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and holds the gills in position for spore discharge. The gills, by virtue of hanging free from all parts of the carpo-phore save the pileus, are in no position to support anything.

ALEXANDER H. SMITH

Herbarium,
University of Michigan, Ann Arbor

Thyroxin Analogs in Tadpoles

The report by Frieden and Westmark [*Science* 133, 1487 (1961)] includes useful information on relative activity of thyroxin and its analogs in promoting certain metamorphic changes in tadpoles. The authors indicate that in the rat, according to oxygen uptake and goiter prevention tests, the various analogs used are from 0.1 to 10 times as effective as thyroxin. In the tadpole, when the hormones are administered by injection (insufficient detail given as to number and frequency of doses, and so forth), three of the analogs show 3 to 7 times the metamorphosis-promoting capacity of thyroxin, that is, within the same range of effect as for the rat, while the most active compound, 3,5,3'-triiodothyronine, is 17 times as active, that is, outside the range of activity shown in the rat, but of the same order of magnitude. In contrast, when these hormones are administered by keeping the tadpole immersed in their solutions, these same analogs show up to 20 to 300 times as much metamorphosing activity as thyroxin.

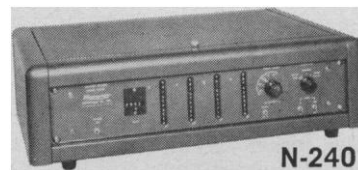
Frieden and Westmark ascribe the very different relative activities to the "unique" route of administration, that is, immersion, and suggest that in part the tadpole response is "probably strongly influenced by relative rate of penetration." Regrettably they fail to remark that most, if not all, of the tadpole tests utilize the relatively insensitive system of the tail, involving either the measurement of tail shortening or of tail height reduction. In contrast, when the most sensitive system, the leg of the tadpole, is used as a test object in hypophysectomized (and thus functionally thyroidless) tadpoles, far less difference in relative activities of the compounds is noted [Kollros, in *Comparative Endocrinology*, A. Gorbman, Ed. (Wiley, New York, 1959), and Kollros and Race, *Anat. Record* 136, 224 (1960)]. Recent studies, using threshold doses of hormones to stimulate leg growth, have shown 3,5,3'-triiodothyropropionic acid to be be-

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tween 10 and 50 times as active, at most, as thyroxin, rather than 290 times, as reported for tail reduction earlier [Roche *et al.*, *Biochim. et Biophys. Acta* **20**, 337 (1956)]. It should be emphasized that the extreme sensitivity shown in this reacting system *cannot* be ascribed to direct external stimulation by immersion, since the growth of the leg is characterized mainly by progressive changes in mass and by differentiation of the *internal* pre-muscle and muscle rudiments, and the precartilage, cartilage, and early bone of the skeleton. Metamorphic skin changes of the limb and of other regions as well are not evident in the animals treated with the lowest effective dosages. Exception should be taken, therefore, to the suggestion of Frieden and Westmark that immersion is likely to favor skin responses.

Since the immersion system provides the tadpole with a continuous and relatively unvarying hormone source, the possibility exists that internal and external hormone levels reach and maintain an equilibrium, as suggested by Moser [*Rev. Suisse Zool.* **57**, suppl. 2, 1-144 (1950)], and that the differences in response between immersion and injection techniques result from the continuous, long-term, high-level stimulation to which the immersed animal is subjected, in contrast to the high-level but much briefer stimulus which the injected animal may receive. That equilibria are achieved is suggested by the studies which establish hormone thresholds for specific levels of limb response, that is, which show that successive stages of limb differentiation require progressively higher hormone concentrations to be realized [Kollros, *Anat. Record* **125**, 624 (1956); *Am. Zool.* **1**, 107 (1961)].

