	Haptoglobintypen 1–1		1–2		2–2		gesamt		Gen-Frequenzen H_p 1	H_p 2	χ^2	Statistische Signifikanz
Kontrollgruppe	114	17,1%	316	47,7%	232	35,2%	662	100%	0,409	0,591		
Leberzirrhose	14	31,1%	17	37,7%	14	31,1%	45	100%	0,499	0,501	35,69	$p < 0{,}001$
Chronische Hepatitis	6	12,5%	26	54,2%	16	33,3%	48	100%	0,395	0,605	7,77	$0{,}05 > p > 0{,}01$

Diskussion. In der Literatur findet man eine Reihe von Arbeiten, die sich mit der Beziehung der verschiedenen Haptoglobintypen zu verschiedenen Krankheitszuständen befassen[7–9].

Die Leber bildet für das Haptoglobin ein Schlüsselorgan. Nach Ansicht der meisten Autoren wird das Haptoglobin in der Leber synthetisiert[10,11]. MERILLA et al.[12] haben nach einer Lebertransplantation beim Empfänger die Verwandlung des Haptoglobintyps 2–1 in den Typ 2–2 des Spenders festgestellt. Bei schwerer Leberschädigung verschwindet das Haptoglobin aus dem Serum[9]; eine akute Leberstörung ist von einem Aufsteigen des Haptoglobinspiegels begleitet. Die Feststellung der Haptoglobintypen im Serum in bezug auf Krankheiten der Leber scheint uns daher bedeutsam zu sein.

In unserer Zusammenstellung von Patienten mit Leberzirrhose wurde ein wesentlich häufigeres Auftreten des homozygoten Typs 1–1 nachgewiesen. Während in der normalen Bevölkerung des Prager Kreises die Träger dieses Typs nur 17% einnehmen, sind unter den Patienten mit Leberzirrhose 31% zu finden. Dieser Unterschied ist äusserst signifikant.

Die Verteilung der einzelnen Haptoglobintypen in der Population ist markant von der geographischen Lage beeinflusst. Breite Rassengruppen unterscheiden sich in der Frequenz der Haptoglobintypen[13–15]. Es ist sicher von Interesse, dass wir bei Leberkrankheiten einem häufigeren Vorkommen bei gewissen geographischen Völkergruppen begegnen[16]. Die Beobachtung dieser von der Bevölkerugsart abhängingen Beziehung wäre hinsichtlich unserer Ergebnisse sehr aufschlussreich.

Obwohl der Nachweis von Beziehungen gewisser genetischer Faktoren zu verschiedenen Krankheiten schwierig ist, steht die Wahrscheinlichkeit nahe, dass der Einzelmensch mit seinem bestimmten, erblich bedingten Kode eine Prädisposition zu gewissen Krankheiten besitzt, gegebenenfalls zu einem weniger günstigen Krankheitsverlauf. Bei Leberkrankheiten wären zu einer solchen Patientengruppe Träger des Haptoglobintyps 1–1 zu rechnen.

Summary. More frequent occurrence of the homozygote haptoglobin type 1–1 was found in patients with liver cirrhosis in comparison with its frequency in the healthy population of Prague.

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Ionic Mechanisms of Opposite Synaptic Actions of an Interneuron in the Abdominal Ganglion of *Aplysia*

An identified cell (L10) of the abdominal ganglion of the marine gastropod *Aplysia californica* makes cholinergic monosynaptic connections with several identified follower neurons in the ganglion, producing inhibitory synaptic potentials in some cells (L1–L6) and excitatory potentials in others (R15, R16)[1]. The present experiments examine the ionic mechanisms of the opposite synaptic actions and the response of the different postsynaptic cell types to iontophoretically applied acetylcholine.

The interneuron and follower cells were impaled under direct visual control with double barrel microelectrodes filled with 3 *M* KCl. ACh was applied to the follower cell soma from a micropipette using constant current pulses. In solutions containing reduced sodium concentration, NaCl was replaced with *Tris* Cl. Chloride-free sea water was prepared by substituting equivalent concentrations of the propionate salt for each cation-Cl compound.

