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The Effect of Carbon Arc Radiation on Circulation in the Dog.

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Depression of the general arterial blood pressure by radiant energy has been repeatedly demonstrated, although a rise in pressure, during or soon after irradiation, has also been recorded. We have investigated the effects of known amounts of carbon arc radiation on the blood pressure, pulse rate and body temperature of normal adult dogs under standard conditions. A total of 13 experiments on 8 dogs have been completed, 11 with the Majestic Arc, and two with the Pan Ray Arc* as the source of energy. The distribution of the energy irradiated by the two lamps, as determined spectroradiometrically† is approximately, for the Majestic Lamp or "Solarite": ultra-violet 21.9 p. c., visible 43.5 p. c., infra red 34.6 p. c., and for the Pan Ray Arc 15, 59 and 26 per cent, respectively. The total energy of the "Pan Ray Arc" is about 6 times that of the Majestic, being equal to 1 gm. cal. per sq. cm. per minute at 103 cm.

In the experiments with the Majestic Arc the animals were irradiated daily for 1 hour, either on the back or the abdomen, at a distance of 40 cm. from the lamp for periods of from 8 to 33 days. Each dose had a total energy equivalent to 55.44 gm. cal. per sq. cm. In 2 experiments the time of the exposures was increased to 2 hours daily for 8 days. In the first experiment with the Pan Ray Arc, the abdomen of the animal was irradiated for 45 minutes at 1 meter (45.0 gm. cal. per sq. cm.) and the dosage progressively increased

* The Pan Ray Arc was presented to one of us (H. L.) by its makers, The Atlas Electric Devices Co. of Chicago, to whom it is a pleasure to record here our thanks.

† A portion of the cost of the spectroradiometric apparatus was defrayed by a grant from the Elizabeth Thompson Science Fund.

TABLE 1.
Effects following fifth daily exposure.

	Systolic Pressure			Diastolic Pressure			Pulse Pressure			Pulse Rate		
	Before	After	24 hrs. after	Before	After	24 hrs. after	Before	After	24 hrs. after	Before	After	24 hrs. after
Dog A (1)	148	120	148	80	68	86	68	52	62	76	80	100
Dog A (2)	144	124	154	72	93	80	72	31	74	92	100	86
Dog C	168	140	184	121	92	108	47	48	76	88	112	80
Dog D	182	147	174	123	104	115	59	43	59	104	100	116
Dog E	161	142	169	81	75	77	80	67	92	80	84	80
Average	160	134	166	95	86	93	65	48	72	88	95	92

Average p. c. decrease: systolic = 16 p. c.; diastolic = 10 p. c.
Dogs A (1), A (2), C, abdomen exposed. Dogs D, E, back exposed.

during a period of 13 daily exposures. In the second experiment, the animal was exposed to massive abdominal exposures at intervals of 2 or more days. Systolic and diastolic pressure values were obtained by auscultation of the femoral as suggested by Allen.[1]

Abdominal irradiation results in a decrease of 5 to 20 p. c. in the systolic pressure after either the first or second exposure, persisting for about 5 hours, and is followed by a gradual return to normal. The diastolic pressure, in some cases, shows a proportional decrease, in others it rises during irradiation and returns to normal soon after. When the back of the animal is exposed, similar changes are evident after the third or fourth dose. The effects in all cases usually reach a maximum on the fifth exposure (Table I), and re-occur with each subsequent irradiation. With few exceptions, all values tend toward normal levels within 24 hours after each exposure. The pulse rate usually increases during irradiation, but this effect is not consistent. Body temperature shows little variation, slight rises during irradiation disappearing within an hour after the exposure is over. If the daily dosage is progressively increased, the magnitude of the changes is proportional to the strength of the radiation.

Long lasting depression of the blood pressure was obtained in two experiments with white, short-haired animals, where the absorption of radiant energy by hair and pigment was doubtless at a minimum. In one experiment, after the twelfth daily irradiation with the Majestic Arc, the dog showed a decrease of about 20 p. c. and 15 p. c. in systolic and diastolic pressures respectively, the values remaining at this level through 5 subsequent exposures and for 3 days thereafter before returning to normal. The most marked effects were obtained in massive irradiation (½ to ¾ hour at 60 cm.), with the Pan Ray Arc at intervals of 2, 3 and 6 days respectively. After the fourth exposure, the levels of both systolic and diastolic pressures dropped and remained low for over a week and then slowly

TABLE II.
Effects following abdominal irradiation with Pan Ray Arc.

	Systolic Pressure	Diastolic Pressure	Pulse Pressure	Pulse Rate	Rectal Temperature °C.
Normal	171	70	101	85	38.1
Immediately after last irrad.	122	79	43	82	38.0
1 day after last irradiation	124	47	77	118	39.4
5 days after last irradiation	123	61	62	88	38.4
10 days after last irradiation	151	54	97	91	38.7
15 days after last irradiation	152	68	84	84	38.4
20 days after last irradiation	168	67	101	73	38.1

rose to normal on the twentieth day. (Table II.) The pulse rate usually increased during the irradiation (average 20 p. c.), returning to normal soon after. Body temperature remained elevated about 1° C. for two days after the last irradiation.

Control dogs placed behind a screen at the same distance from the lamp while the experimental animal was being irradiated showed no changes in blood pressure, pulse rate or body temperature.

This is a preliminary report.

[1] Allen, F. M., *J. Met. Res.*, 1923, iv, 431.

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Action of Bacilli of Paratyphoid, Dysentery and Metadysentery Groups on Various Starches.

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The action of certain bacteria on potato starch has been studied, but very little is known on the action of bacteria on the less common starches. For some time I have carried out researches on the action of bacilli of the paratyphoid, dysentery and metadysentery groups on various starches, and on the possibility of using starch reactions in the differentiation of organisms of these groups.

Fifteen starches have been used, *viz.*, arrowroot, barley, bean, canna, corn, ginger, lentil, oat, pea, potato, rice, sago, tapioca, yam, wheat. The so-called soluble forms have been used, but solution is seldom complete.*

Technique. Tubes containing 1 per cent solution of the various starches in peptone water are used, each tube containing a Durham's

TABLE I.

Action on starches of B. paratyphosus A and B. paratyphosus C.

	Arrowroot	Barley	Bean	Canna	Corn	Ginger	Lentil	Oat	Pea	Potato	Rice	Sago	Tapioca	Wheat	Yam
B. paratyphosus B	0	0	0	0	0	A	0	0	0	A	0	A	0	A	A
B. paratyphosus A	0	0	0	0	0	0	0	0	0	0	A	A	A	0	0
B. paratyphosus C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

The readings were taken after 3 weeks incubation at 37° C. After 6 weeks, the readings were the same but paratyphosus C produced a slight acidity in tapioca.

* The starches were obtained from the Eli Lilly Co., Indianapolis.