

Note on the influence of castration on the weight of the brain and spinal cord in the albino rat and on the percentage of water in them / Henry H. Donaldson and S. Hatai.

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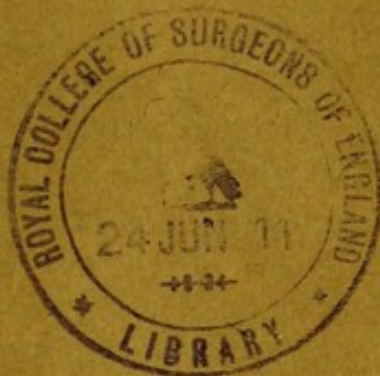
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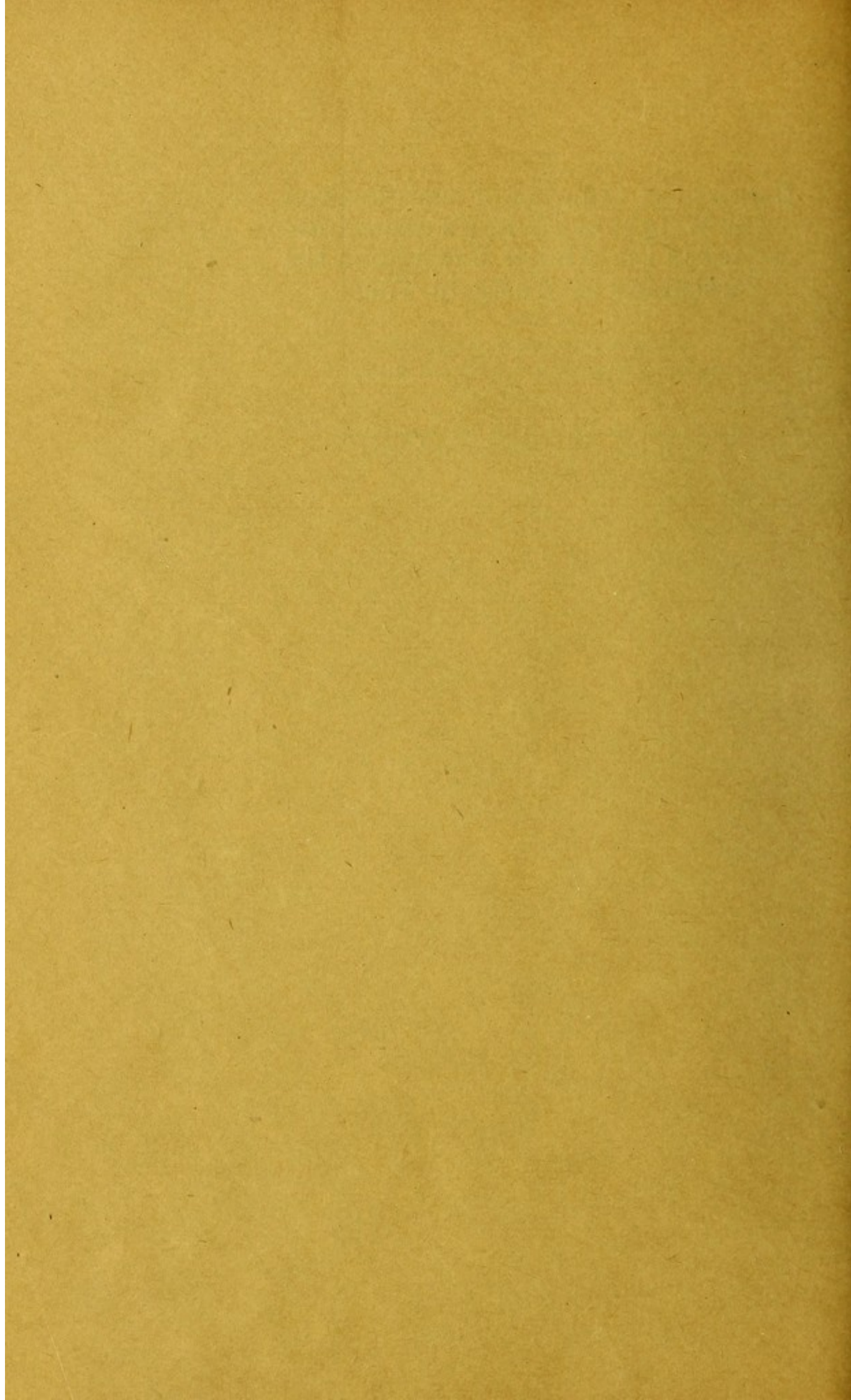
Note on the Influence of Castration on the Weight of the Brain and Spinal Cord in the Albino Rat and on the Percentage of Water in Them

