TABLE 1. *Distribution of octopamine in* Octopus *neural tissues*

	Weight of tissue (mg)	Octopamine (μg/g)
	Supraoesophageal ganglia	
Vertical lobes	8·8±1·6 (5)	0·72±0·19 (6)
Superior frontal lobe	4·9±0·5 (6)	0·55±0·20 (6)
Inferior frontal lobe	2·0±0·3 (5)	1·30±0·08 (5)
Superior buccal lobe	3·7±1·1 (6)	4·57±1·07 (6)
Posterior buccal lobe	2·6±0·7 (6)	2·05±0·76 (5)
Basal lobes system	31±6 (6)	1·23±0·41 (5)
Optic lobes	152±22 (6)	0·74±0·15 (7)
	Suboesophageal ganglia	
Anterior region	31±5 (3)	1·00±0·15 (3)
Median region	23±10 (3)	0·70±0·09 (3)
Posterior region	36±8 (3)	0·57±0·07 (3)
	Other tissues	
Stellate ganglia	15±2 (9)	0·24±0·07 (10)
Posterior salivary gland	932±139 (10)	1390±220 (10)
Anterior salivary gland	290 (1)	0·04, 0·02 (2)
Systemic heart	261±72 (5)	0·03±0·02 (5)

Values are means±S.E.M. in μg/g of fresh tissue. Number of experiments in parentheses.

When homogenates of the optic lobes were subjected to centrifugation on density gradients (15% glucose to 45% sucrose, wt/wt) some of the octopamine was found to be bound to particles. The octopamine-containing particles were found in the same regions of the gradient (21 and 28% sugar) as were noradrenaline and dopamine.

The fact that the concentration of octopamine varies over a 20-fold range in *Octopus* neural tissues, the decrease after treatment with reserpine, and the similarity in the amount and subcellular distribution of octopamine, noradrenaline and dopamine all suggest that octopamine is contained in neurone where it may function as a neurotransmitter.

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Hypnogenic properties of succinic semialdehyde and its fatty acid derivatives

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Several short chain fatty acid derivatives, including 4-hydroxybutyric acid (GHB) and 1,4-butanediol (1,4BDL), have hypnogenic properties in various species (Gessa, Spano, Vargiu, Crabai, Tagliamonte & Mameli, 1968). The experiments described

here were performed to determine the metabolic relationship between these substances which are of special interest in view of the establishment of GHB as a normal metabolite in brain (Roth & Giarman, 1970). There is already evidence that 1,4BDL is converted to GHB *in vivo* (Roth & Giarman, 1968; McCabe & Bessman, 1971).

All compounds were administered intraperitoneally or intraventricularly, by the method of Brittain & Handley (1967), to mice of the C57/BL strain. The doses required to induce 30 min sedation after intraperitoneal injection were as follows (in mMol/kg body weight): nembutal, 0·17; succinic semialdehyde (SSA), 1·45; imidazole-acetic acid (ImA), 2·51; GHB, 2·20; and 1,4BDL, 1·80. After intraventricular injection the effective doses (in μg) were, nembutal, 100; SSA, 180; ImA, 45; GHB, 250; whilst 1,4BDL was relatively inactive. In addition, 3-hydroxypropionic acid, 2-hydroxy butyric acid, 3-hydroxybutyric acid and succinic acid were inactive at doses up to 12 mMol/kg when given intraperitoneally.

The latency of onset of sedation after SSA, GHB, and 1,4BDL support the theory that 1,4BDL is converted to GHB *in vivo*, that is SSA<GHB<1,4BDL, but the potency and short latency of SSA is interesting since SSA has never been directly implicated in the metabolism of GHB either *in vivo* or *in vitro*.

The potentiation of GHB sleeping time by ethanol (McCabe, Layne, Sayler, Slusher & Bessman, 1971) suggests that alcohol dehydrogenase (AD) could be involved in GHB metabolism. Both pyrazole and ImA are inhibitors of AD and potentiate GHB sleeping time by at least 200%. Pyrazole also diminished the 1,4BDL sleeping time whilst at the same time increasing the latency of onset of sedation.

Although Wollemann & Devenyi (1963) reported that GHB could be oxidized by rat brain extract at pH 10 and concluded that the enzyme lactate dehydrogenase (LDH) was responsible, we have not been able to confirm their findings. Neither GHB nor 1,4BDL was significantly oxidized by mammalian liver or brain LDH under conditions where lactate was readily oxidized. However, 1,4BDL, but not GHB was oxidized by liver AD. We have not been able to find any AD activity in brain by conventional assay procedures.

It is concluded that 1,4BDL is converted *in vivo* to GHB by AD, probably in the liver, but the relationship between GHB and SSA is still unclear. A four-carbon chain with a terminal carboxyl group and an aldehyde or primary alcohol group in the 4 position appear to be necessary for hypnogenic activity.

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