

Of the many hundreds of zygotes which made up these experiments, in one of the forbidden classes [*heteroclitus* (Maine) sperm and *heteroclitus* (Rhode Island) eggs], one abnormal fry was discovered. Edematous and short, its behavioral characteristics indicated a severe anomaly of its central nervous system. This case will be restudied.

It is concluded, since:

- a. *F. diaphanus* male will cross with Maine but not with Rhode Island *F. heteroclitus* female
- b. *F. heteroclitus* (Maine) male will not cross with *F. diaphanus* female, yet *F. heteroclitus* (Rhode Island) male will cross with *F. diaphanus* female
- c. *F. heteroclitus* (Rhode Island) male will cross with *F. heteroclitus* (Maine) female but the reciprocal *F. heteroclitus* (Maine) male will not (or very rarely) cross with *F. heteroclitus* (Rhode Island) female -

that *F. heteroclitus* (Maine) is distinct from *F. heteroclitus* (Rhode Island) at least at the sub-species level.

It is probable that the land barrier of Cape Cod which separates the colder waters of the Gulf of Maine from the warmer waters to the south has served to isolate the two *heteroclitus* groups leading to the onset of speciation.

#### EFFECT OF MUCOSAL pH ON PD IN DOGFISH GASTRIC MUCOSA

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The in vitro dogfish gastric mucosa produces a small PD (-5 to -10 mV, reference mucosal soln.) with sufficient O<sub>2</sub> and CO<sub>2</sub> (Kidder, AJP 231:1240, 1976). The magnitude and sign of this PD (reversed from most mucosae) raises the possibility that it arises from diffusion of HCl from the bottoms of the secretory pits (pure HCl, isosmotic, calc. pH = 0.57) to the mucosal fluid (pH 4.5 in vitro). To test this, 6 mucosae were mounted as before (Bulletin MDIBL 15) (hyperbaric) and PD measured as mucosal pH was varied by substitution of H<sup>+</sup> for Na<sup>+</sup>. Such changes produce marked time-dependent variations in PD; I have elected to consider the PD 30 minutes after the change as representing a reasonably consistent value.

These results are shown in Figure 1. While some theoretical considerations predict a curve for such data, the large scatter precludes meaningful analysis on this basis. However, the extrapolated value at pH 0.57 (+11.7 mV) is clearly different from zero (the expected value from the diffusional proposal above), but the finite slope observed makes it likely that H<sup>+</sup> diffusion plays a role in the establishment of the observed PD.

In view of these results, it was decided to measure the PD and pH in dogfish stomach in vivo. Male dogfish of about 2 Kg were restrained on a "V-board" with their heads under running sea water. A combination pH/reference electrode was inserted into the stomach through the mouth, and PD recorded from a KCl/calomel fiber-junction electrode attached to the pH electrode and a similar electrode in the peritoneal cavity. Four fish were studied in this manner, with one additional fish monitored for pH alone. After at least 30 minutes of recording, 0.5 ml of 10<sup>-2</sup> M histamine was injected into the caudal vein, and recording continued for at least an additional hour. The data are corrected for electrode asymmetries.

The results are shown in Figure 2. Stimulation by histamine caused a marked fall in luminal pH (to 0.72 in one case) and a reversal of the PD from -4 to about +5 mV (reference lumen) during the hour following the secretagogue.

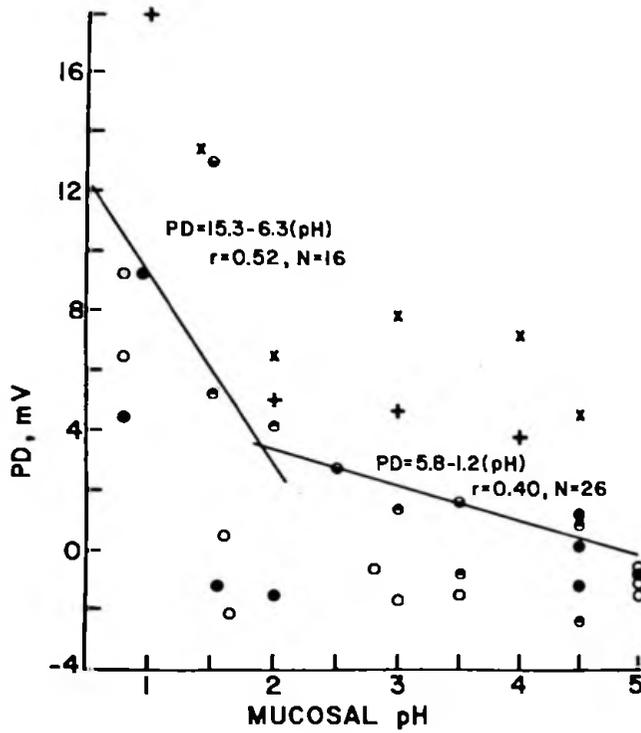


Figure 1. Relationship between pH and PD in vitro, under  $pO_2 = 1.9$  atm,  $pCO_2 = 0.1$  atm. Points taken 30 minutes after changing mucosal pH ( $H^+$  subs.  $Na^+$ ), in random order for 6 mucosae. Lines drawn by least-squares for points pH  $\leq 2$  and points pH  $> 2$ . Different symbols represent different tissues.

