.0
"	20th. " "	-	102.1	102.0	72.0
"	22nd. 2. Op.m.	-	101.9	101.7	74.0
"	24th. 5. Op.m.	-	102.6	102.1	72.0
"	25th. " "	-	102.3	101.9	74.0
"	26th. " "	-	102.5	101.9	73.0
"	27th. " "	-	102.3	102.0	72.0
Apl. 2nd.	5. 30p.m.	-	102.4	101.8	71.0

Monkey XX (Macacus Rhoesus) - Male - Well Developed, Very Docile.

		Right Axilla	Left Axilla	Rectum	Room
1902					
May 1st.	5. Op.m.	102.1	102.2	102.3	71.0
"	2nd. " "	101.5	-	101.1	70.0
"	5th. " "	101.5	101.6	101.7	65.0
"	6th. " "	102.0	101.9	101.8	68.0
"	7th.	-	101.2	100.7	72.0
"	9th. " "	102.2	102.0	101.4	74.0
"	12th. " "	-	102.6	102.4	68.0
"	13th. " "	101.6	101.8	100.9	70.0

Between 5 & 6p.m.	8 observations	- Rectum	Mean 101.5	Max. 102.4	Min. 100.7	Range 1.7
	8	" - Axilla	Mean 101.9	Max. 102.6	Min. 101.2	Range 1.4

Mean temperature of room - 69.8. Range - 65.0 to 74.0.

Monkey XXI (Macacus Rhoesus) - Male.

		Right Axilla	Left Axilla	Rectum	Room
1902 May 1st.	5. Op.m.	102.2	102.1	102.2	71.0
"	2nd. " "	-	102.4	102.5	70.0
"	5th. " "	102.4	102.5	101.7	65.0
"	6th. " "	102.3	102.1	101.6	68.0
"	7th. " "	102.4	-	102.2	72.0
"	9th. " "	102.3	102.3	102.3	74.0
"	12th. " "	102.4	-	102.3	68.0
"	13th. " "	102.6	102.2	102.0	70.0

Between 5 & 6 p.m. 8 observations - Rectum	Mean	Max.	Min.	Range
	102.1	102.5	101.6	0.9
8 " - Axilla	102.3	102.6	102.1	0.5

Mean temperature of room - 69.8. Range - 65.0 to 74.0.

Monkey XXII (Macacus Rhoesus) - Male - Well Developed, Very Tame.

		Right Axilla	Left Axilla	Rectum	Room
1902 May 1st.	5. Op.m.	-	101.2	101.0	70.0
"	9th. " "	102.1	102.2	102.0	74.0
"	13th. " "	102.1	102.0	101.8	

Monkey XXIII (Macacus Rhoesus) - Male - Small Active Animal.

		Right Axilla	Left Axilla	Rectum	Room
June 16th.	5. Op.m.	-	102.2	101.6	72.0
"	17th. " "	-	101.9	101.8	74.0
"	18th. 5.30p.m.	-	102.6	102.1	71.0
"	19th. " "	-	101.9	101.4	70.0

Monkey XXIV (Macacus Rhoesus) - Female
Small and Active but Very Timid.

		Right Axilla	Left Axilla	Rectum	Room
June 16th.	5. Op.m.	-	102.2	102.1	72.0
"	17th. " "	-	102.6	102.2	74.0
"	18th. 5.30p.m.	-	102.1	101.6	71.0
"	19th. " "	-	102.5	101.9	70.0

Monkey XXII (Continued)

			Mean	Max.	Min.	Range
Between 5 & 6p.m.	3 observations	- Rectum	101.6	102.0	101.0	1.0
	3	" - Axilla	101.9	102.2	101.2	1.0

Mean temperature of room - 72.0. Range - 70.0 to 74.0.

Monkey XXIII (Continued)

			Mean	Max.	Min.	Range
Between 5 & 6p.m.	4 observations	- Rectum	101.7	102.1	101.4	0.7
	4	" - Axilla	102.2	102.6	101.9	0.7

Mean temperature of room - 71.7. Range - 70.0 to 74.0.

Monkey XXIV (Continued)

			Mean	Max.	Min.	Range
Between 5 & 6p.m.	4 observations	- Rectum	101.9	102.2	101.6	0.6
	4	" - Axilla	102.3	102.6	102.1	0.5

Mean temperature of room - 71.7. Range 70.0 to 74.0.

Monkey XXV (*Macacus Rhesus*) - Male.Medium sized and fairly quiet.

		Left Axilla	Rectum	Room
1902. Oct. 29th.	5. Op.m.	101.4	101.1	72.0
30th.	9. 30a.m.	100.2	99.8	70.0
	2. 30p.m.	100.1	99.6	71.0
	5. 30p.m.	101.6	101.1	71.5
31st.	9. 30a.m.	100.6	100.1	69.0
	2. 30p.m.	100.1	99.4	69.5
	5. 30p.m.	101.8	101.4	71.0
Nov. 3rd.	5. 30p.m.	100.6	100.1	71.5

33.

Monkey XXV (Continued)

			Mean	Max.	Min.	Range
Between 9 & 10a.m.	4 observations	- Rectum	99.9	100.1	99.6	0.5
	4	" - Axilla	100.2	100.6	99.9	0.7
" 2 & 3 p.m.	4	" - Rectum	100.5	101.6	99.4	2.2
	4	" - Axilla	101.0	102.1	100.1	2.0
" 5 & 6 p.m.	6	" - Rectum	101.2	101.7	100.1	1.6
	6	" - Axilla	101.6	102.1	100.6	1.5

Mean temperature of room - 71.1. Range - 69.0 to 73.0.

Monkey XXV (*Macacus Rhesus*) - Male.Medium sized and fairly quiet.

		Left Axilla	Rectum	Room
1902.				
Oct. 29th.	5. 0p.m.	101.4	101.1	72.0
30th.	9. 30a.m.	100.2	99.8	70.0
	2. 30p.m.	100.1	99.6	71.0
	5. 30p.m.	101.6	101.1	71.5
31st.	9. 30a.m.	100.6	100.1	69.0
	2. 30p.m.	100.1	99.4	69.5
	5. 30p.m.	101.8	101.4	71.0
Nov. 3rd.	5. 30p.m.	100.6	100.1	71.5
4th.	9. 30a.m.	100.3	100.0	72.0
	2. 30p.m.	102.1	101.6	71.5
	5. 30p.m.	101.9	101.7	70.0
7th.	9. 30a.m.	99.9	99.6	71.5
	2. 30p.m.	101.6	101.4	73.0
	5. 30p.m.	102.1	101.7	71.5

Monkey XXVI (*Macacus rhesus*) - Female.

Small - probably not full grown - very tame.

		Left Axilla	Rectum	Room
1902. Oct. 29th.	5. Op.m.	101.6	101.2	72.0
30th.	9. 30a.m.	99.1	98.7	70.0
	2. 30p.m.	100.2	100.1	71.0
	5. 30p.m.	101.1	100.8	71.5
31st.	9. 30a.m.	101.2	100.5	69.0

Monkey XXVI (Continued)

			Mean	Max.	Min.	Range
Between 9 & 10a.m.	4 observations	- Rectum	99.5	100.5	98.7	1.8
	4	" - Axilla	99.9	101.2	99.1	2.1
" 2 & 3 p.m.	4	" - Rectum	100.2	101.2	99.4	1.8
	4	" - Axilla	100.7	101.6	100.1	1.5
" 5 & 6 p.m.	6	" - Rectum	100.9	101.4	100.2	1.2
	6	" - Axilla	101.3	102.1	100.7	1.4

Mean temperature of room - 71.1. Range - 69.0 to 73.0.

Monkey XXVI (*Macacus rhesus*) - Female.

Small - probably not full grown - very tame.

		Left Axilla	Rectum	Room
1902.				
Oct. 29th.	5. 0p.m.	101.6	101.2	72.0
30th.	9. 30a.m.	99.1	98.7	70.0
	2. 30p.m.	100.2	100.1	71.0
	5. 30p.m.	101.1	100.8	71.5
31st.	9. 30a.m.	101.2	100.5	69.0
	2. 30p.m.	100.9	100.2	69.5
	5. 30p.m.	102.1	101.4	71.0
Nov. 3rd.	5. 30p.m.	101.3	101.1	71.5
4th.	9. 30a.m.	100.1	99.6	72.0
	2. 30p.m.	100.1	99.4	71.5
	5. 30p.m.	101.2	100.6	70.0
7th.	9. 30a.m.	99.3	99.1	71.5
	2. 30p.m.	101.6	101.2	73.0
	5. 30p.m.	100.7	100.2	71.5

Monkey XXVII (*Macacus rhesus*) - Male.

Large well developed animal - quiet.

		Left Axilla	Rectum	Room
1902. Nov. 21st.	9. 30a. m.	101.2	101.2	75.0
	5. 30p. m.	101.1	100.6	74.0
24th.	9. 30a. m.	100.4	100.0	73.5
	5. 30p. m.	102.1	101.6	72.0
25th.	9. 30a. m.	101.1	100.4	75.0
	5. 30p. m.	101.6	101.5	73.5
28th.	9. 30a. m.	99.4	99.1	77.5
	5. 30p. m.	101.8	101.6	70.5
29th.	9. 30a. m.	100.4	100.1	76.5
Decr. 1st.	9. 30a. m.	101.4	101.1	74.0
	5. 30p. m.	102.1	101.5	74.0

			Mean	Max.	Min.	Range
Between 9 & 10a. m.	6 observations	- Rectum	100.3	101.1	99.1	2.0
	6	" - Axilla	100.6	101.4	99.4	2.0
" 5 & 6 p. m.	5	" - Rectum	101.3	101.6	100.6	1.0
	5	" - Axilla	101.7	102.1	101.1	1.0

Mean temperature of room - 74.1. Range - 70.5 to 77.5.

Monkey XXVIII (*Macacus Rhesus*) - Female
Medium sized, active but very docile

The observations recorded in this and the next two tables were made in the Laboratory.

		Right Axilla	Left Axilla	Rectum	Room
1902 May 14th.	9. 0a.m.	100.2	100.3	100.0	70.0
	12. 30p.m.	101.5	101.6	100.9	71.0
	4. 30p.m.	101.6	101.6	101.6	70.0
	9. 0p.m.	100.2	100.3	100.1	71.0
	11. 45p.m.	98.6	98.4	98.2	70.0
May 15th.	9. 0a.m.	99.8	99.7	99.4	70.0
	12 (noon)	100.8	101.0	101.0	70.0
	4. 30p.m.	102.0	101.9	101.7	70.0
	9. 0p.m.	99.4	99.2	98.8	71.0
	11. 45p.m.	96.9	96.6	96.4	70.0
May 16th.	9. 0a.m.	99.3	-	98.6	70.0
	12 (noon)	100.0	99.8	99.8	71.0
	4. 30p.m.	101.0	101.2	100.6	70.0
	9. 0p.m.	99.3	99.3	98.0	70.0
	12 (midnight)	97.5	97.2	96.7	69.0

Between 9 & 10a.m. 3 observations - Rectum	Mean	Max.	Min.	Range
	99.3	100.0	98.6	1.4
3 " - Axilla	Mean	Max.	Min.	Range
	99.9	100.3	99.3	1.0

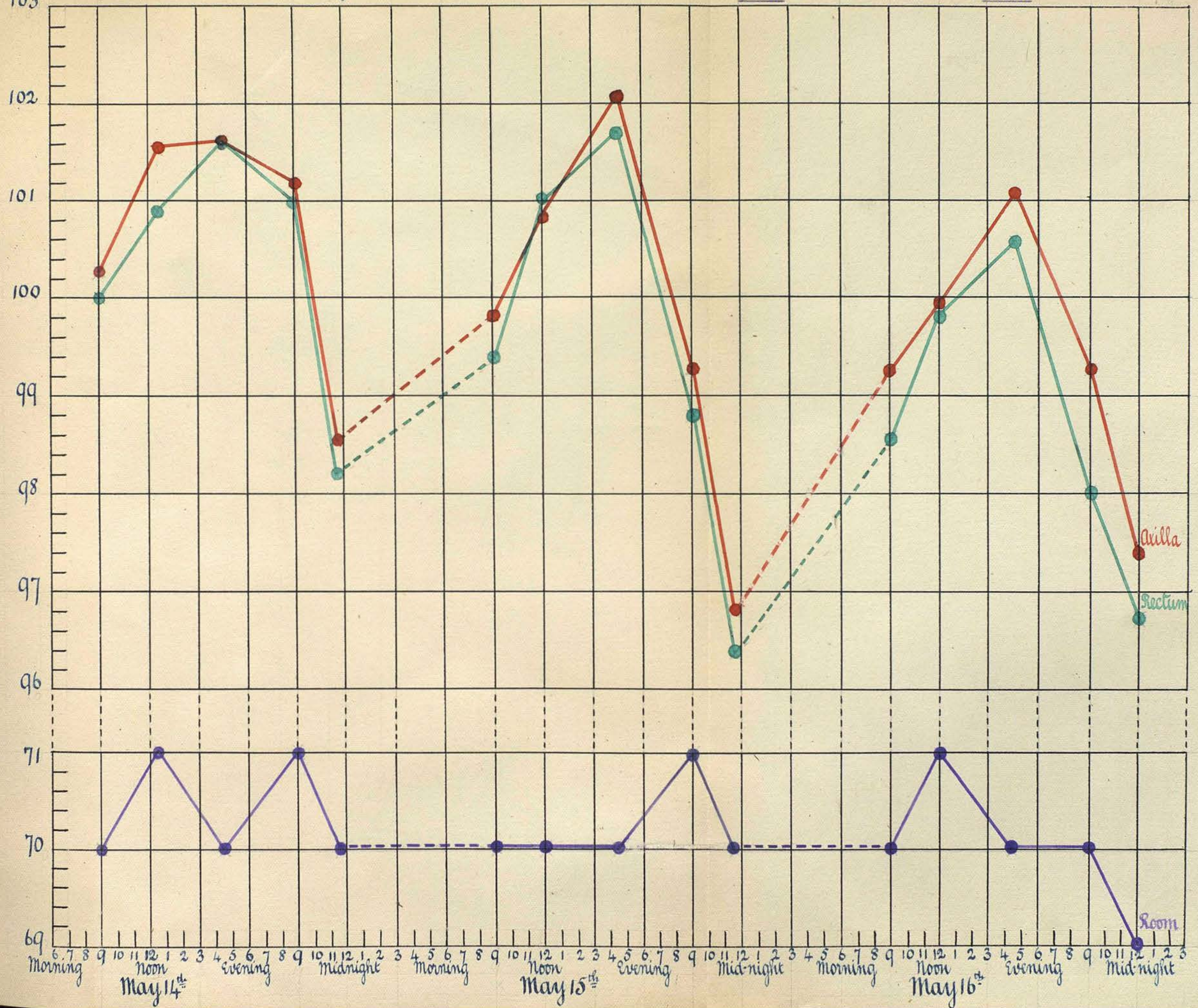
Mean temperature of room - 70.2. Range - 69.0 to 71.0.

