

of the control animals which were sacrificed 3 months after the last injection.

The results of the experiments herein reported show that Duval's chromogenic acid-fast bacillus induces a chronic form of infection in the rabbit with characteristic tissue changes deep in the parenchyme of the various organs.

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Further Studies in the Elimination of Certain Dyes by Gastric Mucosa.

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Studies on the elimination of dyes by the gastric mucosa have been made by several investigators with general agreement in results except for the report of Morrison, *et al.*¹ A comprehensive list of dyes was investigated, and their secretion into the stomach noted by Dawson and Ivy,² Kobayashi,³ and Ingraham and Visscher.⁴ The last named investigators confirmed the conclusion of Kobayashi that only basic dyes, *i. e.*, those having the chromogen in the electro-positive ion, are secreted by the gastric glands. In addition, they clarified the anomalous intragastric appearance of certain dyes, ordinarily classed as acid, following their intravenous injection (noted by Dawson and Ivy). This previously inexplicable phenomenon has been shown to be due to the amphoteric characteristics of certain dyes, and to alterations of charge on the chromogen upon reversible reduction. A review of the data of Dawson and Ivy, Kobayashi, and Ingraham and Visscher, with these facts in mind, indicates general agreement and leads to the conclusion that only those dyes in which the chromogen can be electro-positive are secreted by the stomach. In a more recent study Morrison, Reeves, Gardner¹ have reinvestigated the excretion of dyes by the gastric mucosa in Pavlov pouch dogs. Congo red, an acid colloidal dye, as well as 8 other acid dyes, were found by these

¹ Morrison, Samuel, Reeves, David L., and Gardner, Raymond, E., *Am. J. Dig. Dis. and Nut.*, 1936, **3**, 551.

² Dawson, A. B., and Ivy, A. C., *Am. J. Physiol.*, 1925, **73**, 304.

³ Kobayashi, K., *Acta scholae Med. Univ. Imp. Kioto*, 1926, **8**, 465.

⁴ Ingraham, Raymond C., and Visscher, Maurice B., *J. Gen. Physiol.*, 1935, **18**, 695.

workers to be so excreted. The disagreement of these results with those of other workers has prompted the reinvestigation herewith reported.

Medium size, healthy, mongrel dogs, possessing a functioning Heidenhain or Pavlov pouch which had been constructed a minimum of three months prior to these experiments, were employed. The animals received a varied diet including an extra quantity of sodium chloride, and maintained a good nutritional status. All dogs were trained to remain standing for the duration of the particular experiment. Gastric secretion was stimulated by a subcutaneous injection of histamine diphosphate. (0.2 mg/kg) given in a divided dose or by an intramuscular injection of 10 mg of the histamine base in a beeswax mixture.⁵ The secretion was collected in a test tube suspended from the animal so as to allow for free flow from the pouch via a mushroom type catheter. The fluid thus collected was studied for free and total acidity by titration with 0.1 N NaOH using Töpfers reagent and phenolphthalein. When the value of the former approximated 140 m equiv. per l. the dye to be tested was injected intravenously in aqueous solution. In every instance the quantity and dilution of the dye given was that used by Morrison and his co-workers. Successive samples were then collected for the following 1 to 2 hours, the amount measured, an aliquot taken for titration, and another specimen alkalinized with 0.1 N NaOH and any color change noted, a final sample was oxidized with hydrogen peroxide and observed for color change. The following dyes were investigated: Orange G, Congo Red, Trypan Red, Eosin, Mercurochrome, Erythrosine, Phloxine, Rose Bengal, Lithium Carmine. All dyes were tested by injection into 2 different animals, excepting Congo Red, which was used 7 times.

The detailed observations are shown in Table I. Upon no occasion did any animal eliminate any acid dye in this series. In order to verify the activity and dye secretory capacity of these pouches, chrysoidin, a basic dye, was injected intravenously, under similar test conditions, and in the dose and dilution employed by Morrison, *et al.* In the 2 animals tested, this dye was secreted in the gastric juice within 3 minutes after the injection and increased in concentration for the duration of the experiment. Further observations upon basic dyes were considered unnecessary, in view of previous studies.^{2, 3, 4}

The disagreement in the observed findings presented here and those of Morrison, *et al.*, may have one of several explanations. It is

⁵ Code, Charles F., and Vareo, Richard L., *PROC. SOC. EXP. BIOL. AND MED.*, 1940, **44**, 475.

