TABLE I.
Effect of Standard Bread (S), of Predigested Beef, of Iron and Ammonium Citrate and of Liver Extract on Hemoglobin Production in Gastrectomized Dogs.

Dog No.	No. of days	Hemoglobin Output gm. per day	Diet and Type of Therapy
473	20	0.20	Bread (S)
	20	0.24	750 gm. predigested beef
	20	1.73	Bread (S) + 1 gm. iron and ammonium citrate daily
	24	0.60	Liver extract, 5 cc. 3 times a week*
394	20	0.04	Bread (S)
	20	2.77	Bread (S) + 1 gm. of iron and ammonium citrate daily
	20	0.04	Bread (S) + 5 cc. liver extract daily
393	20	0.10	Bread (S)
	20	0.11	250 gm. of predigested beef
	20	1.85	Bread (S) + 1 gm. of iron and ammonium citrate daily
	20	0.19	Bread (S) + 5 cc. liver extract daily

*The authors wish to thank Eli Lilly and Company for their generous contribution of Liver Extract 343 (N.N.R.).

The daily administration of one gram of iron and ammonium citrate had a marked effect on hemoglobin regeneration. Prior to therapy the hemoglobin output in each case was less than 0.25 gm. daily, whereas after iron therapy it was 1.73, 2.77 and 1.85 gm. respectively. The results of this study of iron therapy compare favorably with those reported by Dragstedt[4] and his associates.

The anemia, as shown in Table I, did not respond to liver extract specific for pernicious anemia.

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Curare-Actions of Erythrina Americana.

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The great scarcity of active curare prompted an investigation of *Erythrina americana,* which has been reported by Altamirano,[1]

[4] Dragstedt, C. A., Bradley, J. D., and Mead, F. B., PROC. SOC. EXP. BIOL. AND MED., 1935, **33**, 58.

[1] Altamirano, *cit.*, U. S. Dispensatory, 1918, 20th Ed., p. 1375; Altamirano, 1876, and Altamirano and Dominguez, *Gaceta Medica,* 1888, *cit.*, Arzac-Behnken, loc. cit.

Arzac-Behnken,[2] and Ramirez and Rivero[3] to possess paralytic actions typical of curare. According to Altamirano, the paralytic and anticonvulsant actions are powerful. The active constituent appears to be an alkaloid, erythroidine, an emetic action being ascribed to erythroresin. Unfortunately, however, details of Altamirano's work are lacking, only an abstract being available to me. Arzac-Behnken claims to have confirmed the curare-like action in a few animals, but without proof. Poisoned animals do not recover from the paralysis, even when given artificial respiration, and pulmonary congestion and subacute nephritis are produced, according to Arzac-Behnken. Ramirez and Rivero report chemical analysis of the drug, and motor nerve paralysis in frogs by chronaxie determinations. This is about the extent of the pharmacologic literature on the drug. Therefore, a complete pharmacodynamic study was planned to assess the validity of the claims, and, if confirmed, the possibilities for the drug. The results obtained are sufficiently encouraging to justify this preliminary report.

The product* used was a liquid alcoholic extract of the seeds, containing 60% alcohol, so that 1 cc. represented 130 mg. of the crude drug. This was diluted with an equal volume of physiological salt solution (0.9% NaCl) before injection. A total of 76 animals of different species was used.

Fatal doses. In animals without artificial respiration, the average fatal doses in mg. of crude drug per kg., body weight are as follows: white mice, 600 (intraperitoneal); white rats, 675 (intraperitoneal and 100 intravenous); rabbits and pigeons, 5 (intravenous); pigeons, 50 (intramuscular); frogs, 500 (lymph sac; complete paralysis).

Sciatic nerve paralysis. This is complete after the following doses in mg. per kg., body weight for different time periods: frogs (lymph sac) and turtle (under plastron), 40 for 8 hours; mice, 600 for 45 minutes (intraperitoneal); rats, 600 for 20 minutes (intraperitoneal) and for 1 hour (intravenous); cats, 2.5 to 5 for 1 to 2 hours (intravenous); rabbits and pigeons, 50 for 2 hours (intra-

[2] Arzac-Behnken, "Estudio Comparativo de la Erythrina Americana (Colorin Comun) con el Curare," Tesis, Universidad Nacional Autonoma, Mexico, D. F., 1934, p. 47.

[3] Ramirez and Rivero, "Contribucion al Estudio de la Accion Farmacodinamica de la Erythrina Americana," 1935 (Lab. Fac. de Med. Univ. Nal. de Mexico), personal communication from Mr. G. G. Colin.

* The product was generously supplied by Mr. G. G. Colin of the Laboratorio Quimico Central, S. A., Mexico, D. F.

venous); dog, 20 for 6 hours (intravenous). (Artificial respiration in higher animals.)

Skeletal muscle-nerve preparation. The classical Claude Bernard experiment gave completely positive results as follows: concentrations of 1:10,000, ineffective; 1:5000, effective, causing complete nerve block in 30 minutes and the muscle substance remaining unpoisoned; 1:2500, no more effective than 1:5000.

Phrenic nerve paralysis. In pigeons, rabbits, and cats, a regular, though shallow, thoracic type of respiration continued almost invariably after sciatic nerve paralysis was complete with doses of 5 mg. per kg. Using the procedure of Thomas and Franke,[4] on cats and rabbits, in which contractions of innervated segments of the diaphragm are recorded simultaneously, one segment being *in situ,* and one, *in vitro* without blood circulation, it was conclusively demonstrated that the seat of phrenic paralysis is peripheral. Respiratory paralysis occurs as the result of asphyxia, but, if asphyxia is prevented by artificial respiration, recovery of natural respiration is complete after 10 to 15 times the average dose for sciatic paralysis, contrary to Arzac-Behnken's claim.

Circulation. In cats, rabbits, rats, and dogs, intravenous injection of erythrina causes a typical fall of blood pressure with decrease in volume of viscera and increase in volume of legs as the result of relaxation of skeletal muscles, as with curare. Recovery is gradual but prompter than with curare. In pigeons, there is a sharp but fleeting rise of blood pressure, like that of epinephrine, as the result of a brief peripheral vasoconstriction (legs): difference from curare, which causes a fall of pressure.

Anticonvulsant action. Using surely fatal doses of strychnine in rats, rabbits, pigeons and a dog (4 times the fatal dose), the typical convulsions were prevented by prior intramuscular injections of erythrina, or abolished immediately by intravenous injections. Using artificial respiration continuously, or as needed, complete recovery and great amelioration of seizures may be obtained, depending on the dose of strychnine, but without the aid of artificial respiration recovery from the highest doses is not yet assured.

Conclusions. Claims that *Erythrina americana* possesses a typical curare action are confirmed, proven, and extended for several species of animals. General pharmacodynamic analysis indicates tentatively a promising usefulness for this drug as a comparatively easily available and practical substitute for curare and as a possible anticonvulsant in poisoning and in excitatory states.

[4] Thomas and Franke, *J. Pharm. Exp. Therap.*, 1928, **34**, 111.