place most rapidly during the initial phase of heat treatment, the kinetics of change are neither linear nor logarithmic. After prolonged thermal stress, the degree of growth impairment tends toward equilibrium levels. It should be noted that the induction of growth inhibition follows a time course that is different from the curve of thermal death for the cells concerned. The latter exhibits an initial shoulder with little or no mortality, followed by a logarithmic decline as previously noted. These findings suggest that mortality and growth inhibition may stem from separate effects of thermal stress.

Relative growth of heat-treated cells as survivor colonies

Clonal sublines of heated cells	Colony diameters, mm	
	First passage	Fourth passage
1	0.11	3.70 ± 0.12
2	0.11	4.00 ± 0.11
3	0.09	2.86 ± 0.11
4	0.11	3.18 ± 0.13
5	0.07	4.37 ± 0.18
6	0.12	3.24 ± 0.10
7	0.13	3.35 ± 0.11
8	0.14	3.09 ± 0.09
9	0.13	3.05 ± 0.08
10	0.18	3.74 ± 0.19
Averages	0.12 ± 0.03	3.46 ± 0.14
Unheated controls	3.02 ± 0.09	3.78 ± 0.13
P	< 0.001	> 0.10

First and fourth passage cultures incubated 12 and 14 days at 37 °C respectively. Mean values and standard error based on measurements of 30 colonies for each series.

Dwarf colonies were subsequently studied in serial passage, to see whether reduced colony size after heat treatment represents a stable variation. For this work, 10 microcolonies were selected at 12 days from recovery cultures that had been set up with cells exposed to 46 °C for 120 min. The diameter of each colony was determined with an ocular micrometer, after which the colony was removed with trypsin-versene and the suspension inoculated into a 3 oz. prescription bottle. Clonal sublines of cells obtained in this fashion were carried for 3 passages in serial subculture, and were then plated out in petri dishes. After incubation for 14 days, the average colony size was determined for each population. The Table gives the results of these determinations. It is clear that no significant difference in colony size can be demonstrated between heated and unheated cells after serial passage. Thus, 'small colony formation' after heat treatment appears to represent a non-genetic change, in contrast to the relatively permanent impairment that may follow X-irradiation. The cellular basis for growth inhibition by thermal stress remains to be determined[7].

Zusammenfassung. Erhöhter Temperatur ausgesetzte Schweinenieren-Zellen produzieren, bei 37 °C kultiviert, Mikrokolonien. Eine Reduktion in der Wachstumsrate ist proportional zur Dauer und Intensität der Hitzebehandlung und verliert sich im Laufe der weitern Kultivierung.

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Studies on the Neurosecretory Cells in the Cerebral Ganglion of *Potamon magnum magnum* (Pretzman)

On the neurosecretory system of decapod crustaceans, a large number of morphological observations have been recorded[1-8]. These authors have attempted to classify the types of neurosecretory cells on the basis of the size of the cell, its way of discharging the product, the nature of the secretory granules and their position in the ganglion. It is apparent that work along these lines is needed, particularly in view of the fact that cytological differences in cell types often are parallel with differences in function. Further the importance of neurosecretory products in the physiology of many crustaceans is apparent from several recent reviews[9-11]. With this end in view, we have studied the neurosecretory cells in the cerebral ganglion of *Potamon magnum magnum* (Pretzman).

The neurosecretory groups of cells have been identified by using the Gömöri technique. Based on the shape, presence or absence of vacuoles in the cytoplasm, and the nature of secretion, the neurosecretory cells may be classified into 2 groups. One type of cell is large (20–45 μ) oval or polygonal with large central nucleus and vacuolated cytoplasm (Figures 1 and 2). These cells are with or without axons. They are mainly found in the anterior, ventral and lateral parts of the dorsal side of the ganglion. There are few cells of this type on the ventral side of the ganglion. The cytoplasm is basophilic, with a Nissl substance in a zone around the nucleus. The nucleus has

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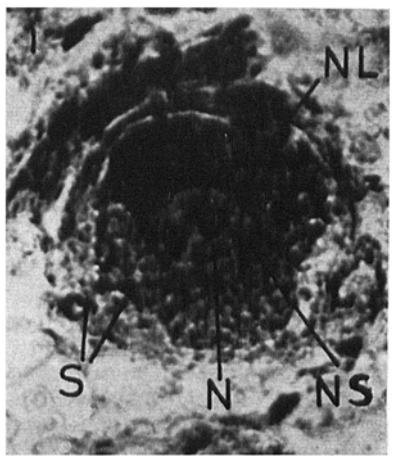

Fig. 1. Horizontal section of the cerebral ganglion of *Potamon magnum magnum* (Pretzman) showing large type of neurosecretory cells. N, nucleus; NL, nucleolus; NS, Nissl zone; S, secreroty droplet, Gömöri.

