

precipitated with dilute sulphuric acid. When the filtrate is concentrated, a crystalline mass is obtained, which upon purification with alcohol produces the same physiological effects as the decoction. Half of a gram of this substance kills an anesthetized dog of 7.7 kilos by circulatory collapse. Qualitative chemical analyses show that these crystals are mostly potassium sulphate and potassium chloride, and that the parts of the plant under investigation contain no alkaloids. If the lead acetate in the percolate is removed by hydrogen sulphide instead of sulphuric acid, and the filtrate upon concentration is shaken with ether continuously for 15 hours, the ether extract after evaporation gives rise to a residue containing needle-like crystals. This residue is pungent in odor, soluble in dilute alcohol (about 12 per cent by volume), and contains no potassium salts. When injected into anesthetized dogs, it constricts the renal vessels and lowers the blood pressure slightly. The yield from 1.5 kilograms of the crude material is so small that no further study is possible.

The impression of this preliminary investigation is that the leaves and stems of *Leonurus sibiricus* probably contain an organic principle, producing renal vasoconstriction and a slight fall of blood pressure. Further experimentation is necessary for its isolation and action. The richness of potassium salts in the plant should be borne in mind.

¹ Li, Shih-cheng, *Pentsao Kang Mu*, 1596, chap. xv.

² Peckolt-Rio, Th., *Ber. pharmac. Gesell.*, 1904, xiv, 384.

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Detoxification of and the Immunity Production to Ricin by Sodium Ricinoleate.

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The works of Larson¹ and his co-workers on sodium ricinoleate suggested the possibility of its use with other toxins such as those of plants and animals. Ricin was chosen first because the author, during the studies on the chemical basis of its toxicity,

found that certain chemical and physical treatments could not only detoxify the toxin, but would produce an immunity to ricin in the animals when so treated.²

The ricin was prepared by the method of Osborne, Mendel and Harris.³ A fresh aqueous solution was made for each experiment. It was clear and light yellow in color when concentrated.

The sodium ricinoleate was kindly furnished by Professor Larson. A 10 per cent stock solution was made in distilled water in a pyrex flask. It was light yellow in color.

These two solutions were mixed in such proportions as to make about 3 per cent of sodium ricinoleate in final volume. When the solution of ricin, containing 2,000 lethal doses for a rabbit in 5 to 10 cubic centimeters, was mixed with the sodium ricinoleate, it immediately became milky and opaque.

The mixed solutions were allowed to stand for one hour and then were injected into rabbits subcutaneously. The doses of the toxin employed varied over a rather wide range. The typical results obtained are given in the following table.

TABLE I.

Rabbit No.	Weight	Lethal doses* of Ricin	Sodium Ricinoleate
52	1850	1000	0.5 gm.
53	1875	400	0.2 gm.
54	1600	2000	0.4 gm.
55	2900	2000	0.2 gm.

* (0.05 mg. is a lethal dose for a rabbit.)

An inspection of the table makes it obvious that it is possible to inject a large number of lethal doses of ricin, if mixed with sodium ricinoleate, without killing the animal. The animals injected with 400 or more lethal doses of the treated ricin always showed an ulcer at the site of the injection. The minimum dose that will cause an ulcer has not been determined.

The detoxification of the ricin must have been complete or nearly so, since such large numbers of lethal doses have been given successfully without causing death. Each lethal dose now in the presence of this soap must have, at the maximum, less than 1/2000 of its original toxicity remaining since the animal lived when 2000 lethal doses were injected. No attempt has yet been made to determine the maximum amount of the mixture of the

toxin and sodium ricinoleate that can be injected without causing death.

Next, in order to test the development of immunity to ricin, the animals were bled at the end of 14 days. The blood was always taken from the ear vein. A few days after the sample of blood had been taken, the animals were each injected subcutaneously with a lethal dose of untreated ricin. All of the rabbits lived.

The sera of the rabbits were tested for their antiricin properties. Various quantities of the sera were mixed with lethal doses (for adult white mice) of ricin and injected subcutaneously into adult white mice. The sera from the rabbits neutralized a lethal dose of ricin when used in as small quantities as 0.1 cc. except that from rabbit No. 54, which required 0.2 cc. of serum to detoxify a lethal dose.

CONCLUSIONS.

1. Sodium ricinoleate detoxified ricin.
2. An immunity to ricin is developed by means of one injection of a mixture of ricin and sodium ricinoleate.
3. The sera from the animals treated as above have antiricin properties, and even in as small quantities as 0.1 to 0.2 cc. detoxify a lethal dose (for adult white mice) of ricin.

¹ Larson, W. P., and Montank, I. A., *PROC. SOC. EXP. BIOL. AND MED.*, 1923, xx, 229; Larson, W. P., and Nelson, E., *ibid.*, 1924, xxi, 278; Larson, W. P., Evans, R. D., and Nelson, E., *ibid.*, 1924, xxii, 194; Larson, W. P., and Nelson, E., *ibid.*, 1925, xxii, 357; Larson, W. P., and Colby, W., *ibid.*, 1925, xxii, 549; Larson, W. P., and Halvorsen, H. D., *ibid.*, 1925, xxii, 550; Larson, W. P., Hancock, E. W., and Eder, H., *ibid.*, 1925, xxii, 552.

² (To be published soon.)

³ Osborne, T. B., Mendel, L. B., and Harris, I. F., *Am. J. Physiol.*, 1905, xiv, 259.