Fahrenheit
103

Temperature chart of Monkey XXVIII to show Diurnal Variations.

Red Curve indicates temperature of Axilla
Green " " " " Rectum
Violet " " " " Room

Centigrade



Monkey XXIX (*Macacus Rhoesus*) - Female -
Medium Size

		Right Axilla	Left Axilla	Rectum	Room
1902 May 14th.	9. 0a.m.	100.6	100.7	100.5	70.0
	12. 30p.m.	101.2	101.1	101.1	71.0
	4. 30p.m.	102.1	102.3	102.0	70.0
	9. 0p.m.	100.3	100.3	100.2	71.0
	11. 45p.m.	99.1	99.3	98.6	70.0
May 15th.	9. 0a.m.	100.8	100.8	100.7	70.0
	12 (noon)	102.0	101.9	101.7	70.0
	4. 30p.m.	102.0	102.2	102.0	70.0
	9. 0p.m.	100.1	100.2	99.8	71.0
	11. 45p.m.	98.4	98.4	98.3	70.0
May 16th.	9. 0a.m.	100.3	100.1	100.0	70.0
	12 (noon)	102.2	102.4	102.2	71.0
	4. 30p.m.	102.8	102.2	101.9	70.0
	9. 0p.m.	99.7	99.5	98.6	70.0
	12 (midnight)	100.1	100.4	99.1	69.0

Between 9 & 10a.m. 3 observations - Rectum	Mean	Max.	Min.	Range
	100.4	100.7	100.0	0.7
3 " - Axilla	100.5	100.8	100.1	0.7

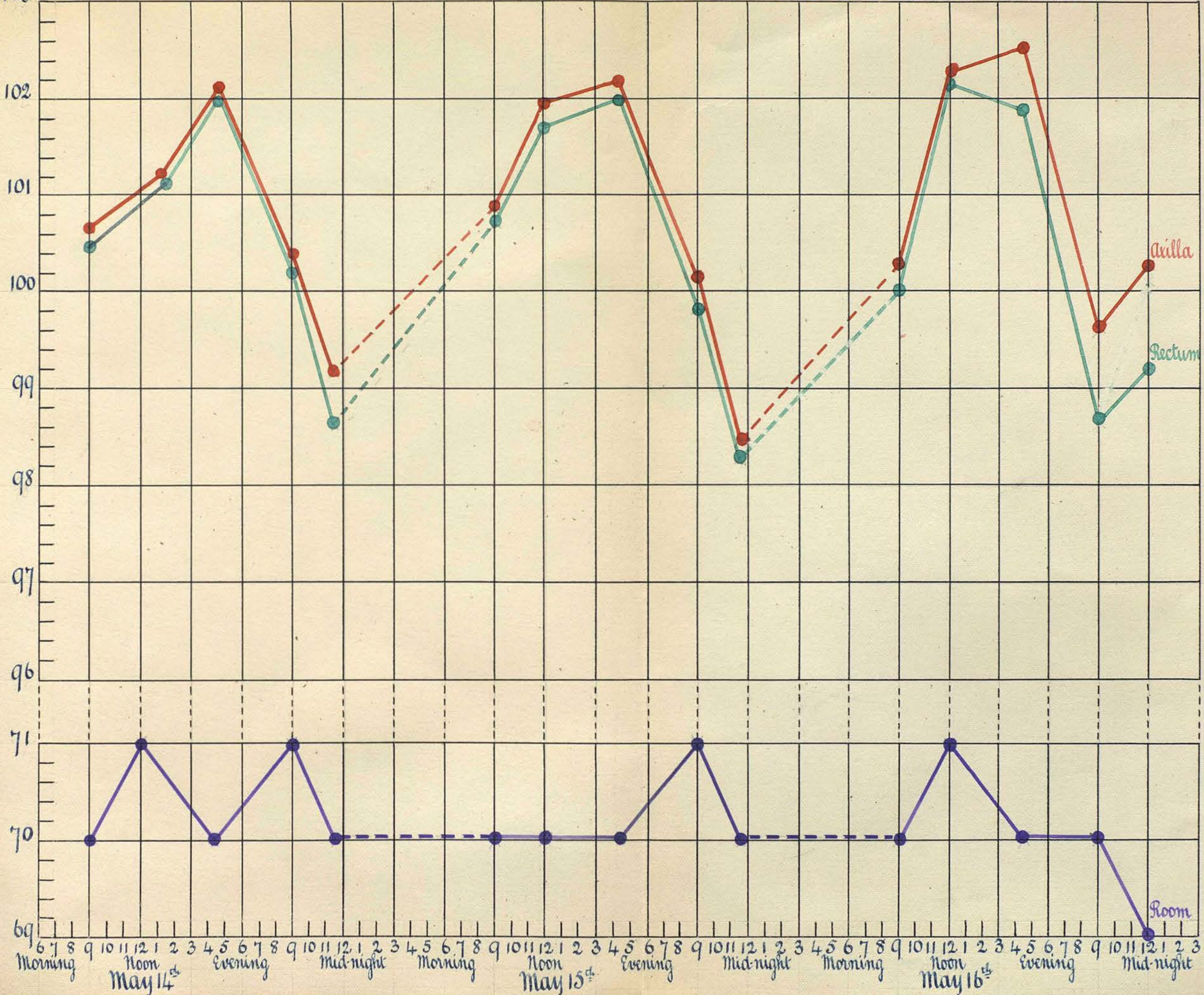
Mean temperature of room - 70.2. Range - 69.0 to 71.0.

Fahrenheit
103

Temperature Chart of Monkey XXIX to show Diurnal Variations.

Red Curve indicates temperature of Axilla
Green " " " " Rectum
Violet " " " " Room

Centigrade



Monkey XXX (Macacus Rhoesus) - Male - Medium Size, Very Docile.

About three weeks before these observations were made this animal fell from the roof of the cage on to the concrete floor and fractured its right humerus. A poro-plastic splint was applied and it was kept in a small cage apart from the other monkeys. Union took place very quickly and within a fortnight it was using the arm to take food.

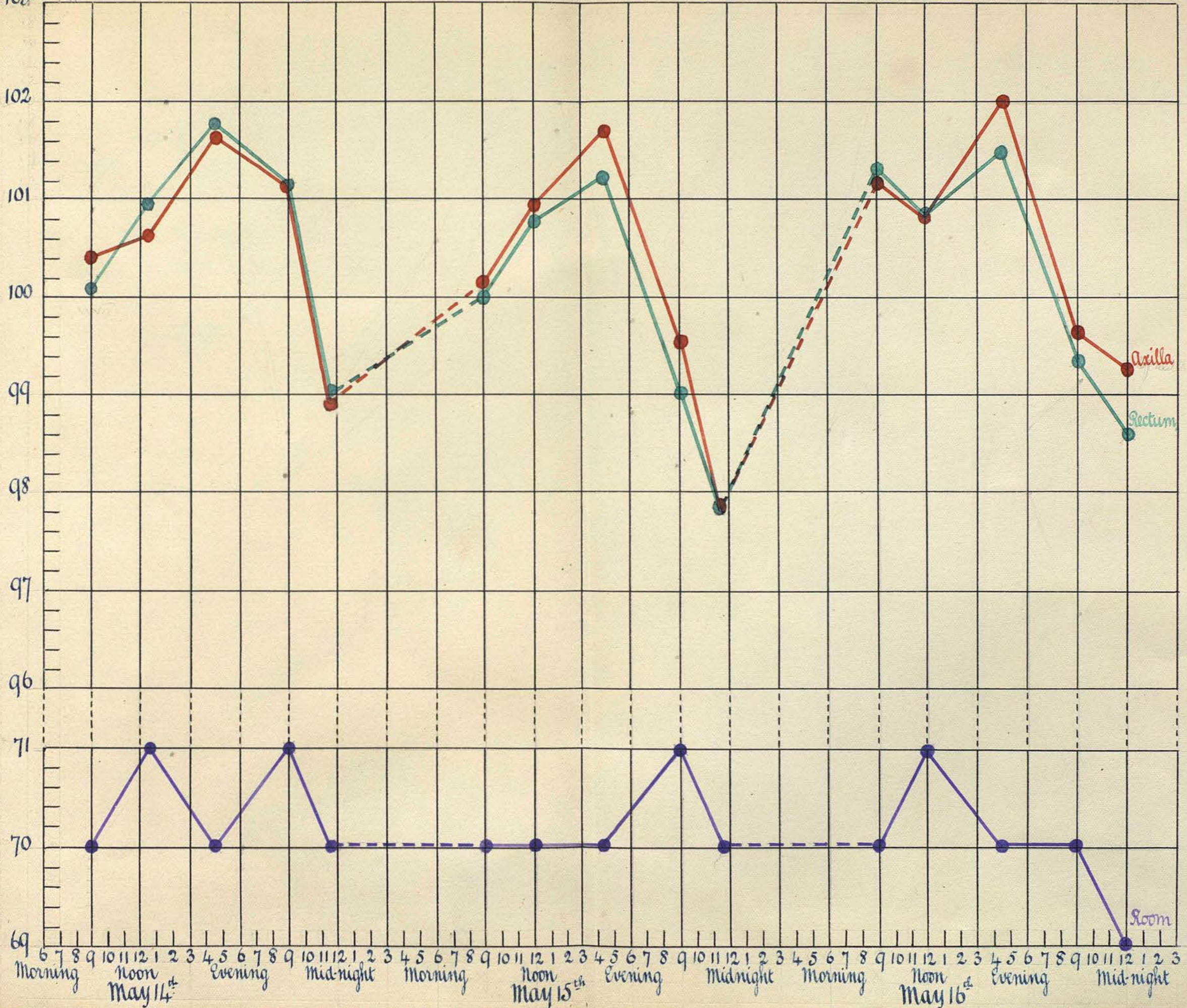
		Left Axilla	Rectum	Room
1902. May 14th.	9. 0a.m.	100.4	100.1	70.0
	12. 30p.m.	100.6	100.9	71.0
	4. 30p.m.	101.6	101.7	70.0
	9. 0p.m.	101.2	101.2	71.0
	11. 45p.m.	98.9	99.0	70.0
May 15th.	9. 0a.m.	100.1	100.0	70.0
	12 (noon)	100.9	100.7	70.0
	4. 30p.m.	101.7	101.3	70.0
	9. 0p.m.	99.5	99.0	71.0
	11. 45p.m.	97.8	97.8	70.0
May 16th.	9. 0a.m.	101.3	101.4	70.0
	12 (noon)	100.8	100.8	71.0
	4. 30p.m.	102.0	101.5	70.0
	9. 0p.m.	99.6	99.4	70.0
	12 (midnight)	99.3	98.6	69.0

Fahrenheit
103

Temperature Chart of Monkey XXX to show Diurnal Variations

Red Circle Multiple temperature of Axilla
Green " " " " Rectum
Violet " " " " Room

Centigrade



Monkey XXX (Continued)

This animal was so very tame that I was able to take its temperature without any assistance. On the forenoon of May 26th. I had it conveyed to my house where I kept it in the kitchen in a small cage for a week and during that time I took as many readings as I could throughout the twenty-four hours in order to find the extent of the daily variation and the maximal and minimal periods. The animal was well nourished, very active and appeared to be in a perfectly healthy condition.

