show that the results obtained from the model (curves) give a satisfactory fit with those obtained from the fibre experiments (points). The slight deviation between model and fibre in the first series of experiments (Figure 1) can probably be attributed to distortion of the electric field caused by the presence of the nerve fibre in the live experiments. The relatively greater deviation between model and fibre in the second series of experiments (Figure 2) is probably due to the same factor, and to the fact that capacitative currents passing through the insulated electrode shafts modify the critical level (threshold) in an unknown manner.

Finally, using the data obtained from the model (and taking into account the conductivity of the electrolyte in the tank, etc.), the strength of the electric field at the node in the single nerve fibre experiments was established. Calculations, however, were only made for the first type of experiment (distance between node and stimulating electrodes in radial direction), since there was better agreement between live experiment and model in the first type than in the second (distance in longitudinal direction). The result gave a peak to peak amplitude of 50 ± 16.5 V/cm. Variance analysis of the value revealed that difference between the individual single nerve fibres could, however, not be established with certainty.

On the basis of the data presented, it can be concluded that middle-frequency current bursts evoke a true transverse stimulation of a node of Ranvier, and that the presence of longitudinal current components can be excluded.

The findings confirm previous observations on transverse stimulation of whole nerve trunk by means of middle-frequency current bursts[4]. They also show that a stronger electric field is required to attain threshold level when applying middle-frequency current than is the case when using conventional stimulation, namely, longitudinally applied direct current or low-frequency alternating current.

Zusammenfassung. Einzelne markhaltige Nervenfasern von *Rana esculenta* wurden mit Mittelfrequenz-Impulsen (20 kHz) quer durchströmt (Mittelfrequenz-Querreizung). Die Lage der Reizelektroden bezüglich eines Schnürrings wurde variiert, und die zugehörigen Reizschwellen wurden bestimmt. Die Simulierung der Experimente mit einem Modell zeigte, dass wirkliche Querreizung einer Nervenfaser im Bereich eines Schnürrings möglich ist, wobei für einen Schwellenreiz eine Feldstärke von 50 ± 16.5 V/cm (Scheitel zu Scheitel) notwendig ist.

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Dietary Fat and Tissue Cholesterol in Female Rats

Coronary disease occurs in men significantly earlier in life than in women. Pathological evidence indicates that coronary atherosclerosis increases in occurrence, severity and extent to age 60 in men and 80 in women[1]. A search for a causal factor in the environment cast early suspicion on dietary fat[2], although Mayer[3] feels that the decreased physical activity of the American today, in comparison to that of 50 or even 25 years ago, may also play a significant part.

In earlier work we reported the effects of exercise on young, adult male rats fed high and low fat diets[4,5]. The effects of exercise on young, adult female rats fed high and low fat diets has not been adequately studied and this report is one attempt toward correcting this imbalance in emphasis between the sexes.

Materials and methods. The 35 rats used in this study were female Sprague-Dawley strain obtained at 100 days of age and they were held on a commercial stock diet for 1 week prior to the start of the study. 5 rats were then randomly selected and sacrificed in order for initial carcass and serum composition to be determined[5].

The 30 experimental animals were assigned in groups of 15 to one of 2 diets as described in Table I. The high fat diet contained around 60% of its calories as fat while the low fat diet contained only 20% fat calories. Approximately 24% of the added fat was provided by a polyunsaturated fatty acid source (corn oil), which is representative of U.S. 'market basket' diets. The source of carbohydrate in both diets was a mixture of carbohydrates simulating that found in U.S. 'market basket' diets[6]. Lactalbumin, mineral and vitamin content of the high fat diet was elevated so that equicaloric amounts of the 2 diets provided an equal intake of these nutrients.

One group of 5 rats on each diet were forced to swim for 30 min each day in 27 °C water with a weight equivalent to 2% of body weight attached to the tail of each rat. A second group on each diet were placed in wire restraining cages and immersed in 27 °C water up to their necks for 30 min daily. The third group on each diet were allowed to remain sedentary in their cages. After 8 weeks the 30 animals were sacrificed and changes in serum and carcass composition determined.

Results. Animals fed the high fat diet gained proportionately more fat (Table II) than those fed the low fat diet ($p < 0.01$). This despite the fact that the calorie intake for rats gaining similar ingesta-free weights on the 2 diets was nearly the same. This confirms earlier

Table I. Composition of high fat and low fat diets fed to forced-exercised, immersed and sedentary female rats

	High fat (%)	Low fat (%)
Lactalbumin	36.70	27.50
Corn starch	6.47	22.70
Lactose	3.23	11.35
Dextrin	1.62	5.67
Sucrose	1.62	5.67
Glucose	1.62	5.67
Fructose	1.62	5.67
Corn oil	9.30	2.30
Beef tallow	29.50	6.90
Vitamin A and D concentrate	0.07	0.05
Cellulose	2.00	2.00
Salt mix, Jones and Foster[7]	5.40	4.00
Vitamin mix[5]	0.85	0.52
Total	100.00	100.00
Gross Calories (kcal/g)	6.45	4.60

