PHYSIOLOGY

Fireman Save My Child!

A Serious Medical Drama of Blue Babies Whose False Start in Life Is Corrected By a Common Gas

By WATSON DAVIS

THIS is a story of babies, blue babies babies who did not let out those first, shrill cries so welcome to doctors, nurses, and mothers exhausted with pain of childbirth. It has to do with clanging fire engines. It contains those chemical symbols CO_2 and O_2. Through it walks with energy and tenacity a first citizen of Yale and the realm of physiology, Yandell Henderson, professor and fighter. The Henderson who told the Congress to make the alcohol limit of waning prohibition's beer, the famous 3.2 per cent. —but that is of course another story. But most of all this is a tale of babies who lived and babies yet unborn who might otherwise have died, but now will live.

They will live because this energetic professor found a way to make them draw those vital first gasping breaths which fill their lungs. The babies—one out of every hundred—who fail to start breathing when they are born, and thousands of grown-up persons who have been drowned, who have suffered carbon monoxide gas poisoning, electric shock, or the after-effects of anesthesia will live because this professor, disregarding scientific theory sticking to the facts he discovered, has been telling physicians all over the country that it takes carbon dioxide with oxygen to start breathing.

When Breath Fails

How do we breathe? This may seem a silly question, answerable: Through our noses. With our lungs. Quite right, of course. But more fundamentally, oxygen in exchange for carbon dioxide is soaked up by the blood that courses through the lungs. Breathing is quite automatic most of the time but when it fails to start at birth or when drowning, electric shock, carbon monoxide poisoning, anesthetic after effects, mountain sickness, aviators' collapse, lung irritating gases or pneumonia stops the service of oxygen to the blood, asphyxia,—suffocation to you—results. This is very serious, a first step toward death. Action, prompt and proper, is needed.

"The first quarter of an hour after birth," Prof. Henderson declares, "is the most dangerous period of life. Its mortality is as great as that of any subsequent month. No single discovery of medical science or improvement in practice could do more to save lives than would measures to avoid the losses that now occur within a few minutes after birth."

"Crude, ineffective and reprehensible is the treatment which ignorance and immemorial custom tolerate and even recommend for the non-breathing newborn child," referring to plungings into cold water or vigorous spankings.

More lives could be saved by giving new-born babies a carbon dioxide-oxygen mixture to stimulate their first breath than by the elimination of some of the diseases of infancy and childhood, such as infantile paralysis, Prof. Henderson estimates.

A Hazard For All

Getting down to figures, he says that this measure would "make a difference of one life in a hundred—and it must be kept in mind that birth is a hazard through which all must pass."

"The normal baby starts to breathe under essentially the same stimulus that causes an adult to breathe again after holding his breath," Prof. Henderson explains.

You know what happens to your own breathing when you get under a cold shower or when some playful friend throws cold water over you literally, or when a rush of cold air suddenly strikes you. You catch your breath. The stimulus of the sudden cold against your skin makes you draw in a deep, prolonged breath or even repeated ones.

When the new born baby meets the cold world for the first time the same thing happens to him and in this way his lungs are at least partially expanded. So long as his lungs are unexpanded, they send no impulses over the nerves to the respiratory center, but as soon as baby's lungs are even partially expanded they send messages over certain nerves that call forth the reflexes which determine the alternation of inspiration and expiration in normal breathing.

But the collapsed state of the baby's lungs at birth is not so quickly overcome. Even in wholly normal babies the lungs are not fully expanded for hours, days or even longer. There is danger in this.

If parts of the lungs stay unexpanded, conditions favorable for lung infections are provided. Unrecognized pneumonia resulting from this condition is a far more frequent cause of death during the first weeks of life than has been realized. One medical scientist, investigating a series of deaths among the new-born, found that nearly one-fourth of them had pneumonia.

Make Him Cry

To avoid such lung infections the textbooks recommended making the baby cry —by the methods Prof. Henderson terms "reprehensible." Much better and more effective, he maintains, is starting the baby's breathing by nature's own stimulus—specifically by inhalations of five to seven parts of carbon dioxide in a hundred parts of oxygen.

Babies, adults, children, cats and dogs, all breathe in response to the same stimulus and the same mechanism. And the trigger that sets off and maintains the breathing is the carbon dioxide that is brought to the brain's respiratory center by the blood. That is Prof. Henderson's contention.

