INTRODUCTION &
HISTORY OF HYPERBARIC OXYGEN THERAPY

전남대학교 의과대학 응급의학교실

허 탁

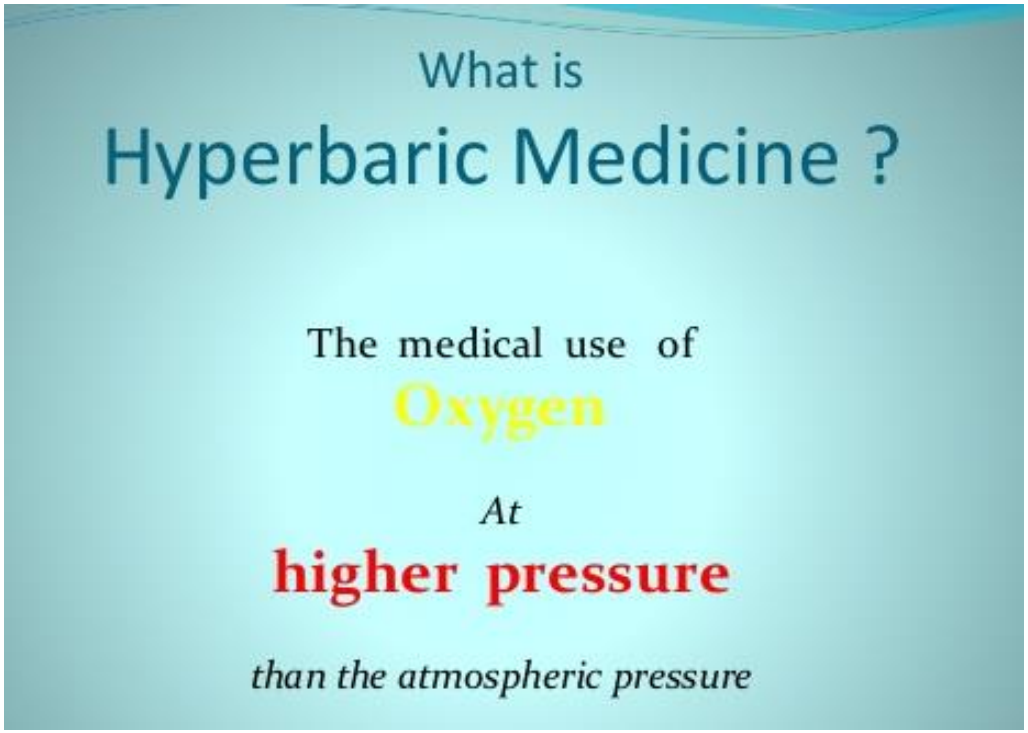
“죽은 사람은 왜 핏빛을 잃고 창백해질까?”

Definition

- **Hyperbaric Medicine**:
  is the medical use of oxygen at greater than atmospheric pressure to increase the availability of oxygen in the body; and therapeutic recompression

