

**Induction of Ovulation in *Rana pipiens* by Pituitaries of  
*Triturus viridescens*.\***

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Since the first report of ovulation induced during the non-breeding season in *Rana pipiens* by homoplastic anterior pituitary transplants,<sup>1</sup> this species has been used repeatedly for demonstrating and studying this reaction.<sup>2</sup> This form will also ovulate after treatment with pituitaries of other species of *Rana*, e.g., *R. sphenoccephala*, etc.,<sup>3</sup> and of fish, *Lepidosteus*,<sup>4</sup> and with beef pituitary extract (phyone).<sup>5</sup> There is, however, the report that "mammalian pituitary extract, whole sheep pituitary, and the Antuitrin-S from pregnant human female urine have proven to be entirely ineffectual in respect to ovulation in *Rana pipiens*" (p. 29<sup>6</sup>) and more recently negative results followed the use of pregnant mare's serum, Antuitrin-S, beef anterior lobe extract, Antuitrin, live implants and macerated injections of whole glands from fishes (*Perca flavescens*, *Cristovomer nanay-cush*, *Stizostedion vitreum*) and from *Necturus* even when very large doses were used.<sup>7</sup>

Because of this apparent refractoriness of *Rana pipiens* to heteroplastic anterior pituitary treatment, tests were made in which whole pituitaries of *Triturus viridescens* were injected into the body cavities of females while others received equivalent amounts of homoplastic pars anterior. In a preliminary test made in December, 1937, in which 4 anterior pituitaries from male *Rana pipiens* and 8 whole pituitaries of *Triturus viridescens*, respectively, were implanted into 2 animals, no ovulation occurred, so larger doses were employed in the succeeding experiments.

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<sup>1</sup> Wolf, O. M., *Proc. Soc. Exp. Biol. and Med.*, 1929, **26**, 692.

<sup>2</sup> Bardeen, H. W., *Proc. Soc. Exp. Biol. and Med.*, 1932, **29**, 846; Rugh, R., *Biol. Bull.*, 1934, **66**, 22; 1935, **68**, 74; *J. Exp. Zool.*, 1935, **71**, 149, 163; *Science*, 1937, **85**, 588; *Physiol. Zool.*, 1937, **10**, 84.

<sup>3</sup> Creaser, C. W., and Gorbman, A., *Copeia*, 1936, No. 2, p. 91.

<sup>4</sup> Wills, I. A., Riley, G. M., and Stubbs, E. M., *Proc. Soc. Exp. Biol. and Med.*, 1933, **30**, 784.

<sup>5</sup> O'Neil, H., unpublished data.

<sup>6</sup> Rugh, R., *Biol. Bull.*, 1934, **66**, 22.

<sup>7</sup> Creaser, C. W., and Gorbman, A., *Am. J. Physiol.*, 1935, **113**, 32; *Copeia*, 1936, No. 2, p. 91; Creaser, C. W., and Sheolnek, M., *Anat. Rec.*, 1937, **70**, Suppl., No. 1, 117.

*Rana pipiens injected with pars anterior from Rana pipiens.*  
 No. 1. 1/9/38, ♀, wt 73.9 g, received 2.42 mg P.A. from 3 ♀ R. p. (av wt, 35.5 g); 1/11, 2.43 mg P.A. from 2 ♀ R.p. (av wt, 62.2 g) were injected; 1/15, two bunches of eggs in water.

No. 2. 1/22/38, ♀, wt 88.4 g, received 4.51 mg, P.A. from 4 ♀ R. p. (av wt 58.3 g); 1/27, at autopsy, ovaries were nearly empty, 2 eggs were in body cavity, 3 in oviducts and uteri were full.

No. 3. 1/27/38, ♀, wt 93.6 g, received 7.62 mg P. A. from 6 ♀ R. p. (av wt, 85.1 g); 1/28, 1/29, 1/31, eggs pressed from cloacal opening; 1/31, at autopsy, ovaries contained 13 mature eggs, 3 were in body cavity, one in left oviduct, and uteri were very full.

No. 4. 1/31/38, ♀, wt 116.8 g, received 5.67 mg P.A. from 4 ♀ R. p. (av wt, 57.0 g); 2/2, uteri appeared full and eggs were pressed from cloacal opening, after which 3.59 mg P.A. from 2 ♀ R. p. (av wt, 77.8 g) were injected; 2/3, ♂ which had received 1.96 mg P.A. from 2 ♀ R. p. was placed with ♀; 2/4, large numbers of eggs in water; 2/7, at autopsy, 8 mature eggs in ovaries, 9 in body cavity, and a medium-sized bunch of eggs remained in left uterus.