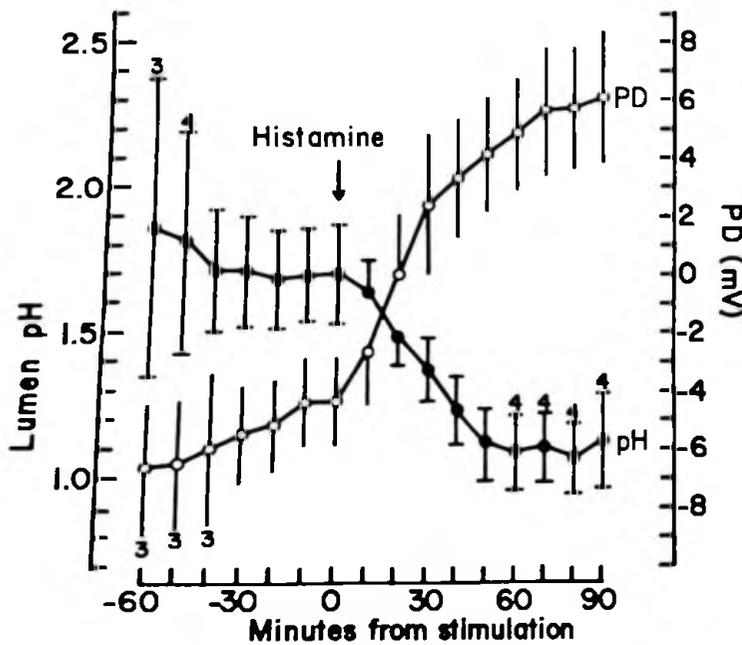


Figure 2. Time course of luminal pH and PD in vivo, before and after histamine stimulation. PD values are the average ( $\pm$  SEM) of 4 fist. For pH, the unspecified value is 5.

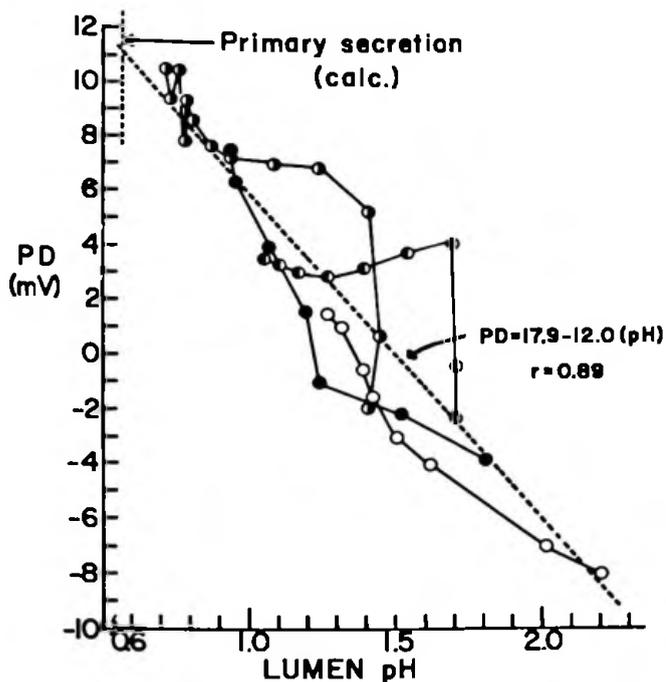


Figure 3. Plot of PD as a function of pH for 4 fish. Points recorded every 10 minutes from histamine administration to the time at which pH started to increase again. Line drawn by least squares.

For the four fish in which both parameters were measured, Figure 3 shows a plot of PD vs. pH. Less scatter is seen than in vitro, and the line has a slope of -12 mV/pH and an extrapolated PD at pH 0.57 of +11.0, very close to the in vitro value, and much different from zero.

I conclude that: 1) while diffusion of  $H^+$  from primary secretion to lumen probably contributes to the measured PD, some other process gives rise to the serosal-positive PD at pH 0.57. 2) the inverted (serosal-negative) PD observed in elasmobranchs alone may be due to  $H^+$  diffusion. 3) the consistency of the observations between in vivo and in vitro (hyperbaric) conditions gives some assurance that the latter are a good model for the former.

#### ACID SECRETION BY THE GASTRIC MUCOSA OF *Squalus acanthias* IN CHLORIDE-FREE SOLUTIONS

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The isolated gastric mucosa of the dogfish transports both  $H^+$  and  $Cl^-$  from serosal to mucosal solutions, producing a small potential difference (PD) compared to other species. Some have inferred that in this tissue the coupling between  $H^+$  and  $Cl^-$  active transport is especially strong, leading to the electroneutral secretion of HCl. It was therefore of interest to study the acid secretory rates ( $J_H$ ) in the presence and absence of  $Cl^-$ , both under the hypoxic conditions used for much of the previous work and under  $O_2$ -sufficient conditions, which require a hyperbaric chamber.

Tissues were dissected and mounted in  $Cl^-$ -free solutions, produced by substituting  $SO_4^{--}$  for the  $Cl^-$  in the solutions reported by Hogben (Science 129:1224, 1959), restoring osmolality with glucose. Carbachol