  compressed to greater than 1.4 atm of absolute pressure

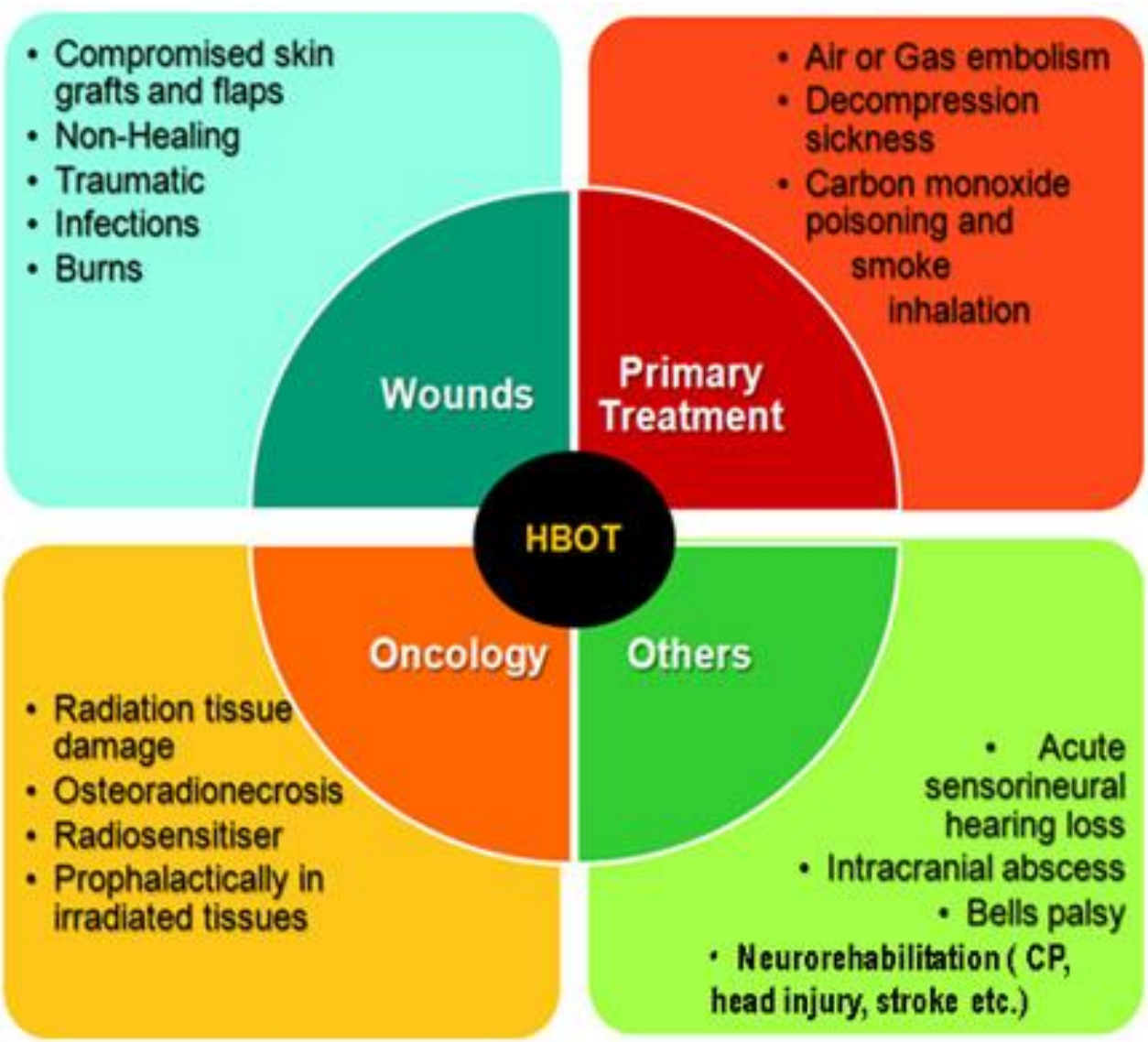
Definition



Hyperbaric chamber -> Medical Device