TABLE I.
Dye Excretion by Histamine-Excited Stomach Pouches.

Dog No.	Dye	Acid M./Equiv./L.				Histamine dosage and comment	
		Free		Total			
		Before	After Dye	Before	After Dye excretion		
116	Congo Red (1)	140			0	4 mg H. Subcut.: Depress. Vol. Secret.	
118	" " (1)	138			0	Same	
112	" " (1)	146			0	Same	
126	" " (1)	142			0	20 mg H. in Beeswax Intra-musc. Depress. Vol. Secretion	
129	" " (1)	148			0	20 mg H. in Beeswax Intra-musc. Depress.	
37	" " (1)	120			0	6 mg H. Subcut.: Depress. Vol. Secret.	
129	" " (1)	128			0	6 mg H. Subcut.: Depress. Vol. Secret. Reduct. Free Acid 128-70 M./Equiv./L.	
1	Orange G (2)	146		154	0	10 mg H. in Beeswax Intra-musc.	
1	Mercurochrome (2)		138		148	0	Repeated Emesis after Inject. of Mercurochrome
2	Erythrosine (2)	150		158	0	10 mg H. in Beeswax Inject. Intra-musc.	
2	Phloxine (2)		138		142	0	
3	" (2)	116		130	0	0	Same
3	Erythrosine (2)		80		96	0	
4	Mercurochrome (2)	115	70	130	110	0	10 mg H. in Beeswax Intra-musc. Emesis after inj. of dye.
4	Orange G (2)		95		115	0	
92	Rose Bengal (2)	148	100	156	133	0	12 mg H. in Beeswax injected intra-musc.
92	Lithium Carmine (2)		152		158	0	
116	Trypan Red (2)	162	134	166	142	0	4.5 mg H. Subcut.
116	Rose Bengal (2)		158		166	0	
126	Eosin (2)	140	146	150	152	0	
126	Trypan Red (2)	*	106	150	116	0	Same
129	Lithium Carmine (2)	137		147	0	12 mg H. in Beeswax Intra-musc.	
129	Eosin (2)		132		142	0	
92	Chrysoidin (3)	132	125	140	150	+	3 min.
37	" (3)	122	134	140	142	+	3 min.

(1) Acid Colloidal Dye.

(2) Acid Dye.

(3) Basic Dye.

*Major portion of sample lost—no dye noted.

possible that there are differences in the chemical purity of the dyes used in the two studies. However, it seems more likely that another interpretation is correct. Morrison, *et al.*, found the colloidal dye Congo Red in pouch fluids. This dye is used for plasma volume determinations because it leaves the blood stream very slowly. We suggest that it may have appeared in pouch secretions either in serous exudate or in blood, more probably the former. The finding of a colloidal component of the plasma is most plausibly accounted for on such an assumption. We repeated the experiment on 7 dogs with 2 samples of Congo Red of different origins in order to be quite certain of a failure of excretion. If the interpretation given above is correct, the finding of other non-colloidal acid dyes in pouch fluid by Morrison, *et al.*, loses its theoretical significance. Our failure to find any of these dyes in highly acid secretions confirms this view.

Summary. A list of acid dyes reported to be secreted in gastric juice has been reinvestigated. None of them appeared in histamine-excited gastric juice from Pavlov or Heidenhain pouches in dogs. This work gives support to the earlier generalization that only dyes in which the chromogen may be in the cation, appear in highly acid gastric secretions.

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Peptic Activity of Achlorhydric Human Gastric Juices from Carcinomatous Stomachs. Comparative Study.*

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A comparative study of the peptic activity of human gastric juices was made as part of a general investigation in the problem of the physiology of the cancerous stomach. It has been stated that achlorhydric juices from such stomachs are weaker in peptic activity than juices containing normal concentrations of free HCl, and that in this respect they resemble achlorhydric juices in general. In the recent literature, at least, there is but little specific data upon this question. Polland and Bloomfield¹ recorded their observations upon

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¹ Polland, W. S., and Bloomfield, A. L., *Bull. Johns Hopkins Hosp.*, 1930, **46**, 307.