known properties of presynaptic inhibition. Mendell[4] reported the occurrence of positive dorsal root potentials induced by stimulation of group III muscle afferents and suggested that positive dorsal root potentials may be the result of inhibition of a tonic depolarizing pathway. Similarly one can propose that the excitability decrease in the GS secondaries may result from the inhibition of the internuncial D-cells depolarizing the intraspinal terminals of the GS group II afferents. GABA may act as neurotransmitter in this presynaptic disinhibitory circuit, since the GABA-antagonist bicuculline[5] antagonized the depressing effect of the conditioning PDP volleys on the GS secondary afferent excitability.

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Adrenal responses to hypoxia and hypercapnia in the young calf[1]

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Summary. Quantitative analysis of adrenal responses to moderate hypoxia and hypercapnia in the conscious calf shows that the sensitivity of the adrenal cortical response far exceeds that of the adrenal medulla.

Adrenal responses to hypoxia and hypercapnia have been quantified in conscious calves, 3–5 weeks after birth, using the 'adrenal clamp' technique[3] to collect the effluent venous blood from the right adrenal gland. After recovery from surgery the animals were habituated to wear a light, transparent 'helmet' through which air was perfused at a rate of 15 l/min. Hypoxia or hypercapnia was induced by infusing a mixture of gases through the 'helmet' for 30 min as follows:

		Air (l/min)	Nitrogen (l/min)	Carbon dioxide (l/min)
Hypoxia	Grade I (n = 7)	7.5	7.5	–
	Grade II (n = 4)	11.5	3.5	–
Hypercapnia	Grade I (n = 7)	13.5	–	1.5
	Grade II (n = 6)	14.25	–	0.75

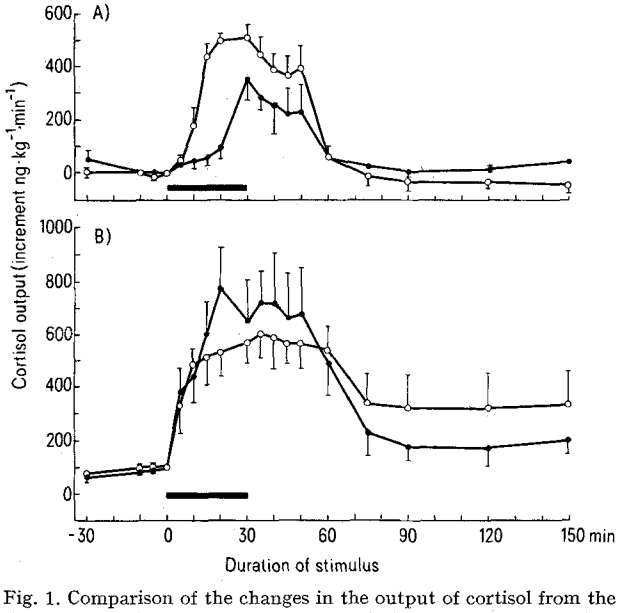

Fig. 1. Comparison of the changes in the output of cortisol from the right adrenal gland in response to hypoxia (A) and hypercapnia (B). Open circles: Grade I stimuli. Closed circles: Grade II stimuli. Horizontal bars: duration of stimulus. Vertical bars: SE of each mean value.

Cortisol and corticosterone were measured by competitive protein binding[4] and catecholamines by a modification of the trihydroxyindole method[5]. Adrenal blood flow was determined gravimetrically during each sample to allow calculation of hormone output.

During grade I hypoxia the P_{O_2} of the arterial blood fell to less than half the initial value within 5 min. Thereafter it declined more slowly to between 20 and 25 mm Hg during the last 10 min. Grade II hypoxia constituted a less severe stimulus; arterial P_{O_2} was reduced by c60% but did not fall below 30 mm Hg at any stage. Grade I hypercapnia caused a progressive increase in arterial P_{CO_2} from c40 mm Hg to maximum values of between

