This article described polarographic measurement of dissolved hydrogen (H₂) gas by platinum electrodes in vitro and implanted in tissues. The rate constant of the exponential washout following H₂-inhalation or arterial infusion of H₂-saturated saline gives local blood flow in tissue surrounding the electrode. (The SC[8] indicates that this paper has been cited in over 400 publications.)

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In the 1950s it was established that osmotic concentration of urine requires a hyperosmotic renal medulla. The subsequent recognition that vasa recta flow will tend to dissipate the osmotic gradient[7] created a need for methods for measuring medullary blood flow. Working with F. Kill and J. Krog in Oslo, Norway, I tried using polarographically determined urine oxygen tension as an indicator, but the results were not convincing. I talked with Robert W. Berliner at the first International Congress of Nephrology in 1960, and he offered me a fellowship at the Kidney and Electrolyte Laboratory at NIH, proposing that we try to quantitate medullary blood flow by measuring H₂ uptake by a platinum electrode inserted into the medulla. Delighted by the proposal, I arrived at NIH in the summer of 1962, where I joined postdoc Bruce F. Bower. He was already recording localized tissue areas.

Without warning, he would suddenly appear with his lit cigar in the middle of our bubbling flasks. Bruce took comfort in saying: “If the lab blows up, we will never know about it.” In any case, Bruce left NIH unhurt in the late fall of 1962.

The H₂ method was not much used or cited during its first decade, possibly because external detection of radioactive gases seemed simpler. Its increasing use in many tissues later on presumably reflects growing awareness of the main advantages of the technique: repeatable and simultaneous measurements of blood flow in several strictly localized tissue areas.

The method has been improved in some details: smaller electrodes probably give less tissue trauma; O₂ sensitivity is reduced by a suitable polarizing potential. Local electrolytic generation of H₂ is an interesting idea that deserves further exploration.


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