		Left Axilla	Rectum	Room
1902 May 26th.	8. 30p.m.	101.6	100.7	70.0
	12 (midnight)	100.6	100.2	71.5
May 27th.	4. 45a.m.	99.0	98.4	68.0
	8. 0a.m.	99.7	99.8	68.0
	12 (noon)	101.0	100.2	70.0
	7. 0p.m.	102.0	101.4	71.0
	10. 30p.m.	100.4	100.2	71.0
May 28th.	3. 0a.m.	96.9	96.7	68.0
	6. 30a.m.	97.7	97.7	67.0
	9. 0a.m.	100.2	99.6	70.0
	12 (noon)	100.8	100.6	70.0
	4. 30p.m.	101.0	100.8	69.0
	7. 0p.m.	102.8	102.1	69.0
	7. 45p.m.	102.2	102.0	70.5
	10. 30p.m.	100.7	100.6	70.0

Monkey XXX (Continued)

		Left Axilla	Rectum	Room
1902. May 29th.	12. 15a. m.	99. 4	99. 4	71. 0
	2. 0a. m.	98. 4	98. 2	69. 0
	4. 30a. m.	98. 3	97. 8	68. 0
	7. 30a. m.	98. 3	98. 0	67. 5
	12 (noon)	100. 3	100. 0	68. 5
	4. 45p. m.	101. 2	100. 9	69. 0
	6. 15p. m.	101. 8	101. 4	69. 0
	7. 15p. m.	102. 1	102. 0	69. 5
	7. 45p. m.	102. 3	102. 0	69. 5
	10. 45p. m.	100. 6	100. 0	70. 0
	12 (midnight)	100. 3	100. 1	70. 5
May 30th.	5. 15a. m.	97. 4	96. 8	67. 5
	7. 0a. m.	98. 7	98. 2	67. 0
	8. 0a. m.	98. 9	98. 6	69. 0
	12. 15p. m.	100. 1	99. 9	69. 0
	6. 0p. m.	101. 5	101. 0	69. 0
	7. 0p. m.	102. 0	101. 8	69. 0
	8. 0p. m.	101. 0	100. 8	70. 0
	12 (midnight)	99. 6	99. 4	71. 0
May 31st.	1. 15a. m.	99. 1	99. 0	70. 5
	2. 0a. m.	98. 0	97. 8	70. 0
	5. 0p. m.	100. 8	100. 3	67. 0
	6. 0p. m.	100. 8	100. 8	67. 0
	7. 0p. m.	101. 5	101. 3	67. 5
	8. 0p. m.	101. 4	100. 8	68. 5

Monkey XXX (Continued)

		Left Axilla	Rectum	Room
1902. May 31st.	8. 45p. m.	101.0	100.7	67.0
	10. 45p. m.	100.0	99.6	67.0
	12 (midnight)	99.6	99.0	69.0
June 1st.	1. 0a. m.	100.1	99.6	70.0
	2. 0a. m.	99.4	98.9	71.0
	3. 15a. m.	98.3	97.8	70.5
	5. 30a. m.	97.4	97.2	70.0
	7. 0a. m.	98.0	97.8	67.0
	8. 0a. m.	98.4	98.0	66.0
	9. 0a. m.	98.8	98.4	65.5
	10. 0a. m.	99.3	99.0	66.5
	11. 0a. m.	100.3	100.2	67.0
	12 (noon)	99.5	99.7	67.0
	1. 0p. m.	100.4	100.2	67.0
	2. 15p. m.	100.7	100.6	67.0
	3. 15p. m.	100.7	100.8	67.0
	4. 0p. m.	100.6	100.3	66.0
	5. 15p. m.	101.2	101.1	66.0
	6. 30p. m.	101.8	101.6	67.0
	7. 15p. m.	102.2	102.0	67.5
	9. 30p. m.	99.9	99.4	68.0
10. 45p. m.	99.0	98.9	68.0	

Monkey XXX (Continued)

		Left Axilla	Rectum	Room
1902.				
June 2nd.	3. 0a.m.	95.7	95.2	66.0
	4. 15a.m.	97.5	97.0	67.5
	5. 0a.m.	98.2	97.7	68.0
	6. 0a.m.	98.2	97.6	68.5
	7. 0a.m.	98.6	98.1	68.5
	8. 0a.m.	98.8	98.4	69.0
	12. 30p.m.	100.4	100.0	66.5
	5. 30p.m.	101.2	100.8	69.0
	6. 30p.m.	101.6	101.0	68.5
	7. 15p.m.	101.5	101.0	68.5
	8. 0p.m.	101.2	100.6	68.5
	9. 15p.m.	100.5	100.2	68.5
	10. 15p.m.	100.1	99.8	69.0
	11. 15p.m.	99.4	99.3	69.5
	12 (midnight)	98.2	98.0	69.5

				Mean	Max.	Min.	Range
between 9 & 10a.m.	6 observations	-	Rectum	99.8	101.4	98.4	3.0
	6	"	- Axilla	100.0	101.3	98.8	2.5
"	2 & 3 p.m.	1	" - Rectum	100.6	-	-	-
		1	" - Axilla	100.7	-	-	-
"	5 & 6 p.m.	6	" - Rectum	100.8	101.1	100.3	0.3
		6	" - Axilla	101.1	101.5	100.8	0.7

Mean temperature of room 68.5. Range 66.0 to 71.5.

Monkey XXXI (*Macacus rhesus*) - Male.

Small but full grown - very
active and fairly quiet.

These observations were made in the same place and
under the same conditions as those shown in the last temper-
ature chart (Monkey XXX).

		Left Axilla	Rectum	Room
June 20th.	9 p.m.	102.6	102.1	66.0
	10 "	101.5	101.3	67.0
	12 (midnight)	101.3	100.9	67.5
21st.	1 a.m.	101.6	101.2	66.5
	2 "	100.4	100.1	68.0
	6 "	100.2	100.0	69.0
	8 "	99.5	99.1	70.0
	10 "	100.8	100.3	69.5
	1 p.m.	99.9	99.6	69.0
	2 "	99.6	99.2	69.5
	3 "	101.1	100.5	68.0
	4 "	101.5	101.4	67.0
	5 "	102.0	101.8	67.5
	6 "	101.0	100.5	69.0
	7 "	101.8	101.3	68.5
	10.15 p.m.	102.5	102.4	68.0
11.30 "	101.6	101.2	70.0	

Monkey XXXI (Continued)

		Left Axilla	Rectum	Room
June 22nd.	12.15 a.m.	101.1	100.4	70.5
	1. 0 "	101.7	100.8	69.5
	2. 0 "	100.1	99.6	69.0
	3. 0 "	99.4	99.1	69.0
	4. 0 "	100.1	99.5	68.5
	5. 0 "	98.2	98.0	68.0
	6. 0 "	99.8	99.2	67.0
	7. 0 "	98.0	97.6	69.5
	8. 0 "	100.1	99.6	69.0
	9. 0 "	100.8	100.6	68.5
	10. 0 "	99.8	99.7	70.0
	12 (noon)	101.1	101.0	67.5

Monkey XXXI (Continued)

			Mean	Max.	Min.	Range
between 9 & 10a.m.	4 observations	- Rectum	100.3	100.8	99.7	1.1
	4	" - Axilla	100.6	101.1	99.8	1.3
" 2 & 3p.m.	3	" - Rectum	99.9	100.5	99.2	1.3
	3	" - Axilla	100.4	101.1	99.6	1.5
" 5 & 6p.m.	3	" - Rectum	101.3	101.8	100.5	1.3
	3	" - Axilla	101.6	102.0	101.0	1.0

Mean temperature of room - 68.5 Range - 66.0 to 71.0.

Monkey XXXI (Continued)

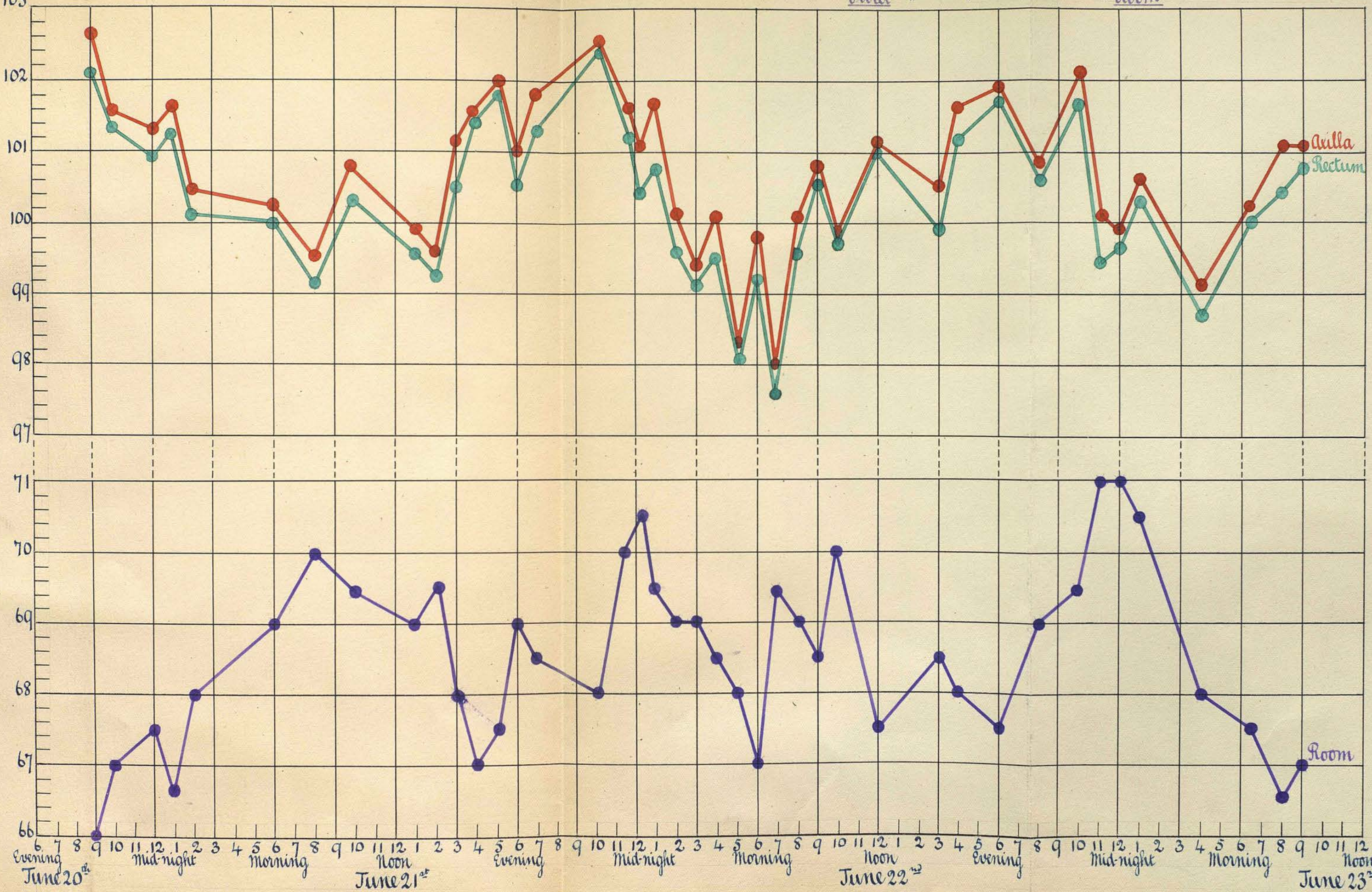
		Left Axilla	Rectum	Room
June 22nd.	12. 15 a.m.	101.1	100.4	70.5
	1. 0 "	101.7	100.8	69.5
	2. 0 "	100.1	99.6	69.0
	3. 0 "	99.4	99.1	69.0
	4. 0 "	100.1	99.5	68.5
	5. 0 "	98.2	98.0	68.0
	6. 0 "	99.8	99.2	67.0
	7. 0 "	98.0	97.6	69.5
	8. 0 "	100.1	99.6	69.0
	9. 0 "	100.8	100.6	68.5
	10. 0 "	99.8	99.7	70.0
	12 (noon)	101.1	101.0	67.5
	3. 0 p.m.	100.5	99.9	68.5
	4. 0 "	101.6	101.2	68.0
	6. 0 "	101.9	101.7	67.5
	8. 0 "	100.8	100.6	69.0
	10. 0 "	102.1	101.7	69.5
	11. 0 "	100.1	99.4	71.0
	12 (midnight)	99.8	99.6	71.0
June 23rd.	1. 0 a.m.	100.6	100.3	70.5
	4. 0 "	99.1	98.7	68.0
	6. 30 "	100.2	100.0	67.5
	8. 0 "	101.1	100.4	66.5
	9. 0 "	101.1	100.8	67.0

Fahrenheit

Temperature Chart of Monkey XXXI to show Diurnal Variations.

Red Curve indicates temperature of Axilla
Green " " " " " Rectum
Blue " " " " " Room

Centigrade



From the foregoing observations the following conclusions have been arrived at:-

1. Muscular exercise raises the temperature of the monkey very markedly. This is well seen in Monkey XII (p. 23). A chase of 10 minutes was sufficient to raise the temperature of the axilla from 101.5° F (38.6° C) to 103.1° F (39.5° C) - 1.6° F (0.9° C), and that of the rectum from 101.3° F (38.5° C) to 102.8° F (39.3° C) - 1.5° F (0.8° C), while after a chase of 45 minutes the temperature of the axilla (right say) rose from 101.6° F (38.7° C) to 104.9° F (40.5° C) - 3.3° F (1.8° C), and that of the rectum from 101.6° F (38.7° C) to 105.1° F (40.6° C) - 3.5° F (1.9° C).

This effect of muscular exercise has been observed in many animals, including man. Mott (2) has noticed it in monkeys, Hobday (3) in sheep and pigs, Aronsohn and Sachs (4) in rabbits, and Jürgensen (5), Davy (6), Clifford Allbutt (7), Wunderlich (8), Marcet (9), Vernet (10), Gresswell (11), Forel (12), Obernier (13), Bouvier (14) and many others in man. The monkey, however, in this respect, appears to be more susceptible to the influence of muscular exertion than most other mammals.

From this it is evident that in all observations made with a view to determine the normal temperature of animals, struggling either immed-

ately before or during the operation will give a reading above the normal.

2. In the monkey the temperature of the axilla is higher than that of the rectum. This was observed in 1818 by John Davy (15) in Simia aygula in Ceylon. In the single case which he records he found the rectal temperature to be 103.5° F, and that of the axilla 104.5° F, that is 1° F of difference. Richet (16) discards this observation as unreliable, possibly for no other reason than that the temperature of the axilla was found to be higher than that of the rectum. In 337 observations which I have made on 29 animals in which the temperature of the axilla and that of the rectum were taken at the same time, the mean for the axilla was 101.3° F (38.5° C), and the mean for the rectum 100.9° F (38.3° C). This gives a difference of 0.4° F (nearly 0.2° C) in favour of the axilla.

Every fallacy was guarded against. I thought it possible that the lowering of the rectal temperature might be due to the monkey's sitting upon the floor of the cage, but this was not the case, because the same difference was observed when it was prevented from doing this.

In man the rectal temperature is stated, by most observers, to be from 0.2° C to 0.6° C higher than that of the axilla, although Ringer and Stewart (17) assert that there is no difference

between the temperature of the mouth, axilla and rectum if due care be taken and sufficient time allowed.

The axilla in the monkey is always dry, and it can be so well closed, that it is to all intents and purposes an internal cavity, while on the other hand, the monkey is not so well developed in the gluteal region, relatively, as man, and consequently the rectum is not so well protected. The rectum may also have a smaller blood supply in the monkey than in man, relatively; but whatever the explanation may be the fact remains.