The reversal potential for the PSP and the ACh response was determined in both inhibitory and excitatory follower cells. Figure 1, A shows that when the inhibitory follower L5 is hyperpolarized, both the IPSP and the ACh response are nullified and then invert to become

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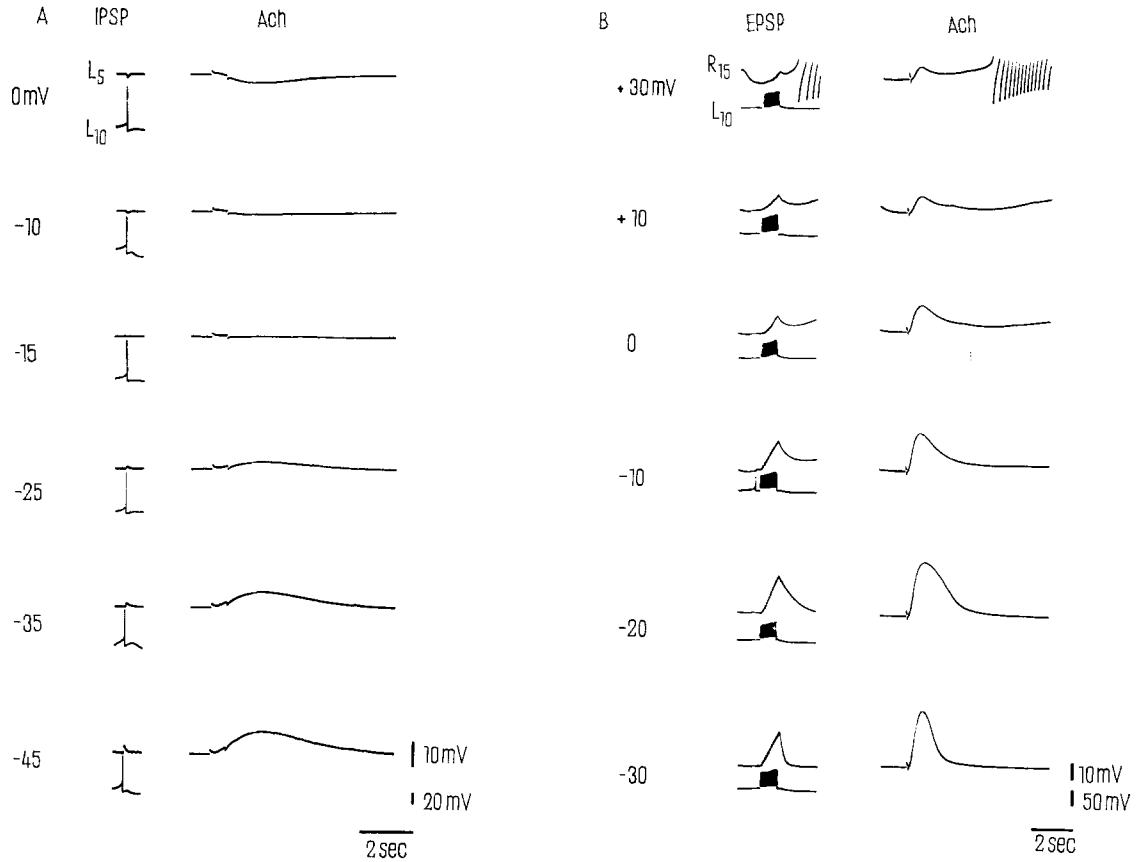

Fig. 1. Reversal potentials for synaptic and ACh responses in follower cells of interneuron L10. A. Intracellular recordings from inhibitory follower L5. Upper traces in left column show IPSP from L10 spikes (lower traces), and right column shows ACh responses. 0 represents the resting potential (actual value: —44 mV), and negative numbers are mV hyperpolarized from resting. B. From excitatory follower R15. Same arrangement as part A. except trains of spikes from L10 were used. Positive numbers are mV depolarized. At 30 mV hyperpolarized anomolous rectification has reduced amplitude of responses. Resting potential: —67 mV.

depolarizing responses as the membrane potential is made more negative. In the 3 inhibitory follower cells studied (L2, L3, L5; total of 22 measurements) the reversal potentials for the IPSP and the ACh response were not significantly different. The mean reversal potential for all the inhibitory responses was 16.8 mV ($\pm$ 2.9 mV, S.D.) negative to the resting membrane potential, placing the reversal level in the range of -55 to -65 mV.

