

tion 2. Our results are not in agreement with those of Eckert (1976), who found a much faster disintegration time of hard gelatin capsules in vivo. However, the discrepancy might be explained by the findings of Casey et al (1976) which suggests that the in vivo dispersion time of hard gelatin capsules is dependent on the solubility of the content of the capsule. Both uncoated and coated ASA can be regarded as insoluble in relation to the NaHCO<sub>3</sub> used by Eckert. Another important factor in the latter study is probably the formation of CO<sub>2</sub>, which could be expected to give a very fast dispersion of the content of the capsule.

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## Are there opiate receptors in the invertebrates?

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In the vertebrates it is thought that the regulation of dopamine neurons is influenced by morphine and morphine-like neuropeptides through opiate receptors (see Kuschinsky 1976). Naloxone can antagonize this influence. Furthermore high-affinity receptor binding occurs in the vertebrate but not in the invertebrate nervous system and because of this it has been suggested that opiate receptors do not exist in the invertebrates (Simantov et al 1976). This preliminary report shows that methionine-enkephalin has a specific effect on the dopamine neurons in the snail *Helix pomatia* which can be reversed by a previous injection of naloxone. This suggests that opiate receptors may indeed be present in the invertebrates.

Shells were removed from snails and 50 or 100 µg methionine-enkephalin in a volume of 0.1 ml snail saline (Meng 1960) injected directly into the auricle. Controls were injected with 0.1 ml saline alone while other animals received 0.1 ml saline together with either 100 µg naloxone or 100 µg naloxone plus 100 µg methionine-enkephalin. Forty min thereafter, the ganglia were dissected and analysed either for their dopamine or homovanillic acid (HVA) content, following the methods of Palkovits et al (1974) and Andén et al (1963).

The results showed that 50 µg methionine-enkephalin produced an increase in both dopamine (17.7 ± 2% n = 6) and HVA (14.9 ± 2% n = 8) compared with the controls which received only saline (dopamine concentration = 9 (s.d. 0.5; n = 10) and HVA concentration = 0.5 (s.d. 0.08 µg; n = 10)). Injection of 100 µg substance had an even greater effect, increasing the dopamine content by 26% s.d. 4% (n = 6) and the

HVA content by 18.8% s.d. 3% (n = 8). Snails which received either methionine-enkephalin together with naloxone or naloxone alone showed no significant change (Students *t*-test) in their concentrations of dopamine or HVA.

The present data thus show that methionine-enkephalin can, as with vertebrates, alter the dopamine and HVA content in invertebrate nervous tissue and this can be antagonized by naloxone. This would therefore indicate the presence of opiate receptors in the invertebrates, although clearly more experiments are required to substantiate this. The effect of enkephalin on dopamine content and metabolism in the snail seems to be specific, since in preliminary initial experiments no alteration could be detected in the levels of either 5-HT or amino acids in the c.n.s. following methionine-enkephalin treatment.

During the preparation of this report, Stefano & Catapane (1978) independently observed that enkephalin can alter dopamine content in the invertebrate c.n.s.

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