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The Wistar Institute of Anatomy and Biology

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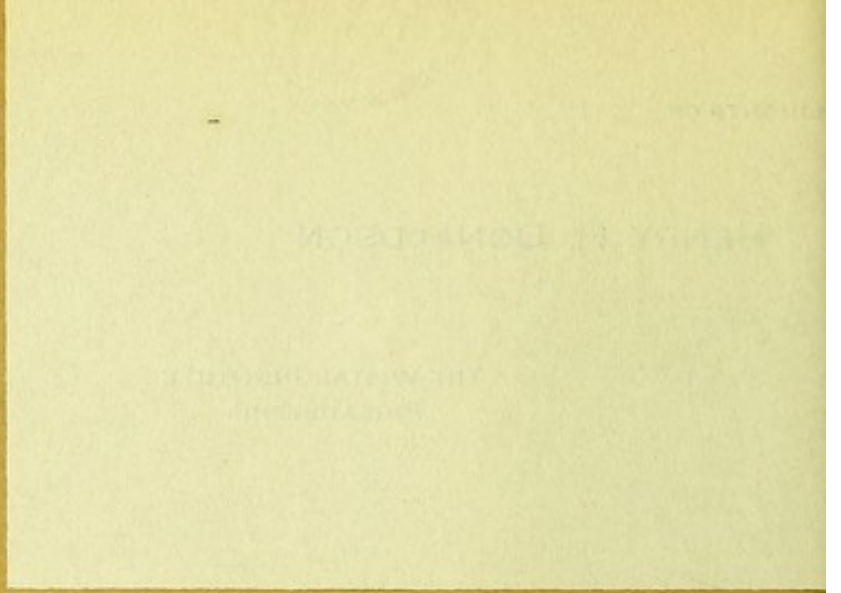


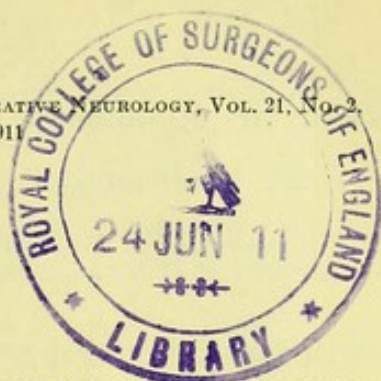


LIMENTS OF

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NOTE ON THE INFLUENCE OF CASTRATION ON THE WEIGHT OF THE BRAIN AND SPINAL CORD IN THE ALBINO RAT AND ON THE PERCENTAGE OF WATER IN THEM

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In connection with the studies now being carried on in this laboratory on the conditions which may modify the percentage of water in the central nervous system of the albino rat, we have put together some observations which give not only these data for castrated rats but also indicate that castration causes some arrest in the growth of both the brain and the spinal cord.

In the spring of 1906 Dr. Hatai examined in the neurological laboratory of the University of Chicago a series of castrated and corresponding control rats, the body growth of which had been followed by Dr. Ranson. These observations by Dr. Ranson were combined with those by Dr. Stotsenburg and published by the latter in 1909 (Stotsenburg, '09), and in that paper all the necessary detail concerning the operation and the care of the animals has been given.

