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Seasonal variation in the resistance of rats

SIR,—For the past three years, the sensitivity of rats to anaphylactic shock has been found to show seasonal variation. It was first thought that the antigen or the adjuvant might have been modified in the summer months but this possibility was finally ruled out by our obtaining similar results with different antigens and different adjuvants. It has since been found that the resistance of the animals varies with the season, as illustrated in Table 1.

TABLE 1. CHANGES IN THE MORTALITY RATE OF WISTAR RATS SUBJECTED TO ANAPHYLACTIC SHOCK AT DIFFERENT TIMES OF THE YEAR 1964

Month	No. of rats tested	No. of deaths	Mortality rate (%)
Jan.–Feb.	45	40	89
April–May	28	20	71
July–Aug.	28	4	14
Nov.–Dec.	36	33	92

Male Wistar albino rats (body weight 150–200 g) obtained from A.R.C., Compton, were sensitised using horse serum (0·5 ml) and *Bordetella pertussis* vaccine (0·25 ml of 80,000 $\times$ 10^6 organisms per ml) intraperitoneally. Ten to twelve days later, they were challenged intravenously with horse serum (1 ml) and deaths were recorded over 24 hr. During the period from June to September, they were relatively insensitive to anaphylactic shock, whereas at other times high mortality rates were obtained. It was possible to reduce the challenging dose to 0·05 ml in the winter and obtain similar high mortality rates. This observation may be of importance to those who are studying the mechanism of anaphylactic shock *in vivo* and that of the antigen-antibody reaction using isolated mast cells.

A similar change in the sensitivity of rats has also been noted after experimental traumatic or tourniquet shock. To produce traumatic shock, anaesthetised male Wistar albino rats were rotated in a revolving drum (40 rotations/min) so that at each rotation they fell 18 inches (the Noble–Collip technique). They were then removed from the drum and their mortality rates were recorded over 24 hr. The results shown in Table 2 indicate that rats in June and July were much more resistant than those in November and needed at least twice as long in the revolving drum to produce similar mortality rates.

To produce tourniquet shock, male Wistar albino rats were restrained and rubber tourniquets were placed high up on the hindlimbs for 4, 5 or 6 hr. They

TABLE 2. CHANGES IN THE MORTALITY RATE OF WISTAR RATS SUBJECTED TO EXPERIMENTAL TRAUMATIC SHOCK AT DIFFERENT TIMES OF THE YEAR 1964

Month	No. of rats tested	Mortality rate (%) after various rotations				
		200	400	600	1,000	1,600
June–July ..	45	0	0	0	50	100
Sept.–Oct. ..	25	0	0	50	100	—
Nov.–Dec. ..	33	0	50	100	—	—

were then returned to their cages and mortality rates were recorded over 24 hr. The results shown in Table 3 indicate that rats in June were more resistant than those in December.

TABLE 3. CHANGES IN THE MORTALITY RATE OF WISTAR RATS SUBJECTED TO EXPERIMENTAL TOURNIQUET SHOCK AT DIFFERENT TIMES OF THE YEAR 1964

Month	No. of rats tested	Mortality rate (%) after various times of application		
		4 hr	5 hr	6 hr
June–July	40	0	0	90
Nov.–Dec.	30	10	90	100

The dextran anaphylactoid reaction does not occur in diabetic rats or in rats in which the blood sugar levels have been markedly raised by injections of glucose or other monosaccharides. The mechanism of this inhibitory action has not yet been fully elucidated and it may be that the rate of entry of dextran, a polymer of glucose, into cells is modified by glucose or that the breakdown of dextran into glucose is accelerated. When the inhibitory effect of glucose was tested at different times of the year using a standard amount of the monosaccharide, less inhibition was found in November than in June. Male Wistar albino rats were given 2 doses of glucose, each of 1·5 g/kg intraperitoneally, the first, 30 min before the dextran (240 mg/kg intraperitoneally), and the second at the same time as the dextran. The anaphylactoid reaction was then recorded over the next 4 hr using an arbitrary visual scoring system. Table 4 shows that

TABLE 4. CHANGES IN THE INHIBITION OF THE DEXTRAN ANAPHYLACTOID REACTION IN WISTAR RATS BY GLUCOSE AT DIFFERENT TIMES OF THE YEAR 1964

Month	No. of rats tested	% inhibition
June–July	20	74
Sept.–Oct.	20	24
Nov.–Dec.	28	18

rats probably utilised glucose easier in the summer and marked inhibition of the reaction occurred. The absorption of dextran may also have been more efficiently delayed by glucose in the summer, as doubling of the dose of glucose in the winter resulted in marked inhibition of the reaction. Similar results were obtained with galactose as the inhibitory agent and dextrin (Astra) as the effective stimulatory agent.

The reason for these seasonal changes in resistance has still to be found.

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