3. In the monkey there is a diurnal variation having a wider range than that found in man. In 41 observations on 12 animals made between 9 and 10 a.m., the mean temperature of the axilla was 100.5° F (38.1° C), with a maximum of 101.8° F (38.8° C), and a minimum of 98.8° F (37.1° C), and in 55 observations on 15 animals, made at the same hour, the mean rectal temperature was 100.3° F (37.9° C), with a maximum of 101.8° F (38.8° C), and a minimum of 98.4° F (37.4° C).

In 23 observations made on 10 animals between 2 and 3 p.m., the mean temperature of the axilla was 101.1° F (38.4° C), with a maximum of 102.1° F (38.9° C), and a minimum of 99.6° F (37.6° C), and in 26 observations on 12 animals at the same hour the mean rectal temperature was 101.0° F (38.3° C), with a maximum of 101.8° F (38.8° C), and a minimum

of 99.2° F (37.3° C).

In 135 observations made on 26 animals between 5 and 6 p.m., the mean axillary temperature was 101.9° F (38.8° C), with a maximum of 102.8° F (39.3° C), and a minimum of 99.2° F (37.3° C), and in 196 observations on 28 animals the mean rectal temperature was 101.5° F (38.6° C), with a maximum of 102.5° F (39.2° C), and a minimum of 99.1° F (37.3° C).

Between 9 and 10 a.m. the mean temperature of the axilla was 100.5° F (38.1° C)

" 2 and 3 p.m. the mean temperature of the axilla was 101.1° F (38.4° C)

" 5 and 6 p.m. the mean temperature of the axilla was 101.9° F (38.8° C)

" 9 and 10 a.m. the mean temperature of the rectum was 100.3° F (37.9° C)

" 2 and 3 p.m. the mean temperature of the rectum was 101.0° F (38.3° C)

" 5 and 6 p.m. the mean temperature of the rectum was 101.5° F (38.6° C)

This would give an average rise from about 9 a.m. till about 6 p.m. of 1.4° F for the axilla and 1.2° F for the rectum. This is somewhat fallacious however, for the readings were not taken simultaneously and from the same animals. ~~the~~

following is a table of approximate

Although the observations are fewer in number, a closer approximation to the average range between 9 a.m. and 6 p.m. will be got from the following figures:-

In 4 animals on 11 occasions simultaneous readings were taken from the axilla and rectum between 9 and 10 a.m. and 2 and 3 p.m. respectively on the same days. Between 9 and 10 a.m. the mean for the axilla was 99.9° F (37.7° C) and for the rectum 99.5° F (37.5° C), and between 2 and 3 p.m. the mean for the axilla was 100.9° F (38.3° C), and for the rectum 100.4° F (38.0° C).

In 4 animals on 10 occasions similar readings were taken simultaneously between 2 and 3 p.m. and 5 and 6 p.m. respectively on the same days. The mean of these readings between 2 and 3 p.m. was, for the axilla 100.8° F (37.7° C), and for the rectum 100.4° F (38.0° C), and between 5 and 6 p.m. 101.5° F (38.6° C) for the axilla, and 101.2° F (38.4° C) for the rectum.

Thus between 9.30 a.m. and 2.30 p.m. say, the average rise both for the axilla and rectum was 0.9° F (0.5° C), and between 2.30 p.m. and 5.30 p.m. say, for the axilla it was 0.7° F (0.4° C), and for the rectum 0.8° F (0.4° C). (In converting Fahrenheit into Centigrade degrees I have given the nearest equivalents to the first decimal place.)

In 10 animals on 32 occasions simultaneous observations on the axilla and rectum were made between 9 and 10 a.m. and 5 and 6 p.m. respectively on the same days, and the mean for the axilla between 9 and 10 a.m. was 100.5° F (38.1° C), and for the rectum 100.2° F (37.9° C), and between 5 and 6 p.m. for the axilla 101.6° F (38.1° C) and for the rectum 101.3° F (38.0° C). Between 9.30 a.m. and 5.30 p.m. say, the temperature of both the axilla and rectum rose 1.1° F (0.6° C).

But the most accurate average range is obtained from the following table, which gives the mean axillary and rectal temperatures taken from the same animals (4 in number - Monkeys XXV, XXVI, XXX and XXXI) on 11 days between 9 and 10 a.m., 2 and 3 p.m. and 5 and 6 p.m. respectively.

	9 to 10a.m.	2 to 3p.m.	5 to 6p.m.
Mean for Axilla	{ 100.0° F (37.8° C)	{ 100.7° F (38.2° C)	{ 101.6° F (38.7° C)
Mean for Rectum	{ 99.7° F (37.6° C)	{ 100.2° F (37.9° C)	{ 101.2° F (38.5° C)

While the above gives the average range from 9.30 a.m. to 5.30 p.m., the temperature charts of Monkeys XXVIII, XXIX and XXX p. 36 &c. show the range in each individual case, from 9 a.m. till 11.45 p.m. on three consecutive days. No observations were made between 11.45 p.m. and 9 a.m. This interval is filled in by the dotted lines.

In each case the lowest temperatures were recorded between 11 and 12 p.m. and the highest between 4 and 5 p.m. Of course it does not follow from this that these are the points of minimal and maximal temperature in the twentyfour hours, because the observations were made at long intervals. It will be seen at a glance that the variation is very regular and the range a very considerable one.

But a more accurate idea of the diurnal variation is obtained from the chart of Monkey XXX (p. 39). In this case observations were made at varying intervals throughout the twentyfour hours for eight consecutive days. The rhythm is very regular and the range very wide. The minimal period is 3 to 5 a.m. and the maximal period 6 to 8 p.m. The curve below indicates the variations in the temperature of the room but it will be seen at a glance, as one would expect, that these have no relation to the variations in the temperature of the axilla or rectum, because where the one curve is rising the other is often falling. The monkey was confined in a small cage during the whole time and was not more exercised at one period of the day than another. It always had a plentiful supply of fruit &c. but was not fed at regular intervals. Indeed, in the case of the monkey, the food is not always ingested at the time the animal



is supplied with it, because it usually fills its cheek pouches and empties them often some considerable time later. At that season of the year (May) daylight appeared about 3 a.m. but the shutters were not removed until between 7 and 8 a.m., and the rise had always begun long before that time, so that the daylight could not ^{have} influenced it. I never caught the animal asleep, but there can be no doubt that it did sleep and was awakened by my coming into the room. Sleep ^{however,} was not the cause of the fall in the temperature because the monkey was usually kept on the alert till about mid-night, and it is not at all likely that it awoke at 3 a.m. and remained awake in a dark and silent room.

Muscular exercise, food, daylight and sleep are the factors usually assigned as the causes of the diurnal variation in temperature in man at any rate, but apart from the direct influence of these altogether, there must be a rhythmical variation in the metabolism either acquired by the individual or inherited from his ancestors (probably both) of which the temperature variation is one expression.

(It has been suggested to me, as a possibility, that the animals on which these observations were made, might have been suffering from some form of tuberculosis - a condition not at all uncommon in monkeys kept in confinement -, and I am bound to admit that it is a possibility. The three monkeys

They have been
my experience
S.B.

(XXVIII, XXIX and XXX) came to the laboratory from the same source. They were particularly tame and most suitable for my purpose. They were very active, well nourished and in every way they appeared to be in a condition of perfect health. They remained in the laboratory about two months, during which time they rather gained than lost weight, and it is not probable that an animal with a hectic temperature would show no other symptom of the disease. The monkeys were used afterwards for another purpose and I did not examine the organs for evidences of tuberculosis. This, it must be admitted, is a weak point in the research, although personally, I am of the opinion that the animals were perfectly healthy. However, at the earliest opportunity, I intend to repeat these observations on suitable animals, and to guard against any fallacy of this kind by applying Koch's tuberculin test, which I am told is perfectly reliable. If an animal does not react to this test after its second application (made one week after the first application) it is absolutely free from tuberculosis).

The chart of Monkey XXXI shows variations of the same character as that of Monkey XXX, although there are many secondary waves which may be explained by the fact that the animal was not so tame and consequently not so easily handled as the last. In this case both maximal and minimal periods

occur later than in the last case. The maximum occurs between 9 and 10 p.m. on three days, and the minimal between 6 and 8 a.m. on two days, and between 3 and 4 a.m. on the third day. The range is almost as great as in the other cases but the curve is not so regular; in its general characters it is similar however.

In Monkey XXX the greatest range in any single diurnal period was from 102.0° F at 7 p.m. to 95.2° F at 3 a.m. the following morning (rectal temperature) - 6.8° F (3.8° C), and in Monkey XXXI it was from 102.4° F at 10 p.m. to 97.6° F at 6.30 a.m. the following morning - 4.8° F (2.7° C).

Hale White and Washbourn (18) found a range of 6° F (3.5° C) in the monkey. They made observations on the rectal temperature of two healthy Rhesus monkeys. Subjoined is a copy of their figures from which it will be seen that the diurnal variation, although wide in range, was very irregular. Their highest reading (104° F) was obtained at 11.30 a.m. and their lowest (98.4° F) at 11.15 p.m. on the same day.

In man (in adults) the daily variation is about 1° C, according to observations of Jürgensen and Liebermeister (19) which are probably as accurate as any recorded. In children it is considerably greater according to Ringer and Stuart (20), and others. (The photographs on the next page show the curves given by adults (Jürgensen and Liebermeister) and by a child of 12 years.)

Other animals also show a daily variation in temperature. Hobday (21) has made observations on horses, Robertson (22) on oxen, Bidder and

54.

(Copied from Hale White's Paper).
Monkey I

Nov. 4th.	4. 0 p.m.	102.4 ^o F	Nov. 7th.	12. 0 a.m.	101.4 ^o F
" 4th.	12. 0 "	99.6	" "	6. 0 p.m.	101.6
"	5th. 11. 30 a.m.	104.0	" "	11. 45 "	102.0
"	" 6. 15 p.m.	101.8	" 8th.	11. 0 a.m.	103.4
"	" 11. 15 "	98.4	" "	2. 45 p.m.	102.0
"	6th. 11. 15 a.m.	103.4	" "	10. 45 "	101.6
"	" 4. 30 p.m.	101.6	" 9th.	10. 15 a.m.	100.4
"	" 11. 45 "	98.6	" "	4. 15 p.m.	101.8
"	7th. 8. 30 a.m.	102.4	" "	8. 15 "	102.6

Monkey II

Decr. 5th.	11. 30 a.m.	100.4 ^o F	Decr. 8th.	1. 0 p.m.	100.2 ^o F
"	6th. 11. 0 "	102.2	" "	4. 30 "	100.0

In man (in adults) the daily variation is about 1° C, according to observations of Jürgensen and Liebermeister (19) which are probably as accurate as any recorded. In children it is considerably greater according to Ringer and Stuart (20), and others. (The photographs on the next page show the curves given by adults (Jürgensen and Liebermeister) and by a child of 12 years.)

Other animals also show a daily variation in temperature. Hobday (21) has made observations on horses, Robertson (22) on oxen, Bidder and Schmidt (23) on cats, Corin and Van Bened^en (24) on pigeons, and Carter (25) on rabbits, cats and dogs, and all have found a distinct daily variation, the maximum occurring sometime in the evening and the minimum in the morning. In none of the higher mammals, however, does there appear to be such a wide range as in the monkey.

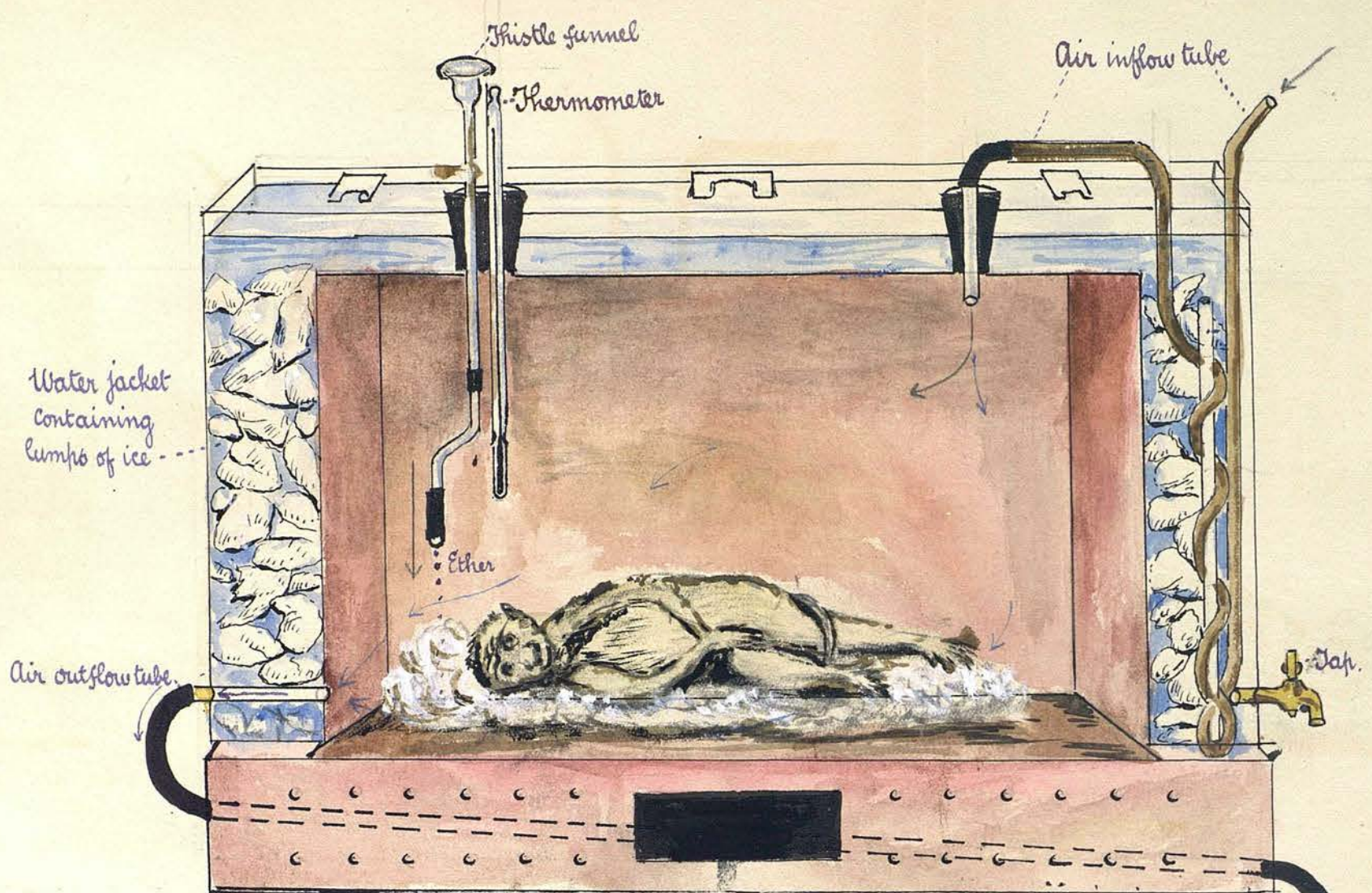
4. The Normal Temperature of the Monkey, that is the mean rectal temperature, is stated by Hale White and Washbourn (26) to be 101.1° F (38.4° C), while Couty (27) gives it as 100.6° F (38.1° C), Aruch (28) as 100.9° F (38.3° C), Lefèvre (29) as 101.3° F (38.5° C) and Richet (30) as 101.0° F (38.3° C). These figures are all probably too high, if by the normal temperature is meant the mean for the twentyfour hours. In Monkey XXX the mean of 77 observations made during night and day for eight consecutive days was for the axilla

100.1° F (37.9° C) and for the rectum 99.6° F (37.6° C). In Monkey XXXI the mean of 41 observations made under the same conditions on three consecutive days was for the axilla 100.7° F (38.2° C) and for the rectum 100.3° F (37.9° C).

