MODERN TECHNOLOGY

Hyperbaric Medicine Technology –

From deep sea to outer space and into your hospital

Most of us that have spent more than a few years in the Medical industry have heard of Hyperbaric Oxygen Therapy HBO_2®. It has specific medical applications ranging from an adjunctive therapy in chronic wound care to the Standard of Care in Gas Gangrene, Carbon Monoxide Poisoning and late effects of Radiation following cancer therapy.

So what is Hyperbarics?

When most people hear the phrase "Hyperbaric Medicine" they think of Deep Sea Divers developing bubbles in their blood and being treated for the "Bends" in a Hyperbaric Oxygen Therapy Chamber. "Hyper" means Greater Than and "Baric" meaning Barometric Pressure or Sea Level.

Human Physiology and Hyperbarics

So let's go back to Biology-101. At sea level, all the oxygen your body can carry is bound chemically to the blood red cell hemoglobin. In a hyperbaric chamber, the entire patient is pressurized to greater than sea level barometric pressure. One "sea-level" atmosphere is equal to 14.7 pounds per square inch pressure or 760 millimeters of Mercury in medical jargon. By the way, while it takes almost 200 miles of air to create this "barometric" pressure, it only takes 33 feet of sea water to exert the same pressure on a diver. This BIG difference is caused by the difference in density between air and water.

Breathing pure oxygen in a hyperbaric chamber that is 2 to 3 times greater than normal Barometric pressure allows the plasma, or liquid part of the blood to carry oxygen in solution, just the way carbon dioxide stays in solution in a bottle of sealed soda. Take the top of the soda too quick- and you get foam. If a diver comes up too quickly from underwater - the same thing happens to his / her blood.

Photos provided

Astronaut practices HUBBLE repairs underwater.

Underwater Divers

As you are reading this, commercial divers are working at underwater depths ranging from a few feet under the George Washington bridge to over 1,000 feet under the ocean, a pressure equivalent to 31 times normal sea level pressure. They do normal construction work in support of the offshore oil industry, like welding or connecting pipes and bolting steel structures together.

Astronauts in Space

Also as you are reading this, astronauts are passing over your head at 17,800 miles per hour in the ultimate Hyperbaric Chamber, a Space Suit. Space Suits are flexible hyperbaric chambers that keep 3.5 Pounds pressure of pure oxygen inside the suit. This is about the same amount of oxygen we breathe at sea level.

Air is a mixture of about 21% oxygen and 79% Nitrogen and trace gases like argon. If the astronauts used air, it would have to be at 14.7 pounds to have enough oxygen "partial pressure" to keep the astronaut alive, it that pressure difference, the astronaut arms and legs would stick out like the Pillsbury Dough boy and he would be unable to work.

Divers exhale into the water. Each time the astronaut exhales, the carbon dioxide mixture goes into the Suit "Backpack" and the CO2 and water vapor is removed and reheated fresh oxygen is sent back to the astronauts helmet. Astronauts can also develop bubbles in their blood and get the "Bends" if they loose pressure in their suits or in their space cabin on the Shuttle or Space Station.

Technology Transfer

Underwater construction to aerospace to medicine and back again

Often, problems in one area of technology actually find solutions from other technologies where a similar problem has already been solved. We call this "Technology Transfer" and it has brought us everything from "Velcro" and "Tang" to new pharmaceuticals and freeze dried Ice cream.

Technology Transfer at it's Best

In early 1991, NASA realized that the recently launched Billion Dollar Hubble Space Telescope had a mirror defect and needed to be modified with a special set of lenses. A failure to repair the Telescope would destroy or cripple future NASA programs. The problem was that these high-tech "Eyeglasses" would take several astronauts over 8 hours to install. Up to this time, the longest NASA "space walk" had been less than three hours long.

To train astronauts to work in space-NASA places astronauts underwater in a giant pool to counteract the Earth's gravity and simulate the zero-gravity of space. The emergency repair of the Hubbell required that the astronauts train to make the repairs underwater to simulate zero-gravity first.

The full-scale size of the telescope and space shuttle mockup placed in a special pool meant that the astronauts would have to train deeper and longer underwater than breathing air would allow them to without risking the "Bends". One astronaut that was also a diver suggested NASA go to the diving industry and look into using NITROX, an oxygen enriched air mixture that permitted commercial divers to stay underwater over five times longer than divers breathing air.

NASA called Dr. R.W. "Bill" Hamilton and Glenn Butler of Life Support Technologies, Inc. Bill and Glenn were considered leading experts in the use of high oxygen breathing mixtures for diving and in Hyperbaric Medicine. Bill and Glenn went on to develop the right mixtures, equipment and training procedures to permit NASA to complete the many underwater training hours without astronauts developing the bends in preparation for the repair.