Oxygen keeps the respiratory center in good condition and allows it and the rest of the body to produce the waste carbon dioxide. But give the body ample oxygen to burn and yet it might not get the signal to do so. The carbon dioxide is thus not an enemy but an ally of oxygen that paradoxically issues the orders that start breathing to draw in the oxygen. An increase of the carbon dioxide in the blood, as Prof. Henderson sees it, is the only stimulus that will restore normal respiration.

It may be technical and some may not understand it. As usual the facts are much simpler than the theory—or theories.

The widely accepted theory of what happens inside when breathing stops is that the waste carbon dioxide gets the upper hand, fills the blood and muscles and produces a state generally called "acidosis" because it is considered to be intoxication by carbonic acid.

Prof. Henderson shocked other physiologists by arguing that this theory is wrong. He recommended, with experiments to back up his advice, that to treat asphyxia, lungs should be fed not oxygen alone, but oxygen mixed with 5 to 10 parts per hundred of carbon dioxide—the very stuff that others assumed caused the trouble. There were heated arguments at scientific meetings.

In Practice

Characteristically Prof. Henderson let the controversy continue in scientific halls and publications while he sent out a rescue call to the firemen of the nation. Through the manufacturers of rescue apparatus, the firemen were told to use the oxygen-carbon dioxide mixture in gas, drowning and other such cases. Not knowing the theories, they followed instructions without question. The "hook-and-ladder boys" did not realize they were refuting Prof. Henderson's professional opponents.

And happily for those saved and Prof. Henderson's idea, many people were snatched from that brink of death to which lack of breathing had taken them. Soon doctors, grasping at hope when life had seemingly fled, began to call the fire department rescue squad when their more orthodox methods had failed. A young interne in a Boston hospital, who had seen a "dead man" revive under the ministrations of fire department rescue apparatus, called the fire department when a new-born baby refused to take its first breath of life. The fire engine came too; but the baby lived.

One summer day, Prof. Henderson vacationing in Paris, reading news of the good old U. S. A., ran across a little Chicago item: "200 Babies Saved by Firemen." Not by carrying them down ladders from burning buildings, but by rushing inhalators to them. Here was a large scale demonstration of the usefulness of adding a little CO_2 to the O_2 of the inhalators. So Prof. Henderson pushed his radical idea harder than ever. He wrote careful, sedate articles in that weekly Bible of physicians, *the Journal of the American Medical Association,* urging them to use the new method;

"Unless one is burned alive, the tissues of one's body always die of asphyxia."

Not In Lungs Alone

Breathing in its widest sense is not confined to your lungs alone. The lungs take in air and expel air, but there is another kind of breathing, known by the scientific term of respiration. This breathing means the exchange of oxygen and carbon dioxide and the production of energy. It is the most fundamental process of life and it goes on all over the body, not only in the lungs but in every other organ and in the minute cells of which your body and all its parts are made.

Any disturbance of the blood system, any change either by accident or disease of the cells of any tissue in the body almost inevitably involves a change of this particular kind of breathing process, either in a single organ or in the whole body. In cancer cells, for instance, an alteration of the cell respiration is found. And such alterations are found not only in carbon monoxide poisoning, in asphyxia of the newborn, or after prolonged anesthesia, but in the majority of all persons dying from disease. As death approaches, the tissues of the body are being suffocated.

Oxygen Not Enough

After the tissues have begun to die from alteration in their breathing process, the process cannot be immediately reversed and the tissues revived by supplying oxygen, even in the most ample amounts.

"Life," says Prof. Henderson, "is not like a candle that on extinction can be immediately relighted. Recovery from asphyxia in an untreated patient is often extremely slow, indicating that certain conditions and processes far more complex than mere deficiency of oxygen have to be slowly and with difficulty reversed.

"If asphyxia of a little less than fatal intensity is prolonged, it may in rare cases render a man permanently an idiot as completely as if his cerebrum had been removed."

Oxygen is not a stimulant to breathing, Prof. Henderson kept on telling doctors who insisted on trying to start respiration with oxygen. The kind of combustion that goes on in the human body, whereby food is converted into energy, requires oxygen like any combustion process. But this combustion is not like a fire which burns more or less vigorously according to the supply of oxygen.

A Misconception

Oxygen is an essential foodstuff. Without it the tissues cannot produce carbon dioxide, he explains. But asphyxia—suffocation, if you like—is not a condition of lack of oxygen and excess of carbon dioxide. This is the prevailing conception but it is a misconception, Prof. Henderson contends.