As Dr. Stotsenburg has shown, castration in the albino rats does not modify the body growth. There does, however, appear to be a slight arrest in the growth of the central nervous system as the following records show. Eight litters were examined comprising 11 controls and 13 castrated individuals. At the time of killing some of the animals were still increasing in body weight while others were losing. The series was therefore divided into two groups—namely, (1) those still gaining, and (2) those losing in body weight. Table 1 gives the data for the first group.

TABLE 1

Rats still increasing in body weight at time of killing

LITTER	BODY WEIGHT	BODY LENGTH	BRAIN WEIGHT	CORD WEIGHT	PER CENT WATER		AGE DAYS
					BRAIN	CORD	
<i>Castrated</i>							
V.....	227.6	194	1.9746	.6168	77.62	69.45	260
V.....	258.0	202	1.9434	.6728	77.36	68.37	260
X.....	156.6	163	1.7726	.4966	77.28	68.10	234
Average..	214.1	186	1.8968	.5954	77.42	68.64	251
<i>Controls</i>							
III.....	272	194	2.0198	.6556	77.12	67.81	290
V.....	281	199	2.0910	.6364	77.01	67.94	260
V.....	268	198	2.0610	.6703	77.85	69.32	260
VI.....	303	205	2.0636	.6904	77.64	67.90	271
X.....	210.4	174	1.8354	.5494	77.16	68.51	234
Average..	267.0	194	2.0141	.6404	77.36	68.29	363

As the data in table 1 stand, the controls show heavier brain and spinal cords than those castrated. This is not only true for the averages of the entire groups, but also for the averages of the litters, so far as they can be contrasted. To make the comparison trustworthy, however, we have referred the values found to the series of standard values in the manner described by Donaldson ('11) in the accompanying study on the influence of exercise on the weight of the central nervous system.

When this is done, it is found that both groups are above the standard as follows:

	BRAIN	SPINAL CORD
	<i>per cent.</i>	<i>per cent.</i>
Body length 194 mm. Excess of observed values in controls.....	9.9	18.5
Body length 186 mm. Excess of observed values in castrated...	5.7	11.6
Deficiency in the castrated group.....	4.2	6.9

In this group therefore the castrated have slightly lighter brains and spinal cords than the controls, while the percentage of water for the brain and spinal cord is nearly the same in both groups.

The data for the second group of animals from this series are given in table 2.

TABLE 2

Rats losing in body weight at time of killing

LITTER	BODY WEIGHT	BODY LENGTH	BRAIN WEIGHT	CORD WEIGHT	PER CENT WATER		AGE DAYS
					BRAIN	CORD	
<i>Castrated</i>							
I.....	225.8	206	1.8990	.6242	77.17	68.11	292
I.....	234.0	196	1.9994	.6470	77.17	69.40	292
I.....	223.4	193	1.8816	.6191	77.36	69.22	292
VI.....	233.2	194	2.0144	.6546	77.99	68.44	271
VI.....	190.8	199	1.9232	.6436	77.23	68.42	271
VIII.....	144.6	192	1.9789	.6374	77.53	68.37	242
VIII.....	212.0	192	1.9838	.6309	77.60	68.67	242
VII.....	156.6	187	1.6538	.5174	77.22	68.38	271
VII.....	144.8	185	1.8164	.5580	77.59	70.03	271
VII.....	122.1	176	1.7514	.5500	77.93	68.76	271
Average..	188.7	192	1.8902	.6182	77.48	68.77	271
<i>Controls</i>							
I.....	230.0	193	2.0426	.6245	77.39	69.09	292
I.....	230.0	195	1.9350	.6434	77.34	69.07	292
I.....	226.0	194	1.9624	.6384	77.67	69.32	292
VII.....	164.4	190	1.8718	.5872	77.62	69.07	271
VIII.....	261.8	206	2.0474	.6730	77.49	67.51	242
VIII.....	152.0	188	1.9634	.6464	77.77	68.77	242
Average..	210.7	194	1.9704	.6355	77.54	68.80	272