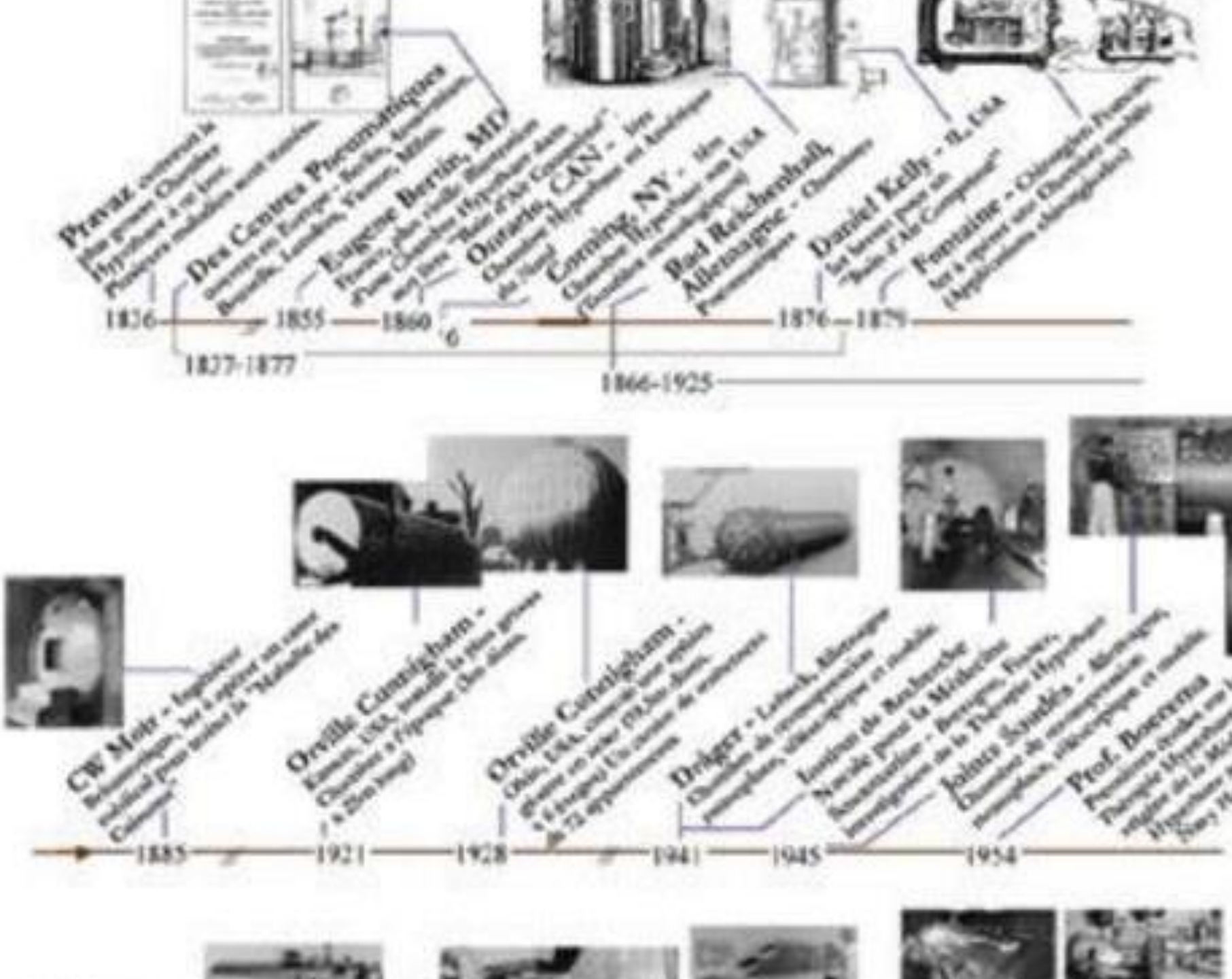
Oxygen -> Medicine

Welcome to the world of hyperbaric oxygenation therapy (HBOT)!