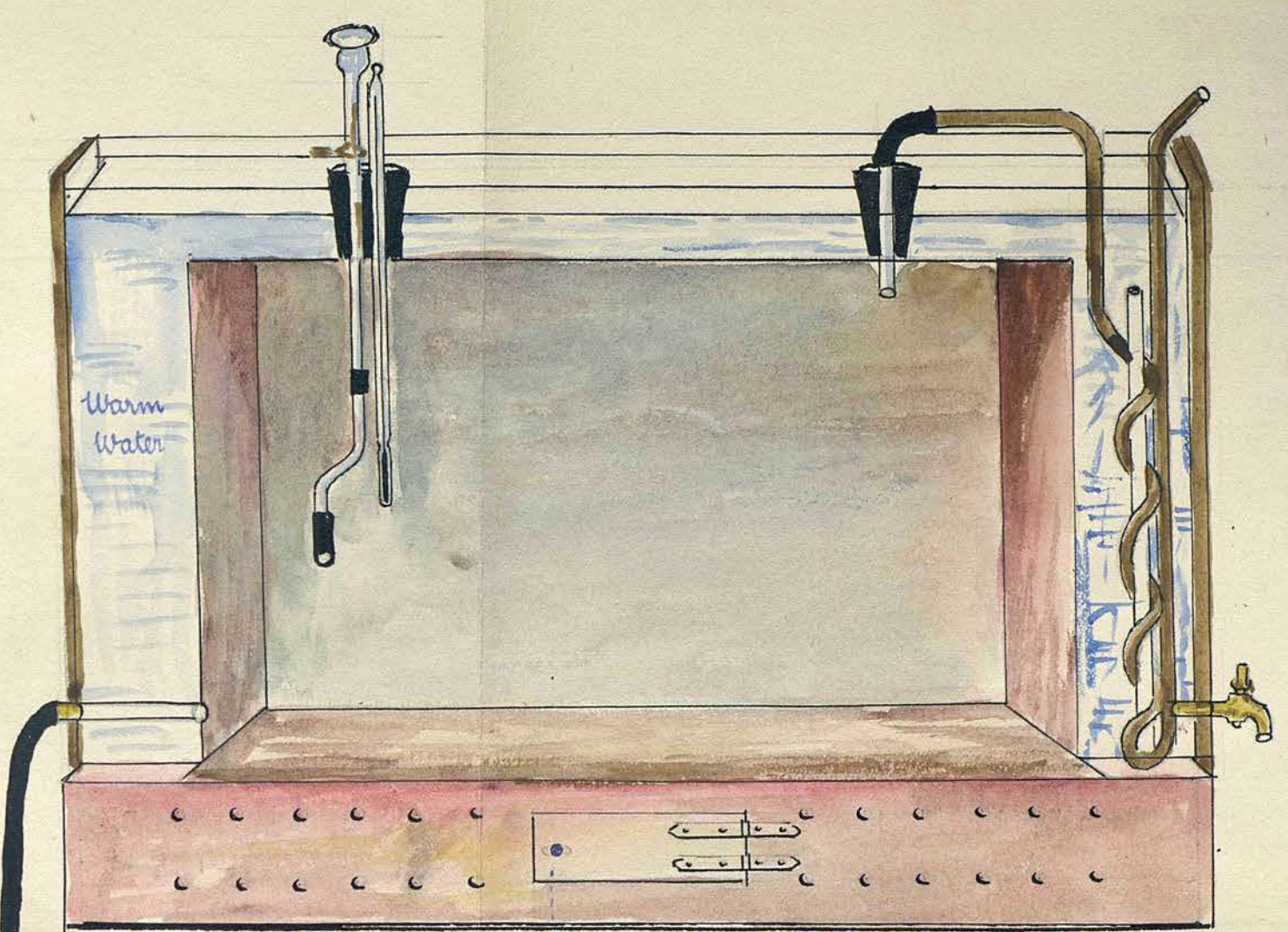
PART IIInfluence of Narcotics upon Temperature and Heat-regulation in Monkeys and Cats.

In the following experiments, the animals were placed under the influence of the particular drug whose action was to be investigated; the rectal temperature was observed, the number of heart beats and respirations per minute noted, and then the cat or monkey was immediately transferred to a small chamber which could be cooled or warmed to any desired extent. This chamber was made of sheet copper, double walled, with a water-jacket between into which lumps of ice could be placed. Its internal dimensions were, 12 inches wide, by 12 inches high, by 18 inches long (30.5 c.m. by 30.5 c.m. by 46 c.m.) - sufficiently large to hold a monkey, cat or small dog comfortably. Two such chambers were required, the one cold, the other warm. They are shown semi-diagrammatically in the accompanying sketch. In the roof there are two round holes each fitted with an india-rubber stopper. Through one of these there is admitted into the interior a thermometer, and a thistle-funnel provided with a stop-cock for supplying ether or chloroform. To the stem of the funnel is attached a rectangular glass tube which can be brought over the head of the animal by rotating the

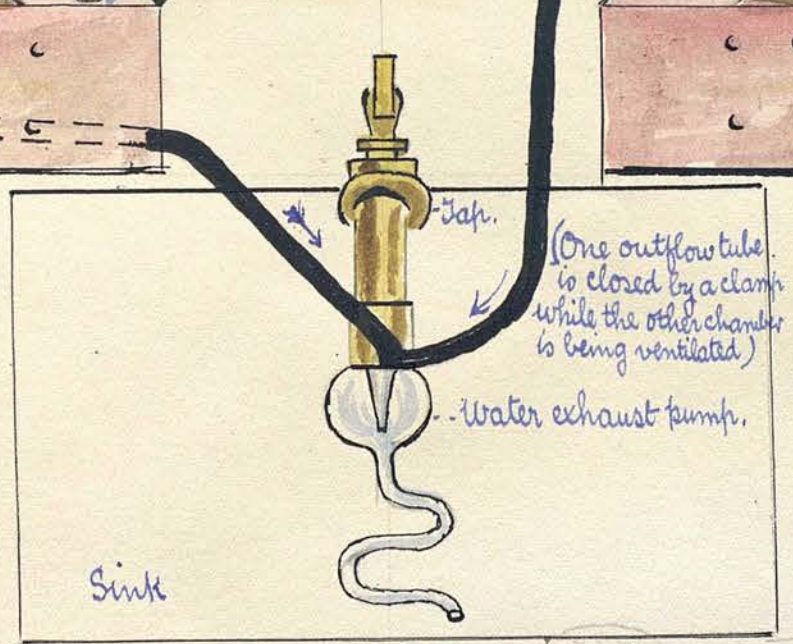
funnel, and by this means a few drops of the anaesthetic allowed to fall on a pad of cotton wool in front of the animal's nose from time to time. Through the other stopper there passes a glass tube which is connected with a piece of gas pipe twisted round a stick in the form of a spiral, and placed in the water jacket, so that the air which passes into the chamber through this tube may acquire the same temperature as the water. An opening at the end is connected with a water exhaust pump by means of which the chamber is ventilated; it also serves to regulate the supply of ether or chloroform for when the air in the interior contains too much of the vapour, it can be quickly swept out by turning the tap full on for a few minutes. There are three openings in the top of the outer wall for admitting the lumps of ice. The chamber is closed in front by a tightly fitting, sliding glass door, through which the movements of the animal inside may be watched. Both are covered over on the outside by a double layer of thick felt. During an experiment the one was cooled down while the other was heated up (by a bunsen burner underneath) so that at any stage the animal may be transferred from the cold to the hot chamber, or vice versa.



Cold Chamber.



Warm Chamber.



(One outflow tube is closed by a clamp while the other chamber is being ventilated)

When the animal was placed in the chamber the bulb of a short stemmed Centigrade thermometer, (6 inches, range 0° to 50° , with degrees subdivided into tenths) was introduced well into the rectum (2 to 3 inches) and observations were made and recorded every quarter or half hour, on the temperature of the chamber, and of the rectum, and on the pulse and respiration rates. In order to count the heart beats the hand had to be passed into the chamber. This was a disadvantage.

A record of the observations is given in each case, and the temperature of the rectum and hot and cold chambers are plotted out in the form of curves on the accompanying charts. The curves are put in in different colours for the sake of distinction; the lower, middle and upper curves in the same colour have reference to the temperature of the cold chamber, rectum and warm chamber respectively in the same experiment.

This part of the research is still very incomplete; the effects of only a few drugs have as yet been investigated, and with the exception of ether and alcohol, only one series of observations has been done with each, but so far as the experiments have gone some interesting facts have been made out.

Monkey A

Ether was administered at 10.30am, and by 10.45 anaesthesia was complete. The rectal temperature was taken, the pulse and respiratory rates determined, and then the animal was placed in one of the chambers described above - temperature 8.8°C.

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
10.45a.m.	8.8°C	38.6°C	212	44	
11.15 "	9.2	34.8	196	56	Resp ^r shallow
11.30 "	9.3	31.1	178	42	
11.45 "	7.2	29.0	154	30	
12 (noon)	6.4	27.0	114	24	Resp ^r deep and regular
÷ 12.15p.m.	5.8	25.0	98	24	
12.30 "	6.0	23.0	74	18	
12.45 "	6.2	20.5	76	14	
1. 0 "	5.8	18.0	48	10	
1.15 "	5.4	16.8	Not palpable	8	Resp ^r jerky
1.30 "	5.6	15.5	"	6	
1.45 "	5.9	15.0	"	4	
2. 0 "	5.8	14.0	"	2	
Transferred to warm chamber.					
2. 5 "	41.6				
2.15 "	42.0	15.2	"	5	
2.45 "	43.0	18.4	"	10	
x 3.15 "	42.5	22.0	55	14	
4. 0 "	41.5	24.8	86	15	
4.30 "	42.0	27.4	112	14	

Monkey A (Continued)

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
5. 0p.m.	42.2 ⁰ C	30.4 ⁰ C	136	22	
5.30 "	41.8	33.2	148	28	
6. 0 "	42.2	35.0	154	33	
6.30 "	43.0	36.5	172	44	
7. 0 "	42.5	37.7	194	58	Heart beating strongly.

Removed from chamber and placed in room at tempr. of 25⁰ C.

9.30 "	25.0	37.3			
--------	------	------	--	--	--

÷ Ether stopped.

x Ether re-administered.

Monkey B

Etherised as in other cases and at 11.30 a.m. placed in a chamber at 12° C.

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
11.30 a.m.	12.0°C	38.9°C	216	78	Resp ^r very shallow
11.45 "	12.5	36.0	-	-	
12 (noon)	9.5	34.5	206	54	
12.15 p.m.	6.3	32.4	184	60	
12.30 "	6.2	31.0	148	30	Resp ^r deep and regular
12.45 "	6.4	29.4	130	32	
1. 0 "	5.4	26.0	124	24	
1.30 "	5.1	23.0	88	16	
1.45 "	5.6	21.8	64	12	
2. 0 "	5.6	19.5	Not palpable	7	
2.15 "	4.9	17.8	"	5	
2.30 "	5.3	16.8	"	4	
2.45 "	5.0	15.9	"	4	
3. 0 "	5.1	14.8	"	2	
3.15 "	6.5	14.0	"	1	
Transferred to warm chamber.					
3.30 "	40.0	15.0	"	-	
3.40 "	42.0	18.2	"	6	
3.45 "	40.0	20.5	72	10	
4. 0 "	40.0	23.0	100	15	
4.15 "	40.0	27.0	130	36	
4.30 "	40.0	29.5	180	29	
4.45 "	44.5	33.0	240	32	
5. 0 "	46.0	37.2	252	39	

Monkey B (Continued)

Time	Tempr.of Chamber	Tempr.of Rectum	Pulse rate	Respiration rate	Remarks
5.15 p.m.	48.0	41.2	266	56	
5.25 "	50.0	44.0	286?	64	Pulse can scarcely be counted.
5.27 "	Animal died.				

Monkey C

Fully anaesthetised with ether and placed in cold chamber
at 12.30 p.m.

