

GASTRIC MUCOSA OF SKATE (RAJA ERINACEA) IS HYPOXIC IN VITRO

George W. Kidder III* and Elizabeth L. Kidder*

Univ. of Maryland School of Dentistry, Baltimore, MD 21201

Dogfish gastric mucosa stripped and mounted in an Ussing chamber between appropriate solutions has been shown to be hypoxic in 0.9 atm O₂ but to be sufficiently oxygenated in 1.9 atm O₂ (Kidder, Am. J. Physiol. 231:1240). The hyperbaric conditions required for sufficient oxygenation severely restrict the sorts of experiments which can be performed. Since it appeared that the reason for the high O₂ requirement was related to tissue thickness (Kidder and Montgomery, Am. J. Physiol. 229:1510), we used the skate gastric mucosa for micro-electrode experiments, expecting that this thinner preparation might be properly oxygenated at normal pressure. We now report on a direct test of that presumption.

The hyperbaric chamber system was that previously described (Kidder and Montgomery, *ibid.*). The tissue was mounted (3.91 cm² exposed area) with its serosal surface exposed to a solution containing (mEq/l) Na⁺, 252; K⁺, 10; Ca²⁺, 5; Mg²⁺, 2; Cl⁻, 244; HCO₃⁻, 30; phosphate, 1; urea, 350; glucose, 25; and histamine, 0.1. The mucosal solution was similar but unbuffered, with all HCO₃⁻ and phosphate replaced by Cl⁻. These solutions were gassed with 90% O₂ / 10% CO₂ when at 1 atm total pressure, or 95% O₂ / 5% CO₂ at 2 atm total pressure, to hold the CO₂ constant at 0.1 atm.

Skates were supplied by Gordon King and stored in a live car until used. The stomach was opened along its lesser curvature and the mucosa removed by blunt dissection and mounted in the chamber. In alternating 1 h periods, the gas was changed between 1 atm total pressure (0.9 atm O₂) and 2 atm total pressure (1.9 atm O₂) with continuous measurement of acid secretory rate by the pH-stat method, titrating the mucosal solution to pH 4.5 with NaOH. The second half hour of each period was averaged and taken as the rate for that period.

Satisfactory measurements were obtained for 6 periods in each condition, using 3 tissues. In 0.9 atm O₂, a rate of 2.64 ± 0.28 uEq/cm²·hr (+SEM) was obtained, while in 1.9 atm O₂ these tissues secreted 3.89 ± 0.37 uEq/cm²·hr. These values are different at the 5% probability level, by t test. To remove variability between tissues, the ratio of the rate in 1.9 atm O₂ to the rate in adjacent periods in 0.9 atm O₂ was formed. The average of 9 such ratios was 1.95 ± 0.09 , which is significantly different from unity at the 1% level of probability. Control experiments exclude pressure alone as the cause of the increased secretory rate.

Since this tissue will not secrete acid in the absence of O₂, and since increasing O₂ concentration over that obtainable at 1 atm pressure increases the secretory rate, it is reasonable to conclude that the skate gastric mucosa, like that of the dogfish, is hypoxic as mounted in the Ussing chamber without hyperbaric conditions. This does not imply that this tissue is hypoxic in vivo with an intact gastric circulation, but should be remembered in interpreting experiments using this tissue in vitro.

* Present address: Dept. of Biology, Illinois St. Univ., Normal, IL 61761
Supported by NIH (NIADDK) AM-23229 to GWK III