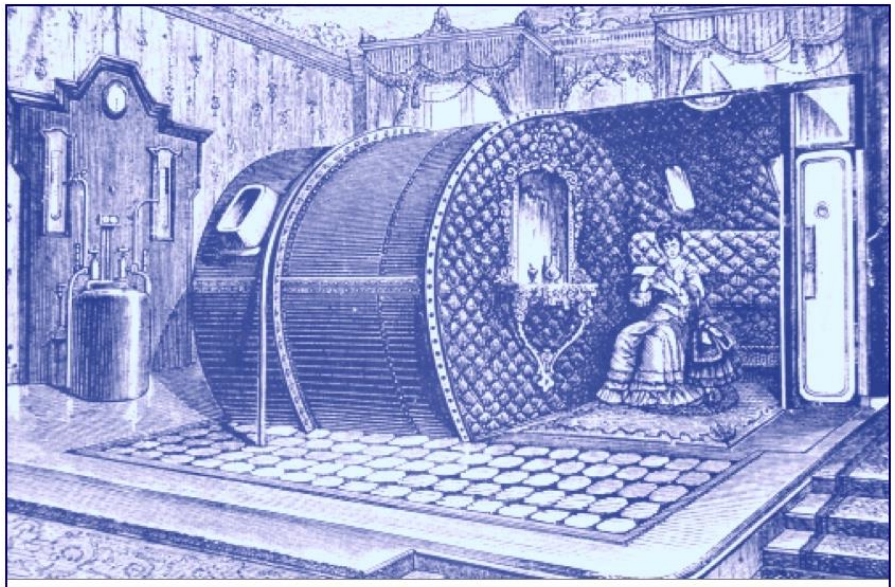


History & development

- 1662 - British physician to treat pulmonary disease and help with digestion.
- 1891 - Doctors in U.S. began using hyperbaric oxygen therapy to treat nervous disorders
- 1895 - Was found to be effective in treating carbon monoxide poisoning.
- 1928 - A five story having 60 rooms chamber for $1 million in Ohio by Dr. Cunningham
- 1934 - A U.S. Naval officer found it to be effective in treating decompression sickness.
- 1961 - Hyperbaric oxygen therapy was found to be effective in treating gas gangrene.
- 1963 - The first International Congress on Hyperbaric Medicine convened in USA
- 1966 - Hyperbaric oxygen therapy was found to be effective in treating stroke patients.
- 1970 - Hyperbaric oxygen therapy was found to be effective in treating multiple sclerosis.
- 1988 - The International Society of Hyperbaric Medicine was founded.
- 2000 -Hyperbaric medicine was approved by the American Board of Medical Specialties as a sub-speciality of emergency and preventative medicine.


Pravaz
Den Centren Pneumatiques
Eugene Berlin, MD
Ontario, CAN
Corning, NY
Bad Reichenhall, Allemagne
Daniel Kelly - IL, USA
Fontaine
1826
1855
1860
1876
1879
1827-1877
1866-1925
CW Mohr
Orville Cunningham
Orville Cunningham
Drager
Prof. Boccerni
1885
1921
1928
1941
1945
1954

History & development



1662 – British "Domicilium"

Henshaw

- used a system of organ bellows to change the atmospheric pressure in a sealed chamber called a domicilium in 1662.
- create both proposed as a good expedient to help digestion, to promote insensible respiration, to facilitate breathing and expectoration, and consequently, of excellent use for the prevention of most afflictions of the lungs."

History & development

In 1834, French physician Junod

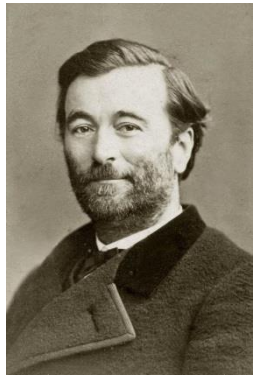
- built a hyperbaric chamber to treat pulmonary afflictions using pressures of 2-4 ATA(with Watt)
- reported increased circulation to the internal organs, improvements in cerebral blood flow, and production of feelings of well-being.

History & development

in 1837, Pravaz

- built the largest hyperbaric chamber of that time
- used to treat patients with pulmonary conditions including tuberculosis, laryngitis, tracheitis and pertussis, as well unrelated conditions such as cholera, conjunctivitis, deafness, menorrhagia and rickets.

History & development



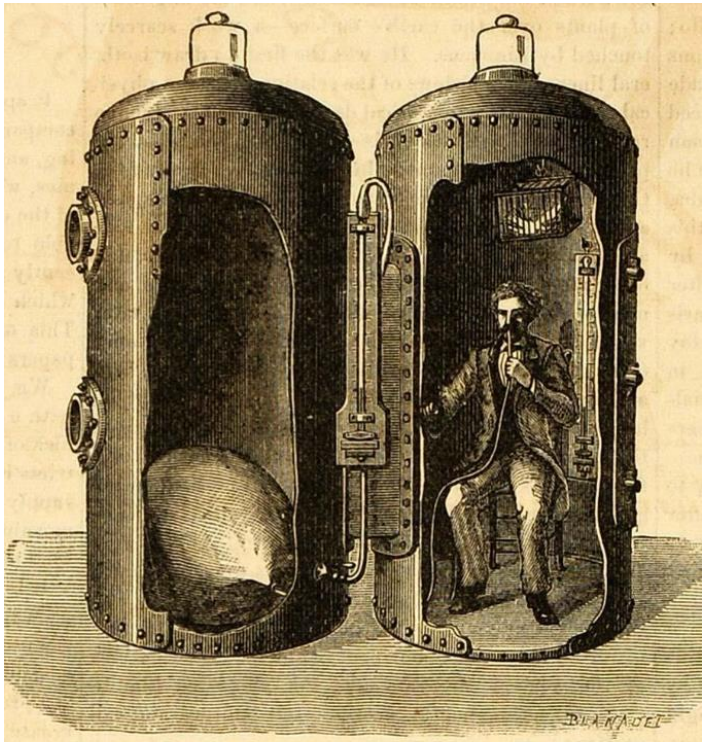