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
12.30 P.M.	12.2 ^o C	38.9 ^o C	186	70	
1. 0 "	14.0	36.5	172	82	
1.30 "	12.9	33.0	144	66	
2. 0 "	11.8	30.0	50	38	
2.15 "	11.5	28.0	-	-	Animal died.
2.30 "	12.0	26.4	-	-	
3. 0 "	12.2	23.0	-	-	
3.30 "	12.4	20.8	-	-	
4. 0 "	12.6	18.5	-	-	
4.30 "	10.2	17.0	-	-	
5. 0 "	10.4	15.5	-	-	
5.30 "	10.5	14.8	-	-	
6. 0 "	10.8	14.0	-	-	
8. 0 "	11.9	12.8	-	-	
9. 0 "	12.4	12.6	-	-	

Monkey D

Etherised and placed in cold chamber at 1.15 p.m.

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
1.15 p.m.	12.7 ^o C	37.8 ^o C	208	48	
1.45 "	12.8	33.1	156	30	
2.15 "	12.3	29.6	120	23	
2.45 "	8.3	26.4	90	22	
3.15 "	8.1	23.2	62	20	
3.45 "	8.2	21.0	54	18	Cheyne-Stokes breathing
4.15 "	8.4	18.3	Not palpable	9	
4.45 "	9.0	16.6	"	6	
5.15 "	9.7	15.0	"	5	
5.45 "	7.6	13.5	"	5	
6.15 "	6.7	12.5	"	2	
6.30	-	-	-	-	Animal died.

Chart I

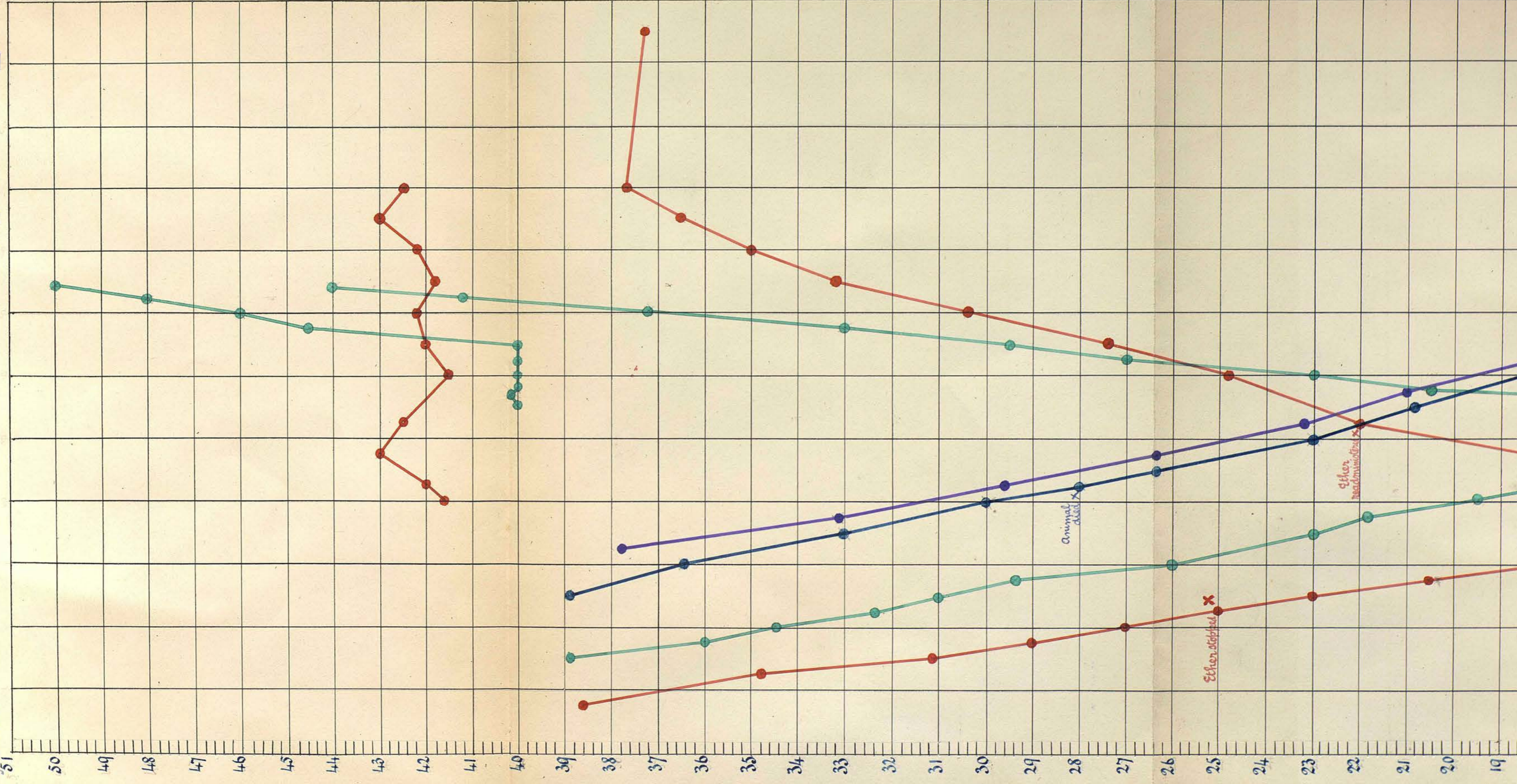
Monkey A
" B
" C
" D

Red curve
Green
Blue
Violet

Warm Chamber

Rectal Temp

Centigrade scale



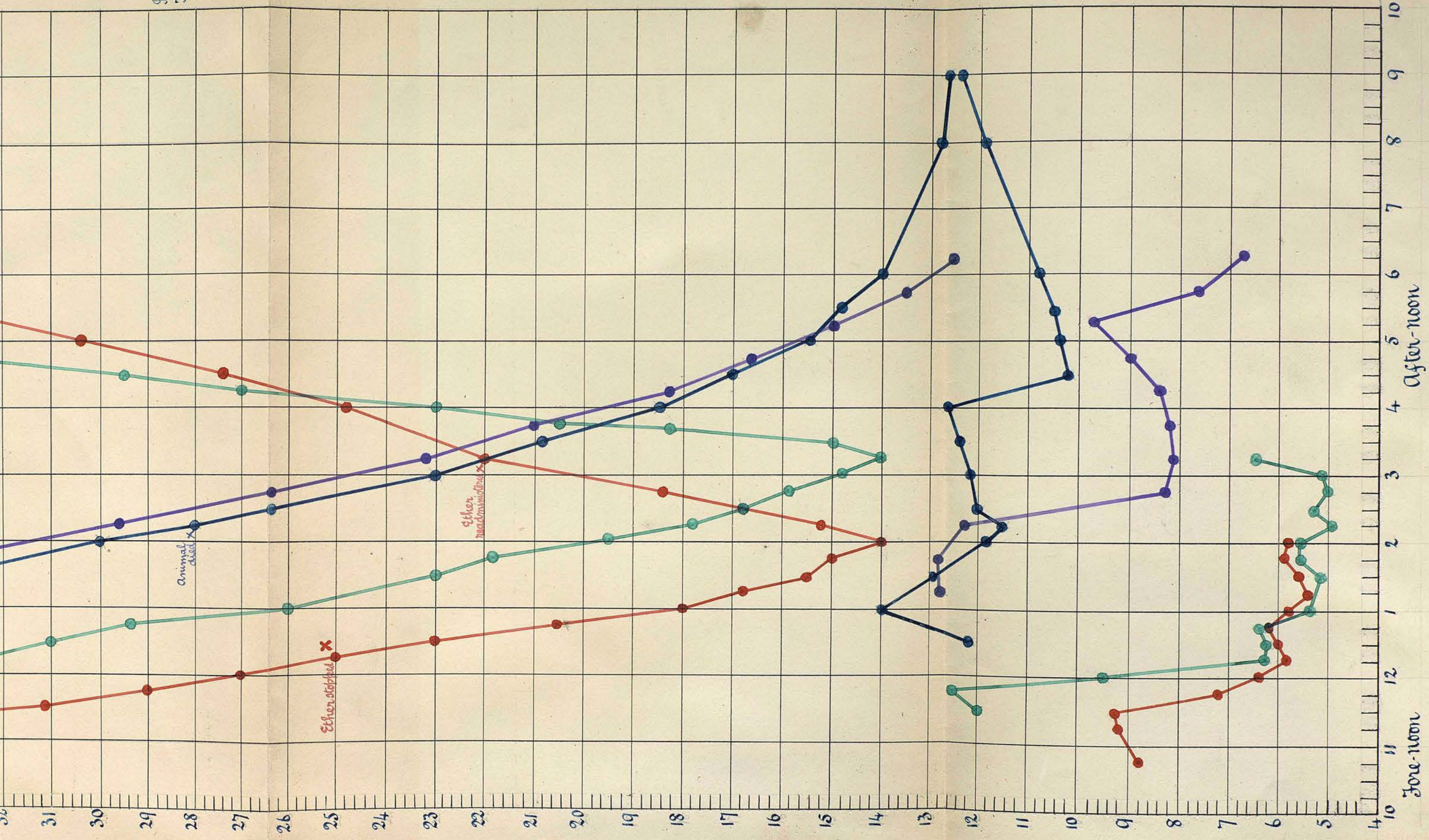
Ether anesthetized X

Animal died X

Other measurements X

Spectal
Lamp

Cold
Chamber



Animal
dead X

Ether stopped X

Ether
readministered X

Monkey E (*Macacus Rhoesus*)- Male.

Old animal - weight 3.54 kilos.

Anaesthetised with ether in the usual way and then placed in a cold chamber at 9.15 a.m.

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
9.15 a.m.	5.0°C	37.5°C	196	34	
9.30 "	8.9	37.2	200	38	
9.45 "	8.4	36.3	186	68	Resp ^r very rapid & shallow
10.0 "	8.0	35.0	178	54	
10.30 "	8.0	33.0	154	32	
10.45 "	7.8	31.6	140	24	
11.15 "	7.9	29.8	122	20	Resp ^r deep and regular
11.30 "	8.1	28.6	108	16	
12 (noon)	7.4	26.7	88	26	Resp ^r shallow
12.30 p.m.	8.1	25.0	72	18	
1.0 "	7.9	23.0	60	16	
1.30 "	8.4	21.4	54	14	
2.0 "	8.3	20.2	Not palpable	12	
2.30 "	8.0	19.0	"	11	Resp ^r jerky
3.0 "	7.8	17.8	"	10	" "
3.30 "	7.6	16.2	"	6	
4.0 "	7.4	14.8	"	4	Transferred to warm chamber.
4.5 "	51.0	-		-	
4.30 "	50.0	19.0	"	-	
6.0 "	50.5	33.2	112	19	
6.30 "	54.8	39.4	192	52	Resp ^r panting

Monkey E (Continued)

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
7. 0 p.m.	54.6	43.0	214	60	Resp ^r panting
7.10 "	55.0	46.5	130	80	" " Pulse very feeble.

Removed from hot chamber and laid on table on cotton wool, but died at 7.20. This was the highest temperature reached in any experiment.

Monkey F (Macacus Rhoesus)-

Small male - probably not an adult - weight 1.14 kilos.

At 11 a.m. 2 c.c. paraldehyde mixed with 20 c.c. of syrup was given by the stomach-tube. At 11.30 the animal was sound asleep, and at 11.45 a.m. it was placed in the cold chamber.

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
11.45 a.m.	7.9°C	37.5°C	220	78	
12.15 p.m.	8.1	34.0	196	56	
12.45 "	7.1	31.0	130	44	Resp ^r deep and regular
1.15 "	7.1	28.2	116	36	
1.45 "	6.4	25.5	94	32	
2.15 "	5.9	24.0	74	26	
2.45 "	5.7	22.0	54	22	" "
3.15 "	5.5	20.5	44	20	
3.45 "	5.3	19.0	32	16	" "
4.15 "	5.2	17.0	Can't be felt	12	
4.45 "	5.0	15.0	"	-	Resp ^r stopped

Transferred to warm chamber at once and applied artificial respiration for a few minutes.

5.15 p.m.	51.0	20.0	78	16	Resp ^r shallow and sobbing.
5.45 "	50.5	26.0	98	20	
6.15 "	50.0	31.2	162	34	Resp ^r regular
6.30 "	49.7	35.5	189	42	" "
7.15 "	50.5	38.3	212	54	" "

Removed from chamber and laid on cotton wool in a room at 80°F, still sound asleep. Next morning it was moving about but seemed to be drowsy. It ultimately recovered perfectly.

Monkey G (*Macacus Rhoesus*) - (Blue Curve - Chart II)
 Female - Weight 1.65 Kilos.

At 9 a.m. 6 $\frac{3}{4}$ (21 c.c.) of whiskey, diluted with an equal amount of water, was administered by means of the stomach tube. Shortly afterwards it began to show signs of intoxication, - inability to co-ordinate its movements, and by-and-by inability to stand or walk, but it did not seem disposed to fall asleep and at 9.40, 4 $\frac{3}{4}$ (14 c.c.) more was given. By 10 a.m. it was apparently sound asleep, and it was then placed in the cold chamber.

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
10. 0 a.m.	5.7°C	38.4°C	244	64	As soon as put into chamber began to shiver violently.
10. 30 "	6.3	38.2	240	-	
11. 0 "	5.4	37.6	208	-	Still shivering in every muscle
11. 30 "	5.1	37.2	204	42	" "
12 (noon)	5.4	37.0	174	34	(difficult to count) " "
12. 30 p.m.	5.2	36.4	148	28	Shivering less marked.
1. 0 "	5.0	35.3	128	26	" "
1. 30 "	5.0	33.6	(weaker) 106	20	" "
2. 0 "	4.8	32.4	82	20	Shivering ceased except for fibrillary twichings of jaw muscles.
2. 30 "	4.2	30.5	74	17	
3. 0 "	4.0	28.0	60	16	
3. 30 "	3.8	25.1	(very feeble) Not palpable	14	

Monkey G (Continued)

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
4. 0 p.m.	3.4°C	22.4°C	Not palpable	10	Still fine fibrillary twichings of jaw muscles
4. 30 "	3.3	20.5	"	8	
5. 0 "	3.7	19.2	"	7	
6. 0 p.m.	3.2	17.4	"	4	
6. 30 "	3.0	16.5	"	4	
7. 0 "	2.9	15.2	"	3	
7. 30 "	2.7	14.6	"	2	
8. 0 "	2.7	14.0	"	$\frac{1}{2}$	
Removed to warm chamber temperature				51°C.	
8. 30 "	50.5	17.9	"	8	
9. 0 "	50.0	23.0	96	20	
10. 30 "	49.7	34.4	(strong)	48	
			167		(strong)

The animal was now removed from the warm chamber, covered with a wool^len cloth and laid in a room the temperature of which was 80.0°F (about 27.0°C). It was still sleeping. By 10 o'clock next morning it had recovered but appeared to be somewhat drowsy and dull. On the following day (two days after the experiment) it was quite well.