In asphyxia, usually, the blood and tissues contain low amounts of both oxygen and carbon dioxide. Thus the practical problem of getting the new-born baby to breathe is very nearly the same as that of resuscitating an adult who has been partially suffocated, either by gas poisoning or drowning or some similar accident. For both babies and adults,

FOR DROWNING

Carbon dioxide and oxygen from the inhalator and artificial respiration by the Schafer method used together, as these girls are doing, will start breathing that has been stopped by drowning, electric shock or other accident. But if the inhalator isn't handy, start artificial respiration by the Schafer method immediately. Delay means death.

it means giving a mixture of carbon dioxide with oxygen.

Every hospital should be equipped with an inhalator for the new-born, or better with an inhalator suitable for infants and adults as well, Prof. Henderson consequently advises. And for babies born at home, the physician need no longer depend on the hook-and-ladder boys. An inhalator small and light enough to carry in an overcoat pocket could easily be made, Prof. Henderson says.

You will notice that Prof. Henderson calls the apparatus an "inhalator." "Pulmotor" is a word he does not like. The original Pulmotor has been discredited by scientists and medical boards many times over but unfortunately its name still clings. He says:

"Because of this confusion of terms, the newspapers often report the resuscitations effected by means of inhalators as cases of 'victims restored to life by the Pulmotor.' Then some ill-informed community buys one of these discredited devices for its fire department."

So certain is Prof. Henderson of the value of his method that he believes it should be required by law as part of the routine management of the baby's life. Just as drops of silver nitrate must, legally, be put in the infant's eyes to save his vision from destruction by possible infection, so he should be given carbon dioxide-oxygen inhalations for a few minutes several times a day during each of the first few days of life. This measure is recommended by Prof. Henderson even for babies that start breathing promptly and normally. For those unlucky ones that fail to get started at breathing, the inhalations are the life-saving measure.

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PHYSICS

Scale For Atom Weighing Uses Electric Lenses

THE existence of a new "scale" for weighing individual atoms that occur by the billions in a single speck of matter was revealed by Prof. A. J. Dempster, of the University of Chicago, to the American Philosophical Society, which Benjamin Franklin founded in 1727 and which is the oldest learned society in the United States.

Dr. Dempster's atom "scale" is known to science as the mass spectrograph. Although the device itself weighs several tons, it can determine the weight of individual atoms. It is used in detecting isotopes of the various kinds of matter, the varieties of a substance like chlorine or oxygen, which are chemically indistinguishable but have slightly different weights.

The new Chicago mass spectrograph is five times as sensitive as the world-famous instrument of Prof. F. W. Aston in England and fifteen times as sensitive as the similar device recently built by Dr. Kenneth Bainbridge at Princeton University.

Secret of the delicacy of the apparatus is a system of "electric lenses" which accurately focus the electrically charged atoms of the element under study as they pass through the device.

These ions, as science calls them, have to pass through a narrow slit only one thousandth of an inch wide as they enter the "scale." After curving under the action of a magnetic field, the ions strike a photographic film and register their positions. Different weight ions fall at critically characteristic positions on the film. The measurements which establish their relative weights are based on a highly accurate determination of the position of the lines. The ideal situation would be to have the lines sharp and clear, but in past instruments the lines were always wider than the entrance slit used because the ion beam was gradually spreading out like the rays from a searchlight.

The "electric lenses" in Dr. Dempster's new instrument focus the various beams of different weight ions into extremely sharp lines on the film after first letting them spread out into their magnetic "weight" pattern.

Using a new source of ions in conjunction with this new instrument, Dr. Dempster has just "weighed," for the first time in the history of science, the isotopes of gold and platinum in the pure state. The new source of ions is a highly intense electric spark which knocks out atoms from the element being studied and at the same time strips an electron from many of them, and hence gives them the needed electric charge.

Previously the only way the "noble" metals like gold and platinum could be studied was to form some gaseous compound of them which could be ionized by irradiating it with X-rays or radium rays.

Isotopes of eighteen elements have been studied so far with the new apparatus, Dr. Dempster said.

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PHYSICS

Earth Has Magnetic Storm; No Effects on Wireless

A MAGNETIC storm, consisting of rapid and irregular oscillations in the earth's magnetic field, was reported by the U. S. Coast and Geodetic Survey observatory at Cheltenham, Md., on Thursday, April 11. Although such "storms" have nothing to do with the storms of ordinary weather, they frequently disrupt telegraph and wireless communication. The wire and radio companies, however, reported no interference.

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The rare plant, *Tumboa,* of South West Africa, grows just two leaves, but these may become ten feet long.