

Sensing oxygen through the skin

Although oxygen levels in blood are one of the most crucial physiological factors in the human body, it has been both difficult and risky to measure them in patients. Now a skin sensor that can measure these levels both accurately and safely has been designed by a husband-wife obstetrics team in Germany. Albert and Renate Huch of the University of Marburg report their results in the June HOSPITAL PRACTICE.

So far, the sensor has been used on more than 1,000 newborns and has proved extremely valuable in managing their breathing problems. It has helped fetuses during labor and may eventually benefit adult heart attack and surgical patients. What's more, it is providing crucial new scientific information about oxygen levels under various conditions.

True, continuous monitoring of breathing in patients is established hospital practice. But normal breathing can, on occasion, coexist with local or even general lack of oxygen to blood. So it would be much better if hospital staff could monitor oxygen levels in blood vessels directly. Such local monitoring has been possible in the past, but it has been inaccurate or risky. For instance, a needle can be stuck into a blood vessel to withdraw a blood sample for oxygen analysis, but the information obtained is discontinuous or invalidated by the trauma of the needle pricking the vessel. Similarly, a catheter can be placed in an artery to measure oxygen levels, but its use is unsafe.

The Huchs wanted to find some way to monitor oxygen levels in blood vessels without having to insert a needle or catheter into them. Since oxygen has been known for over a century to diffuse through intact skin, they set about designing a skin-sensing instrument to measure oxygen levels in vessels.

A small, round device about one inch across is placed on the patient's skin and is connected to a recording apparatus. The apparatus includes a ring-shaped silver anode heated by a coil and three cathodes within the anode, all encased in plastic except for their working face which is covered by a double membrane of Teflon and cellophane. A drop of electrolyte (potassium chloride) is placed between the double membrane and the face and another between the membrane's layers (the second drop helps stabilize the device in operation). The apparatus is connected to electronic equipment. Current flow between the anode and cathodes reflects the amount of oxygen diffusing through the skin into the drop of electrolyte enclosed between the membranes.

The skin sensor has proven particularly helpful in correcting the breathing problems of full-term and premature new-

borns. For instance, it has shown that the amount of oxygen in the blood of some infants may be dangerously low even though breathing and heart rate are normal. In such cases quick action can be taken to prevent the permanent damage that can result from even a short period of oxygen deficiency. The sensor has also been used to determine whether newborns are benefiting from assisted breathing or supplementary oxygen treatment. If not, a repositioning of the inhalation tube or adjustment of the rhythm and depth of the breathing apparatus may be indicated.

Oxygen levels in fetuses during labor can be accurately determined by inserting the sensor into the birth canal with a special forceps and attaching it to the fetus's scalp. If the fetus's oxygen supply is cut critically short, say, during a shift in the mother's position or during increasingly frequent and strong labor contractions, a drug or oxygen can be given to the mother to bring the fetus's dangerously low oxygen levels up.

Since adults have thicker skin than do newborns and fetuses, the sensing device

may not work as accurately on them. Still, the Huchs predict that it will help adult patients acutely ill after a heart attack or undergoing major surgery with extended anesthesia since it is critical to know whether their blood has enough oxygen.

Not unexpectedly, the instrument is divulging some valuable physiological information. Studies of newborns for instance, have shown that oxygen reaches high levels during the first hour of life and does not increase further during the first day in spite of the well-known drop in heart rate during this day. So contrary to some earlier suggestions, the heart rate drop does not reflect an improvement in the function of the newly inflated lungs. Another revelation: The oxygen requirements of the fetus are markedly smaller than those of the newborn.

For the research physician or physiologist, the instrument promises to yield new information about oxygen levels in blood during exercise or other conditions and to assist oxygen-level experiments in small mammals where catheterization is tricky. □

Women as key to development

When the United Nations convened an International Women's Year Conference last year in Mexico City, the American Association for the Advancement of Science held a seminar on the role women play in the development process of Third World countries (SN: 7/19/75, p. 38). Out of that effort has now come a scholarly collection of papers and an annotated bibliography, *Women and World Development*, edited by Irene Tinker and Michèle Bo Bramsen of the AAAS Office of International Science, and published by the Overseas Development Council.

Some of the volume's themes have already become familiar—that women are an important key to the development process through both their public and private roles, and that modernization often lowers rather than raises the position of women in a society. But the expertise brought to bear on discussion of these issues and their implications has probably never been matched, and the case studies bear a fresh shock of truth:

- Development has brought such pressure on the family system that one-third of the world's households are now headed by women. This directly contradicts the frequent assertion that women's income can be considered as "secondary."

- Though women in several countries have begun to enter fields previously dominated by men, often the effect has been one of lowering the status and income of the profession as a whole.

- Margaret Mead points out that when agriculture has been mechanized, not only are women often left out, but their "whole component of thought" is lost. Thus in countries where women have traditionally

been responsible for hand-harvesting crops and preserving them, those mechanically harvested are stored without adequate thought for preservation, and sometimes as much as half is lost to rats.

- Tradition is still a strong barrier, with old religious customs sometimes becoming codified into law. In some moslem countries, women must have their husband's authority to leave the house; not surprisingly, they show the lowest rate of economic integration. Only 5 percent of the women in Middle Eastern countries are part of the labor force, compared with 20 percent in Latin America.

- Urbanization presents a particularly difficult dilemma, providing women with readier access to opportunities for advancement, but more often confining them to marginal existence. The problem is particularly acute in Africa where new towns have sprung up in response to growing foreign trade. A small educated minority of women have succeeded in rising along the occupational ladder, but many more have been forced into demeaning service as indentured domestics and prostitutes.

The authors offer no magic formula for correcting these inequities, but a consensus is implied regarding some necessary steps. Better communication—including greater access by women to the media and public officials—will be needed, both to ensure that development plans do not leave women out and to stimulate local action integrated with national needs. Also, a case is made that more women must be admitted to public management before sex-stereotyped roles at homes and work can be amended. □