Cat I (Green Curve - Chart II)

Small - weight 1.94 Kilos.

At 9.30 a.m. $1\frac{3}{4}$ (about 30 c.c.) whiskey diluted with equal parts of water was administered by the stomach tube. At 10.45 a.m. it was in a deep sleep, and it was then placed in the cold chamber.

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
10.45 a.m.	3.5°C	37.5°C	216	42	
11. 0 "	3.9	37.0	180	38	Violent shiver ^g
11.15 "	3.5	36.8	184	(Can't be counted for shivering)	" "
11.45 "	3.3	36.5	186	"	" "
12 (noon)	3.6	36.2	140	"	
12.15 p.m.	3.8	36.0	138	"	
12.30 "	3.9	35.5	132	35	Shivering less marked
1. 0 "	4.0	34.2	126	30	
1.30 "	3.9	32.9	128	28	" "
2. 0 "	4.0	31.9	132	28	
3. 0 "	2.7	28.5	106	24	Shivering disappeared
3.30 "	2.5	27.0	94	22	
3.45 "	2.5	25.5	86	20	
4. 0 "	2.4	23.2	84	15	
4.30 "	2.6	22.0	Not palpable	14	
5. 0 "	2.4	21.0	"	14	
5.15 "	2.3	20.5	"	12	
5.30 "	2.2	19.8	"	12	

Cat I (Continued)

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
6. 0 p.m.	2.1 ^o C	19.0 ^o C	Not palpable	10	
6. 30 "	2. 3	17. 8	"	8	
7. 0 "	2. 3	16. 0	"	6	
8. 0 "	2. 2	14. 5	"	2	
	Removed to warm chamber - temperature 50 ^o C.				
8. 15 "	50. 0	17. 3			

Three minutes after the last observation was made the cat stopped breathing. Artificial respiration was kept up for some time, but without avail.

During the first two or three hours the animal, which was lying on its side in the chamber, continued to make peculiar correlated swimming movements with its four limbs. It appeared to be deeply narcotised and did not attempt to move about or change its position at all.

Cat II (Yellow Curve - Chart II)

Weight - 3.14 Kilos.

At 11 a.m. 10 grains (0.6 gram) chloral hydrate was dissolved in water and injected subcutaneously into the back. At 12 the cat appeared to be asleep and it was then placed in the cold chamber.

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
12 (noon)	9.4 ⁰ C	38.7 ⁰ C	198	30	Lies curled up in one corner of the chamber - shivering in every muscle.
1. 0 p.m.	9.9	38.5	-	-	" "
1. 30 "	9.1	38.1	-	-	" "
2. 0 "	8.9	38.2	186	-	" "
2. 30 "	9.0	37.8	-	-	" "
3. 0 "	9.2	37.6	206		10 grs. chloral & 10 grs. KBr injected.
3. 45 "	9.2	37.2	-	-	
4. 30 "	9.3	36.7	174		10 grs. chloral & 10 grs. KBr injected.
5. 0 "	7.8	35.4	-	-	
5. 15 "	7.5	34.5	130	18	
5. 45 "	7.8	33.3	-	-	Shivering almost ceased.
6. 30 "	7.6	32.0	88	-	
7. 0 "	7.2	29.4	84	15	
7. 30 "	7.0	26.2	78	-	

Cat II (Continued).

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
8. 0 p.m.	6.8	23.6	52	12	
8. 30 "	6.7	21.3	Not palpable	10	
9. 0 "	6.6	19.2	"	10	
9. 30 "	6.3	17.1	"	4	
10. 0 "	6.1	15.5	"	3	
Transferred to warm chamber - 48°C.					
11. 0 "	47.2	20.2	"	16	
11. 30 "	47.0	26.1	94	20	

Removed from warm chamber, covered with cotton wool and laid in room at temperature of 80°F (about 27°C).

Next morning found dead.

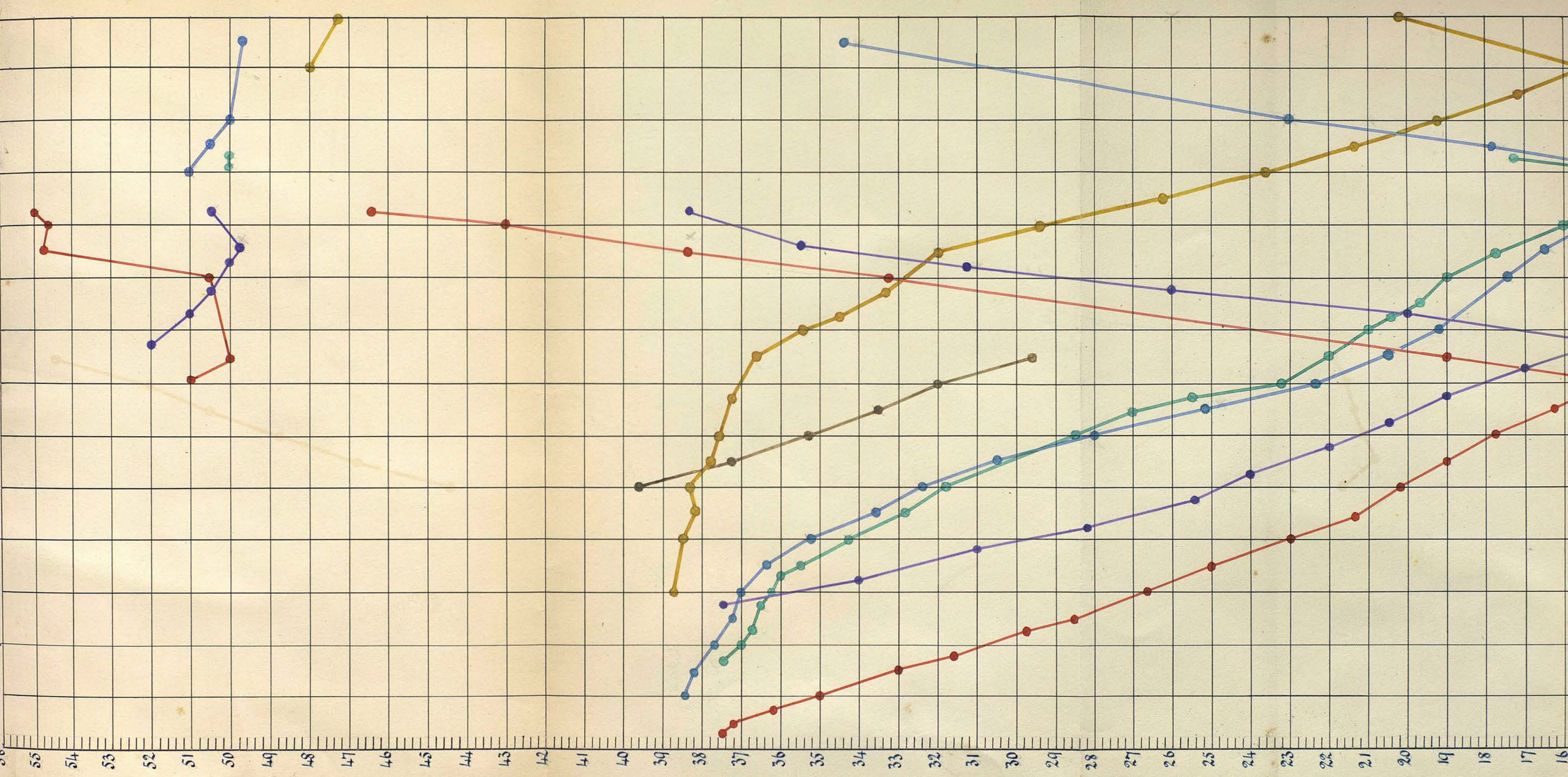
Cat III (Brown curve - Chart II) - Very large - weight 4.21 Kilos.

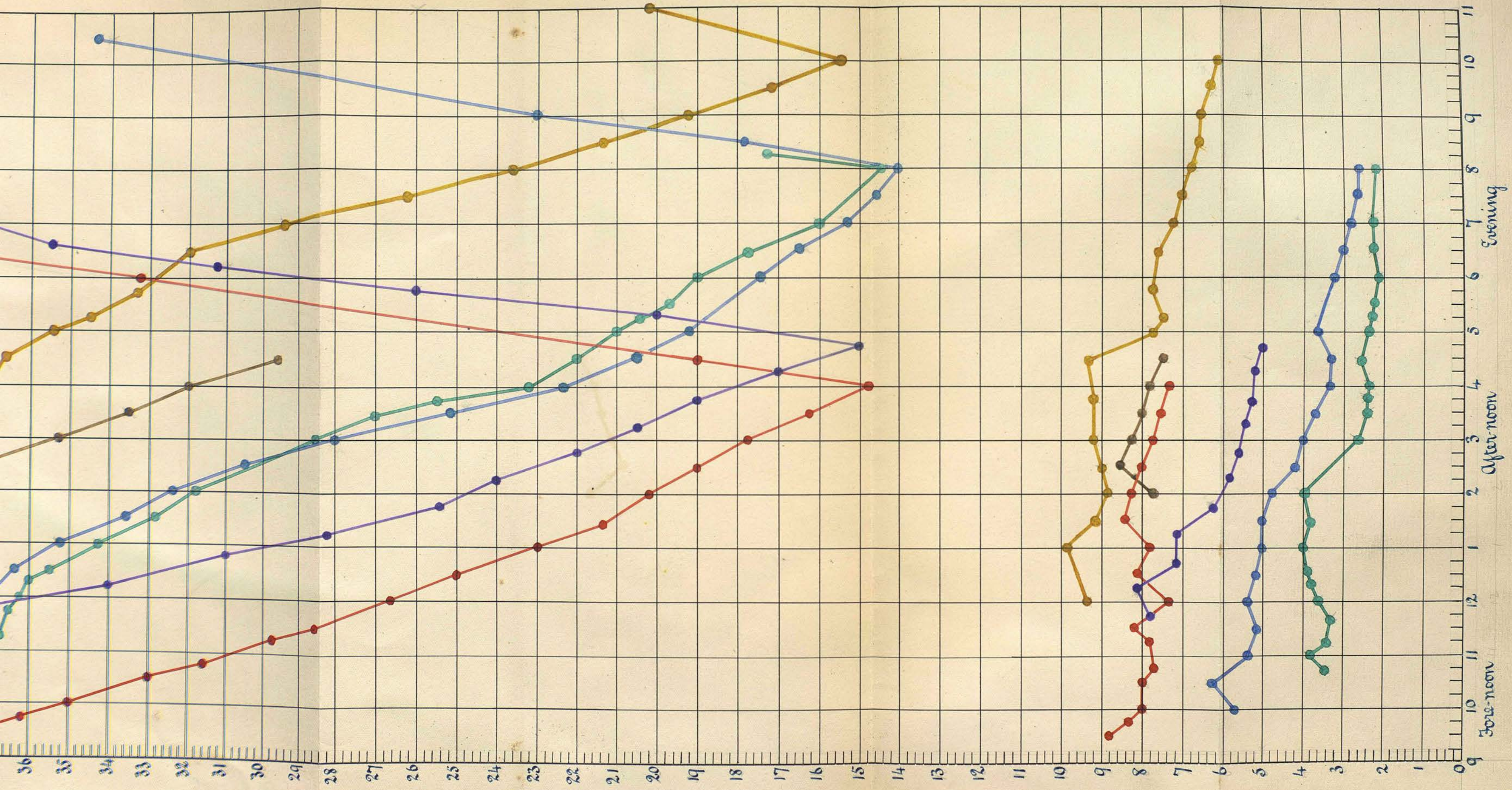
Fully anaesthetised with chloroform, and after rectal temperature, pulse and respiratory rates were noted, it was placed in the cold chamber at 2 p.m.

Time	Tempr. of Chamber	Tempr. of Rectum	Pulse rate	Respiration rate	Remarks
2. 0 p.m.	7.8°C	39.7°C	204	57	Resp ^r very shallow
2. 30 "	8.6	37.2	144	28	Resp ^r regular
3. 0 "	8.2	35.3	100	24	" "
3. 30 "	8.0	33.5	100	22	" "
4. 0 "	7.9	32.0	164	20	" "
4. 30 "	7.5	29.6	Can't be felt	16	" "
4. 35 "	Breathing suddenly stopped. The cat was removed from the chamber and artificial respiration kept up for 15 minutes, but it did not recover. Death was probably due to an overdose of chloroform. (I have observed in these experiments that monkeys stand chloroform and ether much better than cats do.)				

Chart II
Centigrade scale.

Red curve — Monkey E (ether)
 Violet — " " F (Paraldehyde)
 Blue — " " G (Alcohol)
 Green curve — Cat I (alcohol)
 Yellow — " " II (Chloral + KBr)
 Brown — " " III (Chloroform)





Evening

After-noon

Fore-noon

1st. With regard to the action of ether.