Table II. Effects on body weight gain and gains in body components by swimming or immersing young, adult female rats for 30 min daily in 27 °C water while feeding them high or low fat diets

Dietary fat level-activity combination	Ingesta-free gain Weight (g)	Water (g)	Protein (g)	Fat (g)	Ash (g)
High fat – Swim	110.0 ± 4.8[a]	34.5 ± 2.1	27.4 ± 6.9	47.4 ± 8.7	1.7 ± 1.0
Low fat – Swim	85.6 ± 14.0	27.1 ± 7.2	23.8 ± 5.4	33.1 ± 4.1	1.3 ± 0.7
High fat – Immersed	90.6 ± 12.0	29.0 ± 5.8	23.4 ± 4.4	34.3 ± 5.6	2.4 ± 0.8
Low fat – Immersed	81.8 ± 19.8	35.9 ± 12.7	21.6 ± 5.1	17.4 ± 5.9	3.0 ± 1.0
High fat – Sedentary	140.0 ± 18.6	51.8 ± 5.8	25.3 ± 12.2	65.4 ± 13.7	2.3 ± 0.9
Low fat – Sedentary	82.4 ± 9.4	28.6 ± 7.3	19.5 ± 2.3	31.7 ± 1.5	1.5 ± 0.3

[a] Standard error of the mean.

work[4,5] that showed that dietary fat goes more readily to body fat than does dietary carbohydrate. On an equal calorie intake basis these female rats gained proportionately more fat on a high fat diet than on a low fat diet, as had male rats studied earlier.

Table III contains the serum cholesterol data which indicated that the sedentary, unhandled female rats had the lowest serum cholesterol concentration. Among these animals the fat level of the diet affected the linear regression of cholesterol gain and ingesta-free weight gain. Figure 1 is a graphic representation of the relationship between the 2 diet groups in the sedentary animals. Despite the fact that these 2 regression lines only represent 5 rats each, the linear correlation was very high and the

Table III. Comparison of mean caloric intakes and serum cholesterol levels as influenced by dietary fat level and swimming or immersion in 27 °C water for 30 min daily

Exercise treatment	Caloric intake High fat (kcal/day)	Caloric intake Low fat (kcal/day)	Serum cholesterol High fat (mg/100 ml)	Serum cholesterol Low fat (mg/100 ml)
Swimming	78.6 ± 1.4[a]	70.9 ± 3.1	84.0 ± 9.6	89.2 ± 4.8
Immersion	70.4 ± 2.9	65.2 ± 1.8	84.0 ± 8.4	110.4 ± 6.8
Sedentary	74.5 ± 1.9	66.1 ± 3.4	62.8 ± 6.4	64.4 ± 9.6

[a] Standard error of the mean.

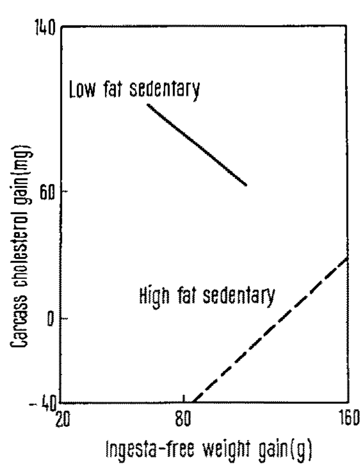

Fig. 1. Regression lines of body cholesterol gain vs. ingesta-free weight gain as influenced by dietary fat: carbohydrate ratio in sedentary female rats. The diet fed significantly affected these regressions only in the sedentary animals. Means of each regression coefficient (b) and the linear correlation (r) were as follows: low fat sedentary, $b = -0.808$, $r = -0.80$; high fat sedentary, $b = 0.924$, $r = 0.59$. The length of each line indicates the range of the data for the 5 animals in the group.

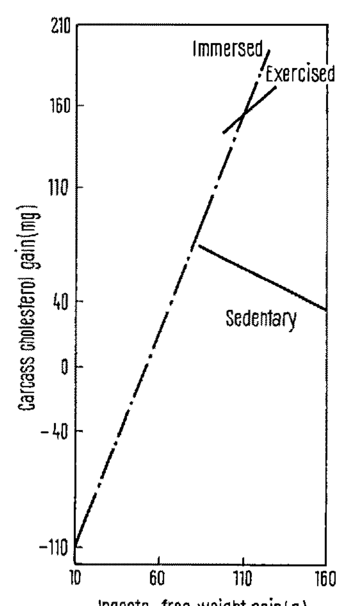

Fig. 2. Regression lines of body cholesterol gain vs. ingesta-free weight gain as influenced by exercise level in young, adult female rats. The effects of swimming and immersion were similar on both high fat and low fat diets and hence each line represents 10 observations. Means of each regression coefficient (b) and the linear correlation (r) were as follows: immersed, $b = 2.568$, $r = 0.83$; exercised, $b = 0.417$, $r = 0.14$; sedentary, $b = -0.477$, $r = -0.35$. The length of each line indicates the range of the data for the 10 animals in the group.

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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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