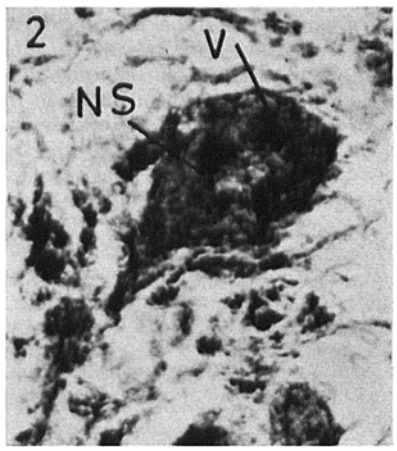

Fig. 2. Horizontal section of the cerebral ganglion of *Potamon magnum magnum* (Pretzman) showing the association of the secretory droplets with the vacuoles in the peripheral region of the cytoplasm of the neurosecretory cell. V, vacuole containing secretory droplet, Gömöri.

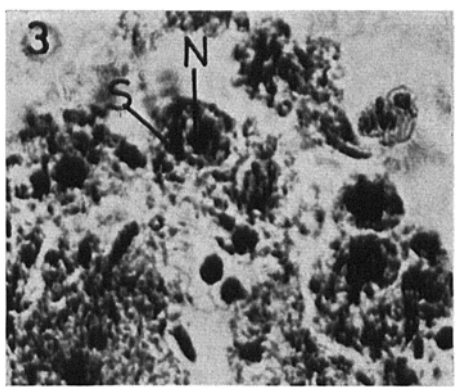

Fig. 3. Horizontal section of the cerebral ganglion of *Potamon magnum magnum* (Pretzman) showing small neurosecretory cells. N, nucleus; S, neurosecretory droplets, Gömöri.

a densely staining basophilic membrane and a markedly acidophilic nucleoplasm. The nucleolus is large, basophilic and invariably found against the nuclear membrane. The size of the nucleolus is variable. It discharges some substance into the surrounding karyoplasm. The basophilic, chromatin-like granules in the nucleus are correlated with the nucleoli, for a large nucleolus is occasionally surrounded by the basophilic granules at the periphery. The nucleus does not show any modification in shape during the secretory cycle as of the giant cells in the thoracic ganglion[12]. The neurosecretory granules usually occur in aggregates just outside the Nissl zone and at the extreme periphery of the cell. A basophilic cytoplasmic substance is very frequently found in the region adjacent to the nuclear membrane; it is called basophilic cytoplasm or basophilic zone. The substance, as well as typical Nissl bodies, is stained with Chrome hematoxylin. It is probable, therefore, that the basophilic substance may be identical with the Nissl substance. It is suggested that the Nissl substance or basophilic cytoplasm is directly or indirectly affected by the action of the nucleus and is gathered near the nuclear membrane in a certain stage of its activity. In early stages of secretion the cytoplasm is more dense and granular but in later stages it becomes finely vacuolar. It indicates that the discharge of neurosecretory granules may take place, at least in part, at the periphery of the cell body, since the fact that the vacuolar contents are involved is indicated by the close association of the neurosecretory granules with the peripheral vacuolation (Figure 2). The second type of cell (Figure 3) is relatively small (8–20 μ) with little cytoplasm and large spherical nucleus. These cells have very fine axons. They are scattered among large cells in the anterior, lateral and posterior parts of the dorsal and ventral sides of the ganglion. Neurosecretory granules similar to those in the large cells are present in the cytoplasm and are particularly concentrated around the nucleus. These cells are not as active as the first type.

Since the cytoplasmic inclusions found in these cells have some relation with the neurosecretory products, it is, therefore, profitable to investigate the cytoplasmic inclusions by means of the cytological or cytochemical techniques in these cells. Work on these lines is in progress[13].

Zusammenfassung. Mit der Gömöri-Technik ist es möglich, zwei Typen neurosekretorischer Zellen im zerebralen Ganglion von *Potamon magnum magnum* (Pretzman) nachzuweisen. Der eine Zellentyp ist gross, oval oder vieleckig, besitzt vakuolisiertes Zytoplasma und einen grossen zentralen Kern. Der Kernmembran anliegend befindet sich eine Zone basophiler zytoplasmatischer Substanz (einige dieser Zellen enthalten Axone). Der andere Zellentyp ist klein, besitzt nur wenig Zytoplasma, jedoch ebenfalls einen grossen Kern. Diese Zellen lassen nur geringe neurosekretorische Tätigkeit erkennen. Die Neurosekret-Granula wandern in das Perikaryon oder in die Axone ein.

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