Seasonal Variation in Sensitivity of *Rana pipiens* to Chorionic Gonadotropin

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Early in 1948, Wiltberger and Miller (*5*) and Robbins and Parker (*3*) independently announced the usefulness of the male *Rana pipiens* as a test animal for detection of chorionic gonadotropin of pregnancy. Both of these reports cited the use of small amounts of native urine. Subsequently Cutler (*2*), Brody (*1*), and others have reported the necessity of using concentrates prepared from large amounts of urine (20–50 ml) in order to obtain satisfactory results.

TABLE 1

SEASONAL VARIATION IN RESPONSE OF *Rana pipiens* TO CHORIONIC GONADOTROPIN

Season (1949)	No. of tests	Refractory animals	
		No.	%
Winter	866	2	0.2
Spring	1376	14	1.0
Summer	367	41	11.2
Fall	620	3	0.5

Our experience with the *Rana pipiens* test, which covers several thousand cases, correlates these discrepant recommendations. The animal is quite sensitive to chorionic gonadotropin during the fall, winter, and spring seasons. In this period it responds to between two and five international units of the hormone. The injection of a small amount of native urine is then sufficient, in most cases, to yield a positive response. In the summer, on the other hand, the animal is relatively insensitive, requiring from 10 to 25 units of gonadotropin for stimulation of spermatogenesis. Under these circumstances, the concentration method is essential to detect the chorionic gonadotropin, if present in low titer.

It is always necessary, and especially during the summer months, to test with known gonadotropin all animals which give a negative response in a test. For this purpose 1 ml of a concentrate prepared by the Scott (*4*) method from pooled pregnancy urine, containing about 50 I. U. of chorionic gonadotropin, is used in the summer season. At other times, 0.2 ml, diluted with saline to 1 ml, suffices. During the summer about 11% of the animals are refractory to gonadotropin, requiring retesting of the unknown specimen with another animal. In other seasons only about one animal in two hundred is refractory.

References

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Behavior of Hydrogen Ion in Exchange Reactions

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The anomalous behavior of hydrogen in ion-exchange reactions is well known. For example, when the adsorption energy of hydrogen ion is compared with other monovalent ions in clays and synthetic resins, it is found that hydrogen occupies a position which is quite abnormal in view of its charge and atomic weight. Moreover, no ion-exchange formulations are found to describe satisfactorily the reactions of hydrogen ion.

A possible explanation of these facts is that adsorbed hydrogen in the exchange materials is partly bound by covalent as well as electrovalent bonds. It is therefore of considerable interest to attempt the calculation of the surface dissociation constant for this ion.

Let us imagine an adsorbent in its hydrogen form treated with an electrolyte solution such as KCl. Then the ideas just stated lead to the following equation:

$$\mathrm{RH} \xrightarrow{\qquad} \mathrm{R}^- + \mathrm{H}^+ (\text{e.a.})^1 \text{ (surface dissociation)}$$

and

$$k_{\mathrm{RH}} = \frac{[\mathrm{R}^-][\mathrm{H}^+(\text{e.a.})]}{[\mathrm{RH}]} \quad . \ . \ . \qquad (1)$$

The quantities in brackets may be expressed in terms of milliequivalents per unit volume of suspension.

Let us now consider the exchange between the K ions and electrovalently bound hydrogen ions. That is,

$$\mathrm{H}^+(\text{e.a.}) + \mathrm{KCl} \xrightarrow{\qquad} \mathrm{K}^+(\text{ad}) + \mathrm{HCl}$$

and applying the mass action law:

$$\frac{[\mathrm{HCl}][\mathrm{K}^+(\text{ad})]}{[\mathrm{H}^+(\text{e.a.})][\mathrm{KCl}]} = \text{constant} = C \ . \ . \ . \qquad (2)$$

We assume here by analogy with weak acids and their salts that all potassium adsorbed is held electrovalently. Then from equation 2,

$$[\mathrm{H}^+(\text{e.a.})] = \frac{1}{C} \cdot \frac{[\mathrm{K}^+(\text{ad})]}{[\mathrm{KCl}]} \cdot [\mathrm{HCl}]$$

$$= \frac{X}{C}$$

where

$$X = \frac{[\mathrm{K}^+(\text{ad})]}{[\mathrm{KCl}]} \cdot [\mathrm{HCl}]$$

The quantity X can be obtained experimentally. Substituting the value of $\mathrm{H}^+(\text{e.a.})$ obtained from equation 2 in equation 1,

$$k_{\mathrm{RH}} = \frac{\frac{X}{C}\left[\frac{X}{C} + \mathrm{K}^+(\text{ad})\right]}{[T - \mathrm{K}^+(\text{ad})] - \frac{X}{C}}$$

$$= \frac{X}{C} \quad \frac{[X + C \cdot \mathrm{K}^+(\text{ad})]}{[C(T - \mathrm{K}^+(\text{ad}) - X]} \qquad (3)$$

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[1] H+(e.a.) refers to the amount of electrovalently adsorbed hydrogen in the adsorbent phase.

where T is the total exchange capacity of the adsorbent.