*Rana pipiens injected with whole pituitaries from Triturus viridescens.* No. 5. 1/9/38, ♀, wt 77.6 g, received 3.29 mg whole pituitaries from 24 ♂ T. v.; 1/11, 3.16 mg from 16 ♀ T. v. injected; 1/18, at autopsy, ovaries were still full of eggs but 6 were found in body cavity, 2 in left oviduct, and 9 in uteri. Seven eggs were released from left ovary when it was shaken in water.

No. 6. 1/22/38, ♀, wt 92.2 g, received 6.92 mg whole pituitaries from 27 ♀ and 17 ♂ T. v.; 1/25, many eggs pressed from cloacal opening and more shed spontaneously later; 1/27, few eggs pressed from cloaca, after which animal was autopsied. Both uteri were full of eggs, 5 eggs were in right oviduct, and 2 in body cavity. Ovaries were almost empty.

No. 7. 1/22/38, ♀, wt 96.1 g, received 7.49 mg whole pituitaries from 25 ♀ and 19 ♂ T. v.; 1/27, animal killed. No eggs ovulated.

No. 8. 1/27/38, ♀, wt 95.0 g, received 11.67 mg whole pituitaries from 39 ♀ and 29 ♂ T. v.; 1/28, 27 hours after first treatment and again on 1/29 and 1/30, eggs were pressed from cloacal opening; 1/31, at autopsy, ovaries were still full of eggs, 13 eggs were in body cavity, 6 in right oviduct and 11 in the bladder.

No. 9. 1/31/38, ♀, wt 128.2 g, received 8.59 mg whole pituitaries from 53 T. v. (25 ♀ and 28 ♂ or 26 ♀ and 27 ♂); 2/2, 40 hours later, uteri seemed turgid and eggs were pressed from cloacal opening; 4.91 mg whole pituitaries from 16 ♀ and 14 ♂ T. v. were injected; 2/3, ♂ which had received 2.0 mg P.A. from 2 ♀ R. p. was

placed with ♀; 2/4, ♂ attempted to clasp ♀ but unsuccessfully; 2/5, another ♂ (previously mated with frog *No. 4*) was placed with this ♀ but no clasping followed; 2/7, at autopsy, ovaries were still full of eggs, but 2 and a small bunch of cystic ones were found in the body cavity and 2 in left oviduct. Uteri were empty.

*No. 10.* 1/31/38, ♀, wt 117.4 g, received 5.07 mg whole pituitaries from 18 ♀ and 12 ♂ T. v.; 2/1, 3.56 mg, from 13 ♀ and 11 ♂ T. v. injected; 2/2, 5.38 mg from 17 ♀ and 19 ♂ T. v. injected; 2/1 and 2/2, no eggs expressed from cloaca by stripping; 2/3, ♂ which had received 2.57 mg P.A. from 2 ♀ R. p. was placed with ♀; 2/4, 18 hours later, ♂ was clasping ♀ and continued to do so during the day. In evening, large mass of eggs had been laid; 2/7, at autopsy, approximately 50 to 60 mature eggs were found in one lobe of the right ovary, 4 in the left, 6 in body cavity and 3 in the oviducts. Uteri were empty.

From the above data, it is evident that each of the 4 *Rana pipiens* females given homoplastic pars anterior, ovulated and in 2 cases egg-laying occurred. Among the 6 given whole pituitaries from *Triturus viridescens* in doses in which the anterior pituitary substance was approximately equivalent to that in doses of frog pars anterior administered to other females on the same date, 2 (*Nos. 6, 10*) gave excellent reactions, the ovaries being almost empty at autopsy, 3 (*Nos. 5, 8, 9*) responded by a slight amount of ovulation, and one (*No. 7*) failed to ovulate. It is, therefore, apparent that pituitaries of *Triturus viridescens*, a urodele, are able to induce ovulation in the anuran, *Rana pipiens*, when given in sufficiently large doses, but the degree of the reaction is variable. Previous experiments<sup>8</sup> have shown that *Triturus viridescens* will ovulate and lay eggs following implants of pars anterior or whole pituitary from *Rana pipiens*. Therefore, between these two amphibian forms there appears to be no "zoölogical specificity" of the gonad-stimulating hormones of the pars anterior.

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<sup>8</sup> Adams, A. E., PROC. SOC. EXP. BIOL. AND MED., 1930, **27**, 433.