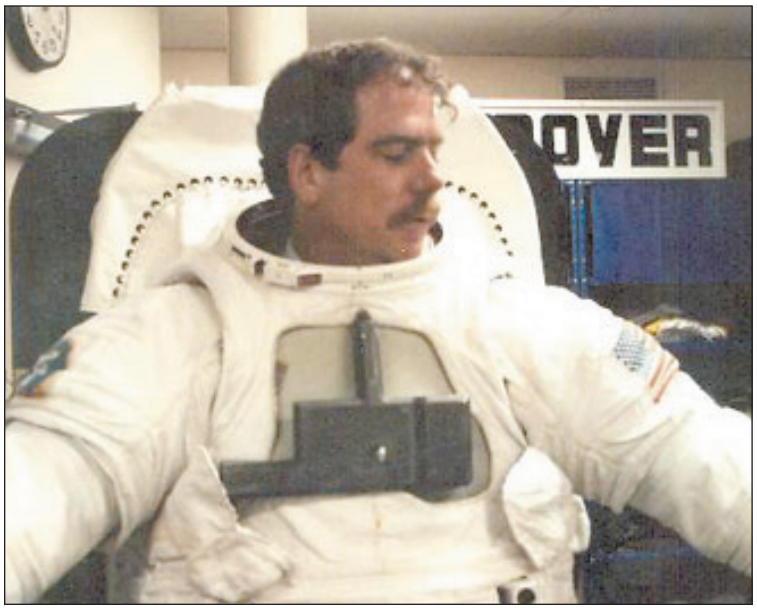
The shuttle "ENDEAVOR" Flight Number STS-61 in December 1993 and Captained by astronaut Story Musgrave flawlessly completed the Hubbell repair after spending almost two months underwater simulating the mission breathing NITROX.

Today, Bill, Glenn and Dr. Jorge Beale utilize gas mixtures and combine many other technologies from the underwater diving, aerospace and medical industries to help treat chronic non-healing wounds at The Chronic Wound Treatment and Hyperbaric Center at The Mount Vernon Hospital and other Chronic Wound Management Network® facilities.

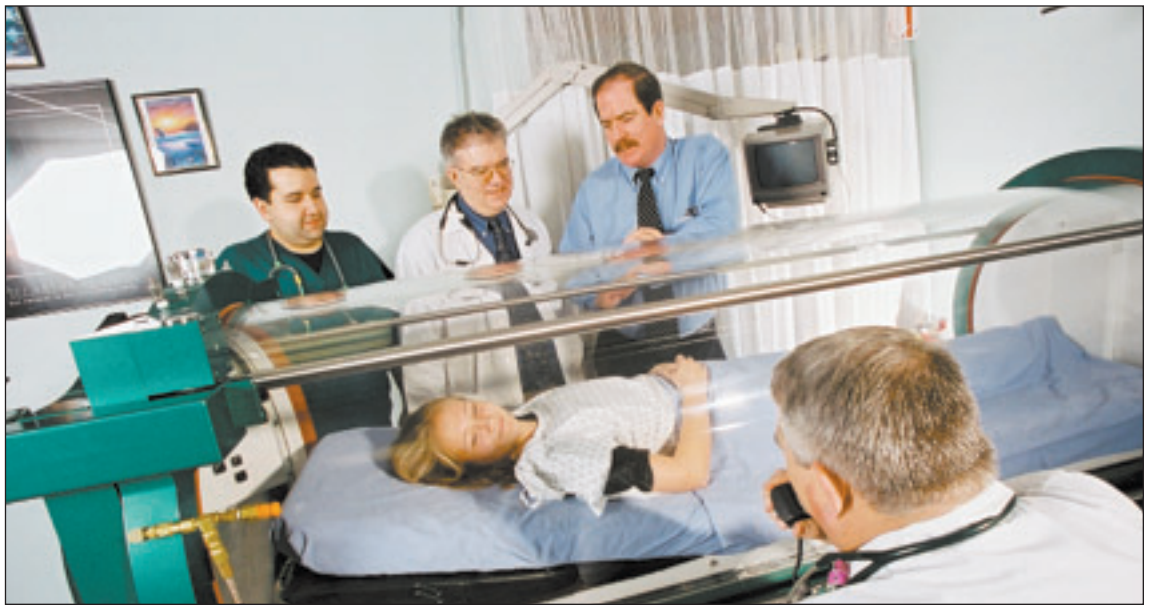
Their last Medical development includes the combined use of Hyperbaric Oxygen and special light frequencies to both stimulate cell mitochondria and improve the rate of new tissue growth while fighting infection.

But that's another story

- PROVIDED
Mount Vernon Hospital



Glenn Butler suits up for training session.



Hyperbaric chamber treats gas gangrene patient at The Mount Vernon Hospital.