By experimentally determining X at any two values of K^+(ad) it is possible to solve equation 3 for k_{RH} and C.

From the experimental data obtained with the synthetic resin ''Ion X,'' k_{RH} and C have been calculated to be 0.82 and 11.0 respectively. It has been found that these values are unaffected by variations in the amount of potassium adsorbed or the amount of HCl in the system. It may be stated that k_{RH} has the dimensions of concentration and is therefore dependent on the mass of the sample used. The value 0.82 is on the basis of meq. per gr of adsorbent.

When the value calculated for C, 11.0, is taken as a measure of the adsorption energy of electrovalently bound hydrogen, the element assumes a position which is much more reasonable with respect to other monovalent ions. This will be clear from the corresponding constants for alkali metal ions. Adsorption energies of alkali metal ions and electrovalently bound hydrogen ions on the synthetic resin ''Ion X'' are set out below for comparison:

H	0.09
Li	0.55
Na	0.74
NH	0.95
K	1.00
Rb	1.22
Cs	1.70

Similar calculations for other exchange materials are being carried out and will be reported elsewhere.

Location of the Syncline in Island Arc Structure

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The tectogene hypothesis of syncline development is one of the more promising contributions to modern stratigraphy. By it we are given a cause, a mode of operation, a set of mechanical principles, a schedule of events, and a more-or-less predictable synclinal pattern. It is tacitly, if not expressly, assumed that the foredeep is the geosynclinal structure in which sediments are accumulated, to be lithified and preserved through future ages. This, however, raises certain difficulties.

In the first place, modern foredeeps include some which have been filled; some, partly filled; and some in which, apparently, little sedimentation has taken place. This third case includes those island arc troughs which now have ocean-water depths measurable in thousands or even tens of thousands of feet. These are true ocean deeps, and when sediments accumulate here to any great thickness, they will be of the deep-ocean type.

It would seem that some of the troughs of the past would have been slow in filling, also; and that, if we accept the identity of the foredeep with the geosynclinal structure, we should find, basal in at least a few such cases, true deep-sea deposits. No such find has ever been reported.

In the second place, the island arc pattern, as developed in modern seas, is sharply defined and distinctive. If the foredeep is also the geosynclinal structure, synclinal sediments of the Paleozoic, for instance, should exhibit such a pattern.

In the third place, sediments of many of the best-known synclines of the past were derived from land masses located seaward. If the foredeep is the geosynclinal structure, however, modern island arc arrangement practically excludes the possibility of a sourceland on the convex rim of the trough.

The island arc proper is the only significant source of sediments until a much later time in the history of the area. While the deep is still present, sediments can move in only two general directions: (1) from the islands, toward the concave rim of the trough, and hence toward (but not to) the main ocean basin; and (2) from the islands, toward the continent, and hence into the *becken* which lies inside the arc.

This *becken* (or *meeresbecken*), being located distinctly on the shelf, can receive only shallow-water sediments. Its pattern and size are only slightly affected by the pattern and size of the island arc. And much of its sedimentary load can be derived from seaward: first from the islands of the arc, and later from the upbuoyed tectogene.

It is not suggested that no true foredeep sediments will ever be found. It is suggested that the shallow *becken*, rather than the deep trough, may have been the geosynclines of the past.

References

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A Rapid Method for Obtaining Clear Soil Extracts

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Barium sulfate is widely used for flocculation of suspended matter in soil extracts, mainly because it eliminates most of the equipment necessary for filter paper procedure, it saves time, and because of its inert characteristics it does not interfere with the ionic concentration of the soil solution. The phenomenon is purely physical, in that the finely divided white powder carries a charge which causes the oppositely charged particles to flocculate and then settle to the bottom of the tube by the action of gravity.

This process, however, is not entirely complete, as a small amount of the powder remains suspended. For this reason alone, a simple and useful method to obtain clear soil extracts is rendered useless when testing for potassium, sulfates, calcium, and chlorides by the customary method, because of interference by the suspended barium sulfate powder. Thus, a quantitative analysis for these ions is out of the question.