Figure 1, B shows comparable data for an excitatory follower cell (R15). This is a spontaneously bursting neuron which exhibits a large degree of delayed rectification, and it was not possible to depolarize the cell sufficiently to invert the depolarizing potentials. Values for the reversal potentials for the EPSP and the ACh response were therefore obtained by extrapolation from reliable points around the resting level. Using this method the reversal potentials for the 2 responses were not significantly different. The mean reversal potential for the excitatory responses in R15 (5 EPSP and 12 ACh measurements) was 28.6 mV ($\pm$ 4.6 mV, S.D.) positive to the resting membrane potential, placing the reversal level in the range of 0 to -20 mV.

Figure 2 illustrates the changes in both the PSP and the ACh response in each cell type when the ganglion is bathed in different ionic solutions. In L5 both the IPSP and the ACh response invert and become depolarizing at the resting membrane potential in Cl-free sea water (A). Extrapolated values for the reversal potentials in Cl-free medium are 35 to 40 mV more positive than those measured under normal conditions (5 experiments). Alterations in Na concentration produced no significant change in the reversal potential of the ACh response in this cell, but low Na solutions reduce the input resistance of the cell causing a decrease in amplitude of the ACh response. Low Na concentrations prevent firing of the interneuron and the IPSP could not be tested. When the external K concentration was changed to $^1/_{10}$, $^1/_2$ or twice the normal amount no significant effect on the inhibitory reversal potentials was observed[2]. Similar results have been reported on other molluscan preparations[3].

The removal of Cl ions had no effect on the reversal potential of either the EPSP or the ACh response in R15

[2] A second, more pronounced and prolonged inhibitory potential is often seen to succeed the initial IPSP described here. This response has been alternatively attributed to an electrogenic Na pump [H. PINSKER and E. R. KANDEL, Science *163*, 931 (1969)] or an increase in K conductance [J. S. KEHOE and P. ASCHER, Nature *225*, 820 (1970)].