JERRY J. KOLLROS

Department of Zoology,
State University of Iowa, Iowa City

The comments of Kollros do not reveal any fundamental disagreement with the results summarized in our recent report in *Science* pointing out the fallacy of the alleged anomalous activity of thyroxin analogs in the tadpole. In this report we compared the results of a single injection with a single 48-hour immersion dose, using the typical criterion of tail reduction. This is essentially the measurement used by other workers, for example, Pitt-Rivers, Roche, Money *et al.*, in their reports of large ratios of analog to thyroxin activity. It seemed logical to us then



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and now to compare the responses to immersion and injected doses, using a test similar to that used in these previous papers. But we clearly stated in our report (page 1489) that "Activity comparisons should also be made using other criteria, for example, limb eruption and growth (4)." [The "(4)" referred to experiments of Kollros.]

However, no adequately detailed data comparing analogs using the leg growth of the hypophysectomized tadpole or any other tadpole test have appeared in the references cited by Kollros, including the two symposium

papers [in *Comparative Endocrinology* (1959), and *Am. Zool.* 1, 107 (1961)] or in the abstract [which appeared in *Anat. Record* 136, 224 (1960)]. We are pleased to learn that recent studies by Kollros and associates, apparently also as yet unpublished, show 3,5,3'-triiodo-thyropionic acid to be only 10 to 50 times as active as thyroxin. This supports our contention that the larger values reported earlier were unrealistic, possibly reflecting, at least in the tail reduction method using normal non-hypophysectomized tadpoles, the test route of immersion.

It was suggested that certain skin responses may be favored in immersion experiments, because of the proximity of sensitive skin areas to the expected sites of absorption, for example, gills and skin. But we did not offer this as an explanation for effects on the limb response. We continue to think that using an immersion rather than an injection test route introduces the important additional variable of the rate of penetration of a test compound from the solution into the animal. It is not yet proved that the immersion system provides the tadpole with a continuous and relatively unvarying hormone source, especially in view of the permeability parameter, the instability of many of the compounds of the thyroxin series, and their variable absorption on glass as emphasized in our report in *Science*.

EARL FRIEDEN

Department of Chemistry,
Florida State University, Tallahassee

Censorship and Propaganda

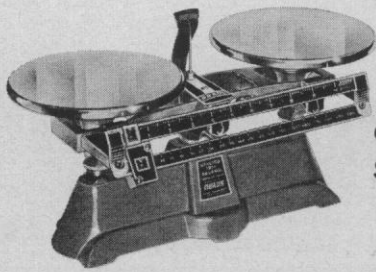
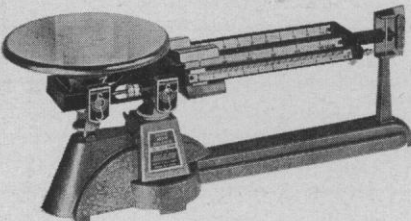
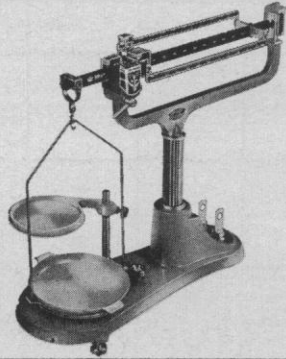
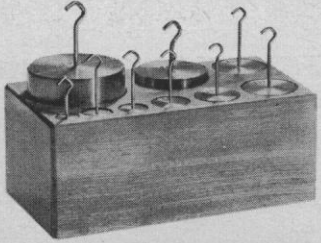
Regarding your editorial "The reluctant dragon" [*Science* 133, 1677 (1961)], I wish to point out that there are two sides to this question. As you indicated, censorship can be dangerous. On the other hand, propaganda can be dangerous, else the communist conspiracy would not spend so much time developing the technique.

I disagree with the implications of the editorial that imposing censorship on foreign propaganda is wrong in principle because censorship "is symbolic of fear and manifests a lack of faith in freedom and in the good sense and good judgment of American citizens." That Americans are not immune to the effects of propaganda is attested to by the number of communists that have been exposed within our government; also, by the communist-inspired student riots in May 1960 against the House Committee on Un-American Activities, in San Francisco.

We can continue to play the ostrich and ignore the dangers of the cold war, but to do so is to court disaster. Those who feel there is no danger have either neglected to study the record or have ignored its implications. Freedom, like health, isn't fully appreciated until it is lost.

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