mentioned 56-year-old subject, cell frequencies for the main olivary nucleus are 447,785 ± 14,375 neurons[4]. The 2 small accessory olivary nuclei added, slightly more than 0.5×10^6 axons project to one cerebellar hemisphere. If these neurites project to the granular cells in form of mossy fibres[5] the divergence ratio may range from 1:10,000 to 1:100,000; if according to another view[7] they synapse in the form of climbing fibres with the Purkinje cells directly, the ratio is 1:15.

Cerebellar outflow is mainly concentrated in the superior peduncle and with few exceptions originates from the cells of the cerebellar nuclei. Counts and estimates carried out on sections of cerebelli of 3 male subjects, rendered for all 4 nuclei of one hemisphere a figure of 311,404 ± 3835 neurons. For the individual nuclei cell frequencies are 284,009 neurons in the dentate nucleus, 16,153 in the nucleus globosus, 10,381 in the emboliforme nucleus and 5210 in the nucleus fastigii. Details of these findings are to be published elsewhere.

At the level where the superior cerebellar peduncle enters the midbrain, an estimate for its constituent number of axons rendered a figure of 782,310 neurites in the right side peduncle. Thus there is a ratio of 1:2.5 of cell numbers of cerebellar nuclei, to that of axons in the main cerebellar efferent fibre tract. The discrepancy may either be due to branching of axons or the presence of incoming fibres. For the occurrence of branchings conclusive evidence was provided by CAJAL[8]. The existence of substantial incoming rubro-cerebellar fibres in the superior cerebellar peduncle was pointed out recently[9].

A proportion of cerebellar nuclear cells are known to project via the fastigio-bulbar bundle directly to the vestibular nuclei. The number of neurons in the vestibular nuclei of man, as recently established[10], is in the order of 245,000 cells. The low figure for the number of neurons found in the fastigial nucleus make it doubtful whether all projections attributed to it, can be served from this limited source[11].

Zusammenfassung. Mit Bezug auf Probleme der Kybernetik wurde die Informationsübertragungskapazität der afferenten und efferenten Zell- und Fasersysteme des menschlichen Kleinhirns numerisch definiert.

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Cytochrome Oxidase Activity in Different Hypothalamic Areas. Influence of Castration[1]

It has previously been shown that sexual activity modifies the oxidative metabolism of hypothalamus. Cyclic changes in the oxygen uptake[2] and in the succinic-dehydrogenase activity[3] were observed in female rats. Experiments performed in castrated male rats showed a decrease in the hypothalamic capacity to oxidize several substrates of the Krebs cycle[4].

In order to determine if the respiratory chain participates in the modifications of the oxidative metabolism of hypothalamus after gonadectomy, the cytochrome oxidase activity in different hypothalamic areas has been studied in normal and castrated rats.

Material and methods. Adult white male rats, fed on the standard diet of the Institute of Physiology, and weighing 150–180 g, were used. Light and temperature were controlled and kept constant (25 °C; 12 h light and 12 h darkness). Gonadectomy was performed 25–30 days before sacrifice. The animals were decapitated and the entire hypothalamus removed. The sample was divided into 3 portions, anterior hypothalamus, middle hypothalamus and posterior hypothalamus, as described previously[5].

The samples were gently blotted on filter paper, weighed on a torsion balance and rapidly transferred to micro-Warburg vessels. Each determination was made on pooled tissue from 2 rats.

Cytochrome oxidase was determined according to the manometric method of SCHNEIDER and POTTER[6] adapted as follows: 0.2 ml of saturated OHNa solution were added to the central well of the micro-Warburg vessel; the main vessel contained the hypothalamic tissue with 1.0 ml of Krebs-Ringer phosphate buffer and the lateral vessel cytochrome C 0.0009 m*M* and ascorbic acid neutralized to pH 7.4, 0.030 m*M* (total volume 1.5; pH 7.4). The vessels were gassed for 5 min with 100% O_2; tipping was performed after allowing 10 min for equilibration; the observation period lasted 60 min. Cytochrome oxidase activity was expressed as µl of O_2/mg wet tissue·h. The results were analyzed for variance following SNEDECOR[7] and the statistical significance was determined according to TUKEY'S[8] method. The minimal significant difference of the means was 0.340 in the anterior hypothalamus and 0.300 in the posterior hypothalamus.

