2 regression coefficients are significantly different ($p < 0.05$)[8].

The accumulation of tissue cholesterol seemed to be mainly determined by exercise. Figure 2 presents the linear regression lines for the 10 rats representing each of the 3 exercise treatments. The linear correlation of cholesterol gain and ingesta-free weight gain was very high for the immersed rats, indicating that cholesterol gain was highly weight gain dependent in these animals. As a result, the linear regression coefficient of this treatment group was significantly different ($p < 0.01$) from the sedentary and exercised groups. The sedentary and exercised groups' regression coefficients were not significantly different from one another, but the exercised rats gained significantly more cholesterol ($p < 0.01$). It is possible that exercise would be less stressful in female rats if they were allowed to remain sedentary on day of estrus, but this will require further study.

*Conclusion.* Young, adult female rats ingesting a high fat diet over an 8-week-period gained more fat than those consuming an equal number of calories of a low fat diet. In sedentary, but not in exercised, females the fat level of the diet also influenced the rate of tissue cholesterol accumulation. Females that were exercised and/or immersed daily in 27 °C water had elevated serum and tissue cholesterol levels over that found in their sedentary counterparts[9].

*Zusammenfassung.* Junge, ausgewachsene weibliche Ratten nahmen nach 8 Wochen fettreicher Diät mehr Fett auf als solche mit einer fettarmen Diät, aber gleichviel Kalorien. Bei Weibchen mit körperlicher Bewegung war der Cholesteringehalt des Blutes und des Gewebes höher als bei eingesperrten, sitzenden Tieren.

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## Surface Tension of Cell Types in Differentiating CNS of Chick

After its establishment, the basic structure of CNS of chick undergoes various external and internal transformations. In this process of individuation of the central nervous system, multifold events like cell proliferations, histodifferentiation, migration and cellular degeneration take place. These morphological manifestations are, it is considered, always associated with biogenesis of various cell substances when the stearic conformances of the molecules of a cell are established. At the same time, all the cells in the differentiating central nervous system of chick are not metabolically equipotent and in different sectors of the central nervous system the biogenesis of at least some of the cytochemical materials often differ[1-3]. Further, variation in the lipid membranes of different kinds of tissues often changes the physical properties of cells[4]. Hence, if there is any alteration in the composition of the cell membrane from one phase of development to the other, surface tension of different cell types is also likely to vary. As surface tension is related to the surface energy of a cell[5], it will be of much interest to evaluate the tension of cell types in the 4 principal sectors of the differentiating central nervous system viz. fore-, mid-, hind-brain and the spinal cord of chick. The importance of surface energy has previously been considered in morphogenesis of amphibian embryos[6].

The CNS of white leghorn chick embryos incubated at 38 °C and belonging to the age group between 6–25 days was dissected out. The cells from fore-, mid-, hind-brain and spinal cord were mechanically separated by sieving through a piece of silk in chick Ringer solution. The surface tension was estimated by Mudd's interfacial tension phenomenon[7] according to which a cell in contact with a fluid will form an interfacial zone and will be completely wetted by the fluid if it has an equal or lower tension than that of the cell. The phenomenon will not take place if the fluid has a tension higher than that of the cell surface. In this way, by examining under a microscope the tension of a cell against a fluid (e.g. glycerine diluted with glass distilled water) is established and the tension of the respective fluid is determined by the usual capillary method. The experiments were repeated 5 times with respect to a single embryo. The tension values were calculated against 5 embryos at each day of observation. All the experiments were carried out at a constant temperature of 21 °C.

*Results and discussion.* The surface tension of different cell types is shown in the Table. The surface tension of a cell depends much on its constitution, particularly the lipoprotein molecules at the membrane area which undergoes changes during differentiation[8]. When the surface tension is high, it indicates that the cell surface will be spherical to occupy a minimum area. A nerve cell undergoing differentiation remains at first spherical, indicating high tension value, but when the polar nature is attained during differentiation[9], the value of the surface tension becomes obviously decreased. This is in conformance with the present findings which indicate that the tension remains high at the early stage of development and with

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Means of surface tension (in dynes/100 cm) of the cell types of differentiating CNS of the chick

| Parts of CNS | Days 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 23 | 25 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fore-brain | 59.9973 | 60.0618 | 61.3503 | 55.9748 | 58.1292 | 58.4760 | 56.4060 | 47.8957 | 44.3364 | 44.5629 | 54.7190 |
| Mid-brain | 60.9498 | 60.7350 | 58.0310 | 57.1399 | 55.2452 | 55.0652 | 53.6894 | 48.2660 | 43.1723 | 41.4299 | 53.3724 |
| Hind-brain | 60.1883 | 60.7071 | 49.9640 | 48.8573 | 47.1043 | 46.1492 | 46.1342 | 45.7957 | 43.7233 | 41.2209 | 48.7844 |
| Spinal cord | 58.6016 | 59.6205 | 54.2214 | 49.8238 | 48.8318 | 45.0713 | 44.6550 | 42.2970 | 42.0962 | 39.4816 | 48.4700 |
| Mean | 59.9345 | 60.2811 | 55.8916 | 52.9489 | 52.3276 | 51.1904 | 50.2211 | 46.0636 | 43.3321 | 41.6738 | 51.3364 |