(Monkeys A, B, C, D, and E - all the curves on Chart I and the red curve on Chart II). In A (red - Chart I) - there is a fall in the rectal temperature from 38.6°C to 14°C , i. e. through 24.6°C , between 10.45 a.m. and 2 p.m. - three hours and a quarter. The descent was most rapid early in the experiment and became slower as the temperature of the animal approached that of the chamber. When the rectal temperature reached 25°C ether was stopped, but notwithstanding this the animal did not wake up and could not be aroused by pinching the skin or pricking it with a needle, and the temperature continued to fall steadily as before. At 2 p.m. the animal was transferred to the warm chamber - 41.6°C ; the temperature rose rapidly and by 7 p.m. it was about the normal. Ether was readministered when the rectal temperature had reached 22°C on the upward limb of the curve. The animal suffered no bad effects from its prolonged cooling. It was kept in the laboratory for a month after this experiment.

Curve B (green - Chart I) shows practically the same characteristics as curve A. The rate of fall diminishes in the same way towards the bottom but the ascent is much more rapid, one reason for this being that the warm chamber was much hotter than in the case of A. This animal

died when the rectal temperature had reached 44°C.

In Curve C (blue - Chart I) the monkey died when the rectal temperature reached 23°C, probably from an overdose of ether, but it was kept in the chamber and the temperature recorded as if it had been alive, and the curve shows that it cooled down at about the same rate as an anaesthetised animal. (theoretically, for one reason, this dead animal should have cooled down faster than a living one because metabolism is at a standstill and no heat is being produced. For another reason it should have cooled at a slower rate, - there is no circulation and consequently no heat is carried by the blood from the centre to be given off at the periphery. These two factors appear to have balanced each other here.)

In Curve D (violet - Chart I) the monkey died when the rectal temperature had been reduced to 12.5°C. This was the lowest temperature attained in any of the experiments.

None of these animals were weighed as they should have been, but they were all small. In order to get comparable results it is necessary to know the weight of the animal because a large animal cools down at a slower rate than a small one.

In Curve E (red - Chart II) the monkey was a large one which may explain the fact that the descending limb is less steep. The ascent is much more rapid. This animal died of hyperpyrexia when its temperature had been raised to 46.5°C - the highest attained in any of my experiments.

2. Paraldehyde. Curve F represents the rectal temperature of a small monkey (weight 1.14 kilos) which had been narcotised with paraldehyde. The general character of this curve is the same as that of those in which ether was the narcotic. At first the descent is rapid; later it slows off somewhat. It was deemed expedient to stop the cooling process when the rectal temperature had reached 15°C . The animal recovered perfectly.

3. Chloroform. The effect of chloroform anaesthesia is seen in curve III (brown - Chart II). The animal was a very large cat - over 4 kilos. It died early in the experiment but it shows the same rapid descent as in the case of the experiments with ether and paraldehyde.

4. Alcohol. Curves I (green) and G (blue in Chart II) obtained from a cat and monkey respectively both of which had received a very large dose of alcohol, in relation to the body weight, in the

form of whiskey, show a very slow fall until a temperature of about 31°C had been reached, after which the descent becomes much more rapid. In both cases there was violent shivering until the temperature had fallen to this point, after which it disappeared. The dose of alcohol was so large that in the case of the cat it was fatal.

5. Chloral Hydrate and Potassium Bromide.

Curve II (yellow in Chart II). The animal in this case was a cat, and the delay in the fall was, no doubt, due to the fact that the dose, although a very large one (10 grains subcutaneously injected) was insufficient to completely narcotise the animal. Not until it had received 30 grains of chloral and 20 grains potassium bromide did the temperature begin to fall to any extent, and even then not very rapidly until it had been reduced to about 32°C .

On examining the curves in these two charts it will be seen at a glance that they divide themselves into two groups; the one includes those due to ether, chloroform and paraldehyde, the other those due to alcohol, and chloral hydrate with KBr. In the one the descent is rapid from

the beginning, probably due to the fact that the central nervous system is completely paralysed; in the other the descent is slow at first, caused by the persistent shivering, which again, is no doubt due to the fact that the central nervous system is only paraesed and not completely paralysed. Whether this difference is due to the specific actions of the two sets of drugs on the central nervous system, or whether it is due to the quantities of alcohol and chloral given being insufficient to produce the full effect in the cases in which it was used is a question which cannot be satisfactorily answered from the results of only two experiments. One would require, first of all, to determine experimentally in the case of each animal the ^{maximal} sublethal dose required to produce narcosis. Has each class of narcotics a "cooling curve" proper to itself with a maximal sublethal dose?

It is now generally agreed that the central nervous system as a whole, presides over heat-regulation, and that this function is not relegated to any particular localised centre. The following is a quotation from Richet (Dictionnaire de Physiol-

ogie - vol. III p. 118) 1 "The action of poisons (including the anaesthetics ether, chloroform, &c.) on temperature may be summed up in two sentences. 1. The temperature follows a march almost parallel with the production of heat. 2. The temperature and the heat production is modified but little while the nervous system is unaffected; depression of the nervous system diminishes metabolism and lowers temperature, stimulation of the nervous system augments both, and it is by the intermediation of the muscular system that the nervous system chiefly acts on temperature"..... "In animals intoxicated with chloral or alcohol, and then exposed to cold, the temperature may fall to 22°C or 23°C , and they may die of cold rather than of poisoning." (In my experiments with alcohol the temperature of a monkey fell to 14°C , and that of a cat to 14.4°C , while with chloral the temperature of a cat was reduced to 15.5°C .)

Many observers have recorded, in various ways, the effects of narcotics on temperature. The literature is fully given in Pembrey's article in Schäfer's text-book - Vol. I p. 821, to which the reader is referred. However, there are one or two

points in the few experiments which I have done to which I would desire to direct attention.

I. With regard to the limits of temperature compatible with life, Pembrey (Schäfer's text-book Vol. I p. 822) says - "In the case of non-hibernating animals an artificial cooling of the body to 18°C is, in a few hours, followed by death, unless artificial respiration and heat be applied" "Adult animals, when cooled to 18° or 20°C , generally died, even when artificial warmth was applied." - Edwards. The lowest temperature I have been able to find in the literature is recorded by Rumpf (31). He succeeded in reducing the rectal temperature of a guinea-pig to 16°C . Winternitz (32) stated that his rabbits died when their temperatures had been reduced to 19°C , but they were not under the influence of an anaesthetic while being cooled down. I have succeeded on more than one occasion in reducing the rectal temperature of a monkey to 14°C with perfect recovery afterwards, and in one case it was as low as 12.5°C but the animal died a few minutes after the thermometer was read. I have reduced a cat's temperature to 14.4°C (died 15 minutes later) and

once to 15.5°C with recovery.

The highest limit observed by me in the monkey was 46.5°C (115.7°F) but this was fatal in a few minutes. Higher temperatures than this have been recorded in the human subject. Teale (33) records one of 122°F ! Donkin (34) mentions the case of a nurse convalescent from typhoid fever who had a temperature of 111.6°F without any constitutional symptoms. In this case, he remarks, the pyrexia was very evanescent and ^{the temp^t} varied from 107.2° to 98.6°F in five minutes. (The italics are mine). It seems extraordinary that a medical man should make such a statement, apparently in all seriousness. That the human body should lose as much heat in five minutes as would reduce the temperature 8.6°F is a physical impossibility and the statement is manifestly absurd. Many of these high figures require to be received with a certain amount of reserve, but a perfectly reliable observer, Professor Leith of Birmingham (35) mentions a recovery in pneumonia after a temperature of 113.9°F and one in malaria after 114.8°F .

II. The pulse and respiratory rates are reduced parallel with the fall in temperature, and are increased parallel with its rise. As the CO_2 excretion was not estimated, these are the

only indications we have of the changes in metabolic activity, and consequently in heat production.

The temperature probably varies then, as the heat production.

III. The temperature always rises more rapidly than it falls so that the upward limb of the curve is steeper than the downward. In the descent two forces are opposing each other - an internal influence (metabolism) is trying to keep up the temperature, an outside influence (the cold air of the chamber) is trying to reduce it. In the ascent, on the other hand, the same two forces are aiding each other, hence the more rapid rise than fall.

IV. When the temperature falls to about 24°C the anaesthetic may be stopped. Beyond this point the animal has no power of self-recovery and it is now in a condition analogous to that of a hibernating animal. How long the animal would live in this condition I have not been able to determine. I have reduced the temperature to about 23°C in two or three cases and then left the animals over-night in a warm room, but the temperature of this room always rose too high (about 80°F - 27°C) and by the morning they had recovered.

It may be possible to produce this condition of artificial hibernation and to maintain it for a considerable time, if the external temperature be prevented from falling too low or rising too high.

GENERAL SUMMARY.

1. In the monkey the temperature is quickly raised by muscular exercise.
 2. The temperature of the axilla is higher than that of the rectum.
 3. There is a marked and regular diurnal variation with a minimal period from 2 to 4 a.m. and a maximal period from 6 to 8 p.m.
 4. The mean temperature for the twenty four hours is about 100.1° F (37.9° C) for the axilla, and 99.6° F (37.6° C) for the rectum.
 5. Under the influence of narcotics in monkeys and cats the power of heat regulation is lost and the temperature of the animal rises or falls with that of its surroundings; but the power of different narcotics to effect such a disturbance in heat regulation differs in degree. With ether, chloroform, and paraldehyde the fall is rapid from the first, with alcohol and chloral hydrate with potassium bromide it is much slower.
- Might/

5. Might not this be used as a method for investigating the intensity of the action of different narcotics on the central nervous system?
6. Beyond 24°C the animals lost all power of self recovery.
7. The pulse and respiratory rates were reduced parallel with the fall in bodily temperature, and increased parallel with its rise, pointing to a similar rise and fall in the metabolism of the animal.
8. The rise is much more rapid than the fall.
9. The lowest temperature reached in the monkey with recovery was 14°C and with fatal results 12.5°C ; in the cat it was 15.5°C and 14.4°C respectively. The highest temperature reached in the monkey was 46.5°C but this was followed by death in a few minutes.

B I B L I O G R A P H Y.

- Finkler "Ueber das Fieber"
Arch. f. d. ges. Physiol., Bonn, 1892 Bd. XXIX.
S. 117.
- Mott Schäfer's Text-book of Physiology - Vol.I. p.792.
- Hobday. Jour. comp. Path. and Therap. 1896 Vol.IX p.286.
- Aronsohn and Sachs. "Die Beziehungen des Gehirns zur Körperwärme und zum Fieber" - Arch. f. d. ges. Physiol. Bonn 1885.
Bd.XXXVII. S.232.
- Jurgensen. "Die Körperwärme des gesunden Menschen" Leipzig 1873.
S. 43.
- Davy. "Miscellaneous Observations on Animal Heat"
Phil. Trans. 1884 Pt.I p.62.
- " "On the Temperature of Man" - Phil. Trans 1845 Pt.II.
p. 322.
- " "On the Temperature of Man within the Tropics"
Phil. Trans. 1850 p.440.
- Clifford Allbutt. "The Effect of Exercise on the Bodily Temperature"
Jour. Anat. and Physiol. 1872. Vol.VII. p.106.
- Wunderlich "Das Verhalten der Eigenwärme in Krankheiten" -
2nd. éd. Leipzig 1870. p.423.
- Marcet. "Contribution to the History of the Respiration of Man"
Brit. Med. Jour. 1895 Vol I. p.1367.
- Vernet. "Etude sur l'organisme humain soumis à un travail musculaire" - Arch. des. sc. Phys. et nat. Geneve,
1885, XIV. p.110.
- Gresswell. "Report on some organic phenomena observed during a voyage round the world in a sailing ship"
Brit. Med. Jour. 1884, Vol 2. P.164.

- Forel. "Expériences sur la température du corps humain dans l'acte de l'ascension sur les montagnes", Geneve, 1874. p.116.
- " " "La température animale pendant l'ascension" - Rev. Scientif.1885 Vol.2 p.155.
- Obernier. "Der Hitzschlag" Bonn. 1867. S.80.
- Bouvier. "Untersuchungen über die Wirkung des Alkohols auf die Körpertemperatur" Arch. f. d. ges. Physiol. Bonn 1869. Bd.II S.386.
- Davy. "Researches" London Vol I. p.181.
- Richet. Dictionnaire de Physiologie, Vol.III. p.90.
- Ringer and Stuart. "On the Temperature of the Human Body in Health" - Proc. Roy. Soc. Lond. 1877. Vol XXVI. p.186.
- Hale White and Washbourn "The Evolution of warm-blooded vertebrates". Jour. Anat. and Physiol. 1891. Vol. XXV. p.379.
- Ringer and Stuart. Loc. cit.
- Hobday. Loc. cit.
- Robertson. "Records of the Internal Temperatures of Healthy Cattle under Different Conditions" - Veter. Jour. 1885. Vol.XX. p.311.
- Bidder & Schmidt. "Die Verdauungssäfte und der Stoffwechsel" Leipzig, 1852 S.346.
- Corin & Van Benedin. "Recherches sur la régulation de la temperature chez les Pigeons privés d'hémispheres cérébraux". Arch. de Biologie. t.VII. p.265.

- Carter. "A Study of Heat Production and Heat Dissipation in the Normal and Febrile States."
- Hale White and Washbourn. Loc. cit.
- Couty. Richet's Dictionnaire de Physiologie. Vol.III. p.90.
- Aruch. Clin. Veterin. Milano (2) I pp.6,7.
- Lefèvre. Compt. Rend. de la Soc. de Biol.(10) I. p.697.
- Richet. Dictionnaire de Physiol, Vol.III. p.90.
- Rumpf "Untersuchungen über die wärmeregulation in der Narkose and im Schlaf" Arch. f. d. ges. Physiol. 1884 Bd.XXXIII S.538.
- Winternitz. Tigerstedt's Lehrbuch der Physiologie Bd.I (1897) S.386.
- Teale Clinical Transactions, 1875.
- Donkin British Medical Journal, 1879.
- Leith Quain's Dictionary, 1902.

In addition to above I have consulted freely

the article on "Animal Heat" by Pembrey in Schäfers' text-book
 I. I p.783, and that on "Chaleur" by Richet in Vol. III of
 his "Dictionnaire de Physiologie". Either of these works
 contains a full bibliography on this subject.