

A comparison of the hormone treated groups however, shows that progesterone does not reduce the tension in response to electrical stimulation. Similarly, there is no significant difference between the oestrogen- and the progesterone-dominated uteri in the degree of calcium binding. These results contrast with similar studies in the rabbit (Schofield, 1955; Csapo, 1956) and pig (Knifton, 1966).

The only effect of progesterone on the rat myometrium that this study reveals therefore, is a decrease in the sensitivity to oxytocin.

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### Nature of adrenergic receptors on the skin melanophores of *Rana tigrina*

SIR,—This report describes the experiments conducted to determine the nature of adrenergic receptors on frog melanophores.

Adult *Rana tigrina* (80-350 g) were anaesthetized by injection of pentobarbitone sodium (50 mg/kg) into the abdominal cavity. Drugs, dissolved in 0.6% saline or amphibian Ringer solution, were injected through the cannulated left branch of thoracic aorta (Bhide & Gupta, 1967) or through one of the liver lobes. Skin colour was observed with the naked eye, and melanophores of the web skin were graded by the method of Hogben & Slome (1931). In experiments in conscious frogs, drugs dissolved in distilled water were injected into the abdominal cavity. From 3 to 6 frogs were used for each dose of each drug and the average change in melanophore index recorded (Tables 1 and 2).

Noradrenaline, which acts predominantly on  $\alpha$ -type adrenergic receptors was more potent in concentrating melanin in melanophores than adrenaline which

TABLE 1. EFFECT OF ADRENERGIC DRUGS ON THE MELANOPHORE INDEX IN *Rana tigrina*

Drug	Anaesthetized frogs		Conscious frogs	
	Dose mg/kg (No. of frogs)	Average change in the melanophore index Decrease (-) Increase (+)	Dose mg/kg (No. of frogs)	Average change in the melanophore index Decrease (-) Increase (+)
Noradrenaline hydrochloride ..	0.1 (7)	-1.2	1.0 (4)	-2.0
	0.5 (7)	-1.8	4.0 (9)	-3.5
	1.0 (5)	-2.6		
Adrenaline hydrochloride .. ..	0.5 (3)	-0.75	0.3 (5)	-0.7
	1.0 (7)	-1.25	1.0 (3)	-1.33
	2.0 (5)	-1.8	3.0 (3)	-2.33
Isoprenaline sulphate .. ..	0.3 (5)	+0.67	0.3 (3)	+0.66
	1.0 (3)	+1.0	1.0 (4)	+1.0
	3.0 (4)	+0.88	3.0 (6)	+1.5

TABLE 2. EFFECT OF ADRENERGIC BLOCKING DRUGS ON NORADRENALINE-INDUCED CHANGE IN MELANOPHORE INDEX IN *Rana tigrina*. Phenoxybenzamine was given 40 min and other blocking drugs 5-10 min before noradrenaline

Blocking agent (dose mg/kg)	Anaesthetized frogs		Conscious frogs	
	Dose of noradrenaline mg/kg (No. of frogs)	Average decrease in melanophore index	Dose of noradrenaline mg/kg (No. of frogs)	Average decrease in melanophore index
None (taken from Table 1)	1.0 (5)	2.6	1.0 (4)	2.0
Phenoxybenzamine (25.0)	1.0 (3)	0.0		
	2.0 (4)	0.2	2.0 (4)	0.0
	6.0 (6)	1.25	6.0 (3)	0.0
Dihydroergotamine methane- sulphonate (1.0)	1.0 (6)	0.5		
	6.0 (4)	1.6		
Yohimbine hydrochloride (1.5)	1.0 (7)	0.6		
Phentolamine methanesulphonate (0.25)	1.0 (4)	0.38		
Pronethalol hydrochloride* (2.0)	1.0 (4)	1.0	1.0 (4)	1.9
INPEA hydrochloride* (2.0)	1.0 (4)	1.62	1.0 (5)	1.6

\* These drugs themselves caused blanching and decreased melanophore index by 0.5 to 2.0. Further decrease induced by noradrenaline is given here.

acts on both  $\alpha$ - and  $\beta$ -receptors (Table 1). Phenoxybenzamine, dihydroergotamine, phentolamine and yohimbine, which block  $\alpha$ -adrenergic receptors, blocked or much reduced the action of an effective dose (1 mg/kg) of noradrenaline (Table 2). This confirms previous reports that ergotamine (Lerner, 1959) and phenoxybenzamine (Bhide & Gupta, 1967) block the action of adrenaline and noradrenaline on frog melanophores.

On the other hand, isoprenaline produced dispersion of melanin and this action was blocked by  $\beta$ -adrenergic blocking agents. Pronethalol and INPEA (*N*-isopropyl-*p*-nitrophenylethanolamine), themselves caused some concentration of melanin and did not block further action of noradrenaline on melanophores.

The present work suggests that the adrenergic receptors on skin melanophores of *Rana tigrina* are predominantly of the  $\alpha$ -type and they are responsible for colour change induced by adrenaline and noradrenaline. It also suggests occurrence of  $\beta$ -type adrenergic receptors on the melanophores.

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