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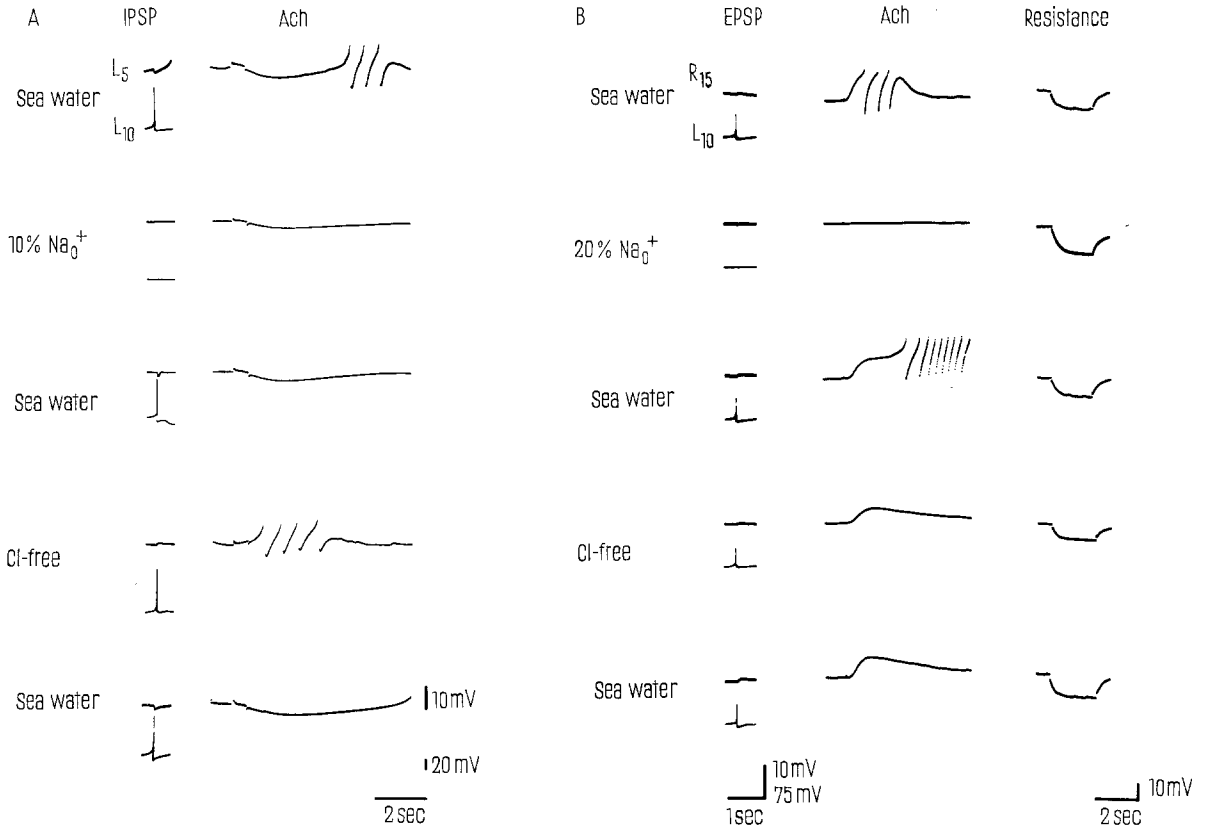

Fig. 2. Effects of changing ionic solutions on synaptic and ACh responses in follower cells of L10. A. From L5 showing inversion of IPSP (left column) and ACh response (right) in Cl-free sea water. Low Na has no effect on reversal level; decreased amplitude of response attributable to reduced input resistance of the cell. All records at resting membrane potential. B. From R15. Left column: EPSP; middle: ACh response; right: potential change induced by injection of constant current square pulses to test resistance. All records at resting potential. Cl-free solution has no net effect (note input resistance is lower); reducing external Na abolishes the ACh response. The interneuron does not fire in low Na, and PSP's are not seen in A. or B. under this condition.

(Figure 2, B). Reduction in the external Na concentration, however, produced a clear diminution of the ACh response amplitude, and the extrapolated reversal potentials in low Na showed a shift in the expected negative direction. For example, when external Na was reduced to 50% of normal, the reversal potential for the ACh response shifted on the average 18 mV negative to the control values. It was not possible, however, to invert the depolarizing ACh response at any low Na concentration, and if Na was reduced to 20% of normal or less, the response disappeared altogether, concommitant with a marked decrease in the input resistance of the cell. Thus, a strict dependence of the ACh response on external Na concentration could not be demonstrated. Changes in external K concentration had no effect on the reversal level of the excitatory responses; but one cannot exclude the possibility that a K conductance increase becomes manifest at depolarized levels of membrane potential[4]. The effects of very low external Na concentrations may imply some alteration in the ACh receptor properties of the membrane. Nonetheless, the results do indicate that Na is the predominantly important ion moving during the excitatory responses in R15[4,5].

Thus the same transmitter (ACh) released from a single interneuron can induce an exclusively Cl-dependent conductance change in some cells and a conductance change in other cells which does not depend upon chloride but is primarily Na-dependent.

Zusammenfassung. Im Abdominalganglion von *Aplysia* erzeugt ein einzelnes Interneuron monosynaptische Cl-abhängige IPSP's in einigen postsynaptischen Neuronen und monosynaptische Na-abhängige EPSP's in anderen Neuronen. Iontophoretisch appliziertes Acetylcholin ahmt diese synaptischen Potentialen in jedem der nachgeschalteten Zelltypen nach.

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