In this case, although the absolute values are somewhat different, the relations for the litters and the averages are quite similar to those found in group 1. When measured by the standards for the given body length we find the following:

	BRAIN	SPINAL CORD
	<i>per cent.</i>	<i>per cent.</i>
Body length 194 mm. Excess of observed values in controls...	7.6	17.5
Body length 192 mm. Excess of observed values in castrated..	3.7	12.3
Deficiency in the castrated group.....	3.9	5.2

In this second group the deficiency in the weight of the brain and spinal cord is a trifle less than that found in group 1, but still of the same order. Again the percentage of water in the brain and in the spinal cord appears to be unmodified by castration.

In both the foregoing groups the percentages of water are unusually low for the age of the animals. For this there is no explanation at present. Whatever the cause, however, there is every reason to believe that the conditions were alike for both the castrated and the controls during this determination, and hence the relative values of the results have not been disturbed.

In 1908 one series of (4) castrated rats with which Dr. Stotenburg ('08) was working in this laboratory, together with the (4) controls, became infected with pneumonia and were killed. The severity of the infection was not recorded. These were examined for the weight of the brain and spinal cord and for the percentage of water in both of these organs. The control in each case was from the same litter as the castrated. The data are given below in table 3.

TABLE 3

Both groups with pneumonia

LITTER	BODY WEIGHT	BODY LENGTH	BRAIN WEIGHT	CORD WEIGHT	PERCENTAGE OF WATER		AGE DAYS
					BRAIN	CORD	
<i>Castrated</i>							
I.....	107.1	180	1.7497	.5071	77.411	68.823	259
II.....	147.8	186	1.7770	.5673	77.901	69.381	264
III.....	146.1	183	1.7560	.5063	78.598	70.867	270
IV.....	172.5	205	1.8225	.6132	77.860	69.635	351
Averages.	143.4	188	1.7763	.5485	77.942	69.677	286

TABLE 3—CONTINUED

<i>Controls</i>							
I.....	116.3	182	1.7460	.5208	77.645	69.797	259
II.....	141.3	186	1.7602	.5656	78.023	68.901	264
III.....	124.8	184	1.8021	.5472	78.643	71.391	270
IV.....	184.7	203	1.8859	.6571	77.644	69.868	357
Averages.	141.8	189	1.7985	.5724	77.989	69.989	287

For the third time, as table 3 shows, the castrated as compared with the controls are on the average possessed of lighter brains and spinal cords. The percentage of water in the brain is nearly the same in both groups, while for the first time a notable difference in the percentage of water occurs in the spinal cord represented by an excess of 0.3 per cent in favor of the controls. The exceptional character of this difference, depending as it does on one high record, permits us to disregard it for the time being.

When the data in this table are referred to the standard values, we obtain the following:

	BRAIN	SPINAL CORD
	<i>per cent.</i>	<i>per cent.</i>
Body length 189 mm. Difference from observed values in control.....	-0.5	+9.8
Body length 188 mm. Difference from observed values in castrated.....	-1.5	+6.0
Deficiency in castrated group.....	1.0	3.8

The deficiencies in the weight of the brain and the spinal cord of the castrated group are less than in the preceding series, but still evident, and we have given reasons for concluding that the percentage of water is not modified.

It is probable that some of the peculiarities of this last series, such as the low percentage of water, depend on the fact that all of the animals were suffering from pneumonia (King, '11).

From the foregoing observations we conclude therefore:

1. Castration in the albino rat reduces the weight of the brain and the weight of the spinal cord somewhat below those weights in the normal control rats, and
2. That castration does not modify the percentage of water neither the brain or the spinal cord.

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