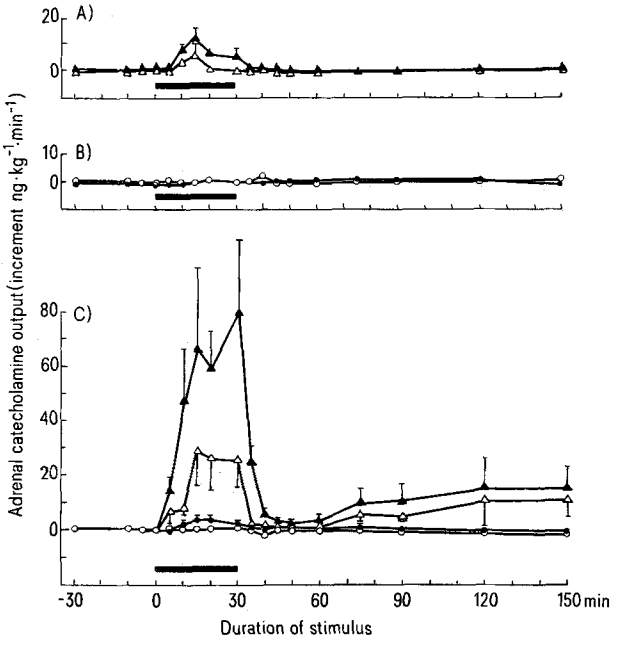

Fig. 2. Comparison of the changes in catecholamine output from the right adrenal gland in response to hypoxia or hypercapnia.
A Grade I hypoxia. ▲ = noradrenaline; △ = adrenaline. *B* Grade II hypoxia. ● = noradrenaline; ○ = adrenaline. *C* Hypercapnia. ▲ = noradrenaline, grade I; △ = adrenaline, grade I; ● = noradrenaline, grade II; ○ = adrenaline, grade II.
Horizontal bars: duration of stimulus. Vertical bars: SE of each mean value.

100 and 120 mm Hg. Grade II hypercapnia produced a 2fold increase in P_{CO_2}.

Cortisol output rose more abruptly and fell more slowly during hypercapnia than hypoxia (figure 1). However, the highest values recorded during both grades of hypercapnia were comparable with those during grade I hypoxia. Similar rates of secretion occur in response to infusions of supramaximal doses of ACTH[6] indicating that both stimuli can elicit a maximal secretory response from the adrenal cortex. The pattern of secretion of corticosterone was the same as that of cortisol but the amounts released were less.

Comparatively trivial amounts of catecholamines were released from the adrenal medulla during hypoxia or grade II hypercapnia. In contrast, grade I hypercapnia caused the release of quite substantial amounts of noradrenaline together with smaller but significant amounts of adrenaline (figure 2). This pattern of release differs from that which occurs in response to intense hypoxia in the conscious calf when adrenaline is invariably the predominant amine and may be secreted at a rate of up to 18,000 ng/kg^{-1} min^{-1}[7].

These results show that a maximal adrenal cortical response can occur in these animals in response to both hypoxia and hypercapnia of insufficient intensity to elicit significant release of catecholamines from the adrenal medulla. It is concluded that the sensitivity of the pituitary-adrenal cortical axis far exceeds that of the adrenal medulla to both these stimuli in the conscious calf.

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Effects of ibotenic acid, quisqualic acid and their relatives on the excitability of an identifiable giant neurone of an African giant snail (Achatina fulica Férussac)

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Summary. An identifiable giant neurone, PON (periodically oscillating neurone), of Achatina fulica Férussac, inhibited by erythro-β-hydroxy-L-glutamic acid, was also inhibited by 2 relatives of β-hydroxy glutamic acid, ibotenic acid and quisqualic acid. These substances similarly showed the effect on the neurone even in the chloride-free medium.

Takemoto et al.[2–4] isolated a heterocyclic amino acid (ibotenic acid, α-amino-3-oxo-4-isoxazoline-5-acetic acid) which shows a fly-killing effect, from the fungus, Amanita strobiliformis (Paul.) Quer. They[5,6] also isolated another heterocyclic amino acid (tricholomic acid, α-amino-3-oxo-isoxazolidine-5-acetic acid) having the same effect from another fungus, Tricholoma muscarium Kawamura. Quisqualic acid [β-(3, 5-dioxo-1, 2, 4-oxadiazolidin-2-yl)-L-alanine], of which was an anthelminthic effect (anti-Ascaris) demonstrated[7], was isolated also by Takemoto et al. from Quisqualis Fructus[8–10].

In the present study, we attempted to examine effects of these biologically active heterocyclic amino acids and their relatives on the excitability of a giant neurone (the PON, periodically oscillating neurone) identified in the subesophageal ganglia of Achatina fulica Férussac. We demonstrated previously[11,12] that the PON was inhibited remarkably by β-hydroxy glutamic acid (BHGA, especially erythro-L-type), the chemical structure of which resembles those of the heterocyclic amino acids isolated by Takemoto et al., although L-glutamic acid did not affect the same neurone.

Experimental methods were described in detail in the preceding papers[12,13]. In the present study, we examined the effects of the above-mentioned heterocyclic amino acids, not only in the physiological medium but also in the chloride-free condition. To obtain the latter condition, we perfused the dissected ganglia with the chloride-free solution (replaced with acetate) for more than 1 h.

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