Results. The cytochrome oxidase activity of the anterior, middle and posterior hypothalamus is presented in the Table. The analysis of variance showed that there are significant differences between the experimental groups in the anterior ($p < 0.01$) and posterior ($p < 0.05$)

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hypothalamus, without modifications in the middle hypothalamus.

As can be seen in the Table, castration produces a significant decrease in the cytochrome oxidase activity in the anterior and posterior hypothalamic area. The values obtained in the middle hypothalamus were similar in both groups of rats. The administration of testosterone (150 µg twice a week) to castrated rats corrected the modifications observed in the hypothalamic metabolism.

Discussion. In a previous paper it was demonstrated that gonadectomy of male rats produces a decrease in the oxygen uptake of the anterior and posterior hypothalamic area, such modifications being corrected by the administration of testosterone to castrated rats[5]. Studies performed with several substrates of the Krebs cycle showed that succinate and citrate oxidation by anterior and posterior hypothalamus is lower in castrated than in normal rats. Nevertheless, the succinic-dehydrogenase activity of such hypothalamic areas was not modified by gonadectomy[9].

The results of the present paper clearly indicate that castration produces a decrease in the cytochrome oxidase activity in the anterior and posterior hypothalamus and that substitutive therapy restores the values of gonadectomized rats to those found in normal animals.

Cytochrome oxidase activity in different hypothalamic areas

Cytochrome oxidase activity (µl O_2/mg wet tissue h)	Hypothalamus		
	Anterior	Middle	Posterior
(A) Control	1.29 ± 0.09[a] (16)	1.39 ± 0.19 (11)	1.45 ± 0.08 (13)
(B) Castrated	0.86 ± 0.07 (13)	1.36 ± 0.12 (11)	1.04 ± 0.08 (11)
(C) Castrated with testosterone	1.34 ± 0.13 (13)	1.40 ± 0.15 (8)	1.36 ± 0.12 (13)
Analysis of variance			
F ratio	8.33	0.13	4.71
P value	< 0.01	n.s.	< 0.05
Multiple comparisons test			
$P < 0.05$ between:	A *vs* B B *vs* C		A *vs* B B *vs* C

[a] Mean ± standard error. Figures in parenthesis are No. of determinations.

The fact that castration depresses the succinate oxidation by hypothalamus[9] without modifications in the succinic-dehydrogenase activity, and that the cytochroms oxidase of the anterior and posterior hypothalamic areae is less in castrated than in normal rats, seems to indicate that the hypothalamic metabolic alterations produced by gonadectomy are directly related to changes in the respiratory chain (probably between cytochrome C and O_2) of this nervous structure.

Considering that the oxidative metabolism in the central nervous system is one of the principal source of high energy compounds involved in the peptide-synthesizing systems, and remembering the probable nature of the hypothalamic releasing substances[10], it is possible that the modifications in the oxidative metabolism of hypothalamus related with the sexual activity are representative of changes in the synthesis and/or liberation of the hypothalamic releasing factors.

The fact that no modifications were found in the cytochrome oxidase activity of middle hypothalamus in castrated rats is in agreement with previous publications[5,11] in which it has been demonstrated that such hypothalamic area did not modify its metabolic activity during sexual activity.

Resumen. En el presente trabajo se ha estudiado la actividad de la citocromooxidasa en diversas areas hipotalamicas de animales machos castrados y con terapia sustitutiva. Los resultados demonstraron que la castración deprime la actividad de la enzima en el hipotálamo anterior y posterior. La posible implicancia de estos hallazgos con cambios en la cadena respiratoria producidos por la castración es discutida en el trabajo.

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Long-Term Changes in Retinal Function Induced by Short, High Intensity Flashes

For several reasons an increasing interest has been paid during the last decades to the effect on the visual processes of short, high intensity flashes. First, it has been shown that the changes in the rhodopsin cycle following an electronic flash differs from those following longer light exposures[1–6]. Secondly, in light perception experiments, the flashblindness recovery time[7,8] and the development of the foveal after-images[9] following flash exposure indicate that special retinal reactions occur in response to this type of light. Finally, in both experimental and clinical electroretinography there has been an increasing use of short, high intensity electronic flashes. Thus, the early receptor potential[10] and the so-called oscillatory potential[11] are evoked with this type of stimulus. In agreement with the results of the aforementioned light perception experiments, a suppression of the ERG following short, high intensity flashes has been noted[12,13].

In connection with a study on long-term retinal effects caused by different agents, a method has been worked out by which the ERG of the intact rabbit eye can be recorded and evaluated over a period of several months[14].