For comparison of parts means, c.d. at 5%, 1.4808.

the progress of differentiation the value of surface tension becomes decreased.

Though apparently the various parts of the differentiating CNS of chick do not show identical relationships so far as the surface tension of cell types are concerned, it may be observed from the Table that the values of the surface tension of the cell types of the fore- and mid-brain and those of the hind-brain and the spinal cord are very much statistically similar, as those values are always less than the c.d. values at 5% level. Thus, while the values for the fore- and mid-brain are quite different from those of the hind-brain and the spinal cord, as evident from the comparison of parts at 5% level, the values of the first two parts of the central nervous system, viz. fore- and mid-brain, are similar while the values of the hind-brain and those of the spinal cord are also alike. This phenomenon fits well with the fact that the anterior part of the primitive streak gives rise to the fore-brain while the posterior part of the streak gives rise to the spinal cord; mid-brain comes from the anterior half of the middle piece of the primitive streak while the hind-brain is the outcome from the posterior portion of the middle piece. Thus, during individuation, the differentiating cells distributed in the anteroposterior direction of the primitive streak maintain the original pattern of the gradient property.

The estimated regression lines for the data were calculated. The results indicated significant linear decrease of the surface tension as a function of the increasing age of the embryo. Computation of the correlation coefficient ($r$) of the data showed a perfect negative correlation in each case. Finally, the significance of $r$ was estimated by $t$-test. The apparent negative correlation was found to be real ($p < 0.01$) and was very strong since 80% of the total variance is due to regression.

*Zusammenfassung.* Es wird gezeigt, dass die Oberflächenspannung von Neuroblasten sich mit zunehmender Differenzierung ändert. Es kann ein kraniokaudaler Entwicklungsgradient nachgewiesen werden.

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## Fever in the Monkey Produced by the Direct Action of Pyrogen on the Hypothalamus[1]

The subhuman primate is generally less responsive than the human to bacterial pyrogens administered by the systemic route[2]. For example, the endotoxin of *Salmonella typhosa* or *Escherichia coli* injected i.v. in doses as high as 10–12 mg per kg produces little if any febrile response in the monkey unless the animal is restrained and covered with a blanket[3].

In the rabbit and cat, certain regions of the brain-stem are known to be sensitive to the presence of a bacterial pyrogen[4,5]. In fact, the local injection of an endotoxin or leukocytic pyrogen evokes a pyrexic response, the magnitude and latency of which depends upon the proximity of the injection to the anterior hypothalamic, pre-optic region. In the present experiments, we have found that different endotoxins injected locally in the rostral hypothalamus of the monkey are able to produce a dose-dependent fever, vasoconstriction and shivering.

*Materials and methods.* Male rhesus monkeys, weighing 5.0–6.5 kg were acclimated to special restraining chairs and maintained at a room temperature of 23–25 °C. Under rigid aseptic precautions, an array of microinjection cannulae guides was implanted stereotaxically in each monkey, according to surgical procedures described previously[6]. Seven to 10 days were allowed for recovery from surgery. During an experiment, body temperature was monitored continuously either from a thermistor bead implanted against the sagittal sinus, a probe inserted within the colon, or both.

A control solution or an endotoxin was injected into brain tissue in a volume of 0.8–1.2 µl at a depth of 6–10 mm beneath the cannula guide tube. *Shigella dysenteriae* (type SH 16), *Salmonella typhosa* (type 643) and *Escherichia coli* (type W3110) were grown to a concentration of $2–5 \times 10^9$ organisms per ml and then killed by toluene bubbling. The cells were then separated by centrifugation, washed and re-suspended in an equivalent volume of 0.9% pyrogen-free saline. Suspensions for micro-injection of the cell bodies were prepared in pyrogen-free 0.9% saline in dilutions ranging from 1:2 to 1:1000.

*Results and discussion.* When an endotoxin was microinjected into the anterior hypothalamus or pre-optic area, a long-lasting fever was produced which was accompanied by intermittent shivering, piloerection and a drawing up of the limbs characteristic of huddling. The Figure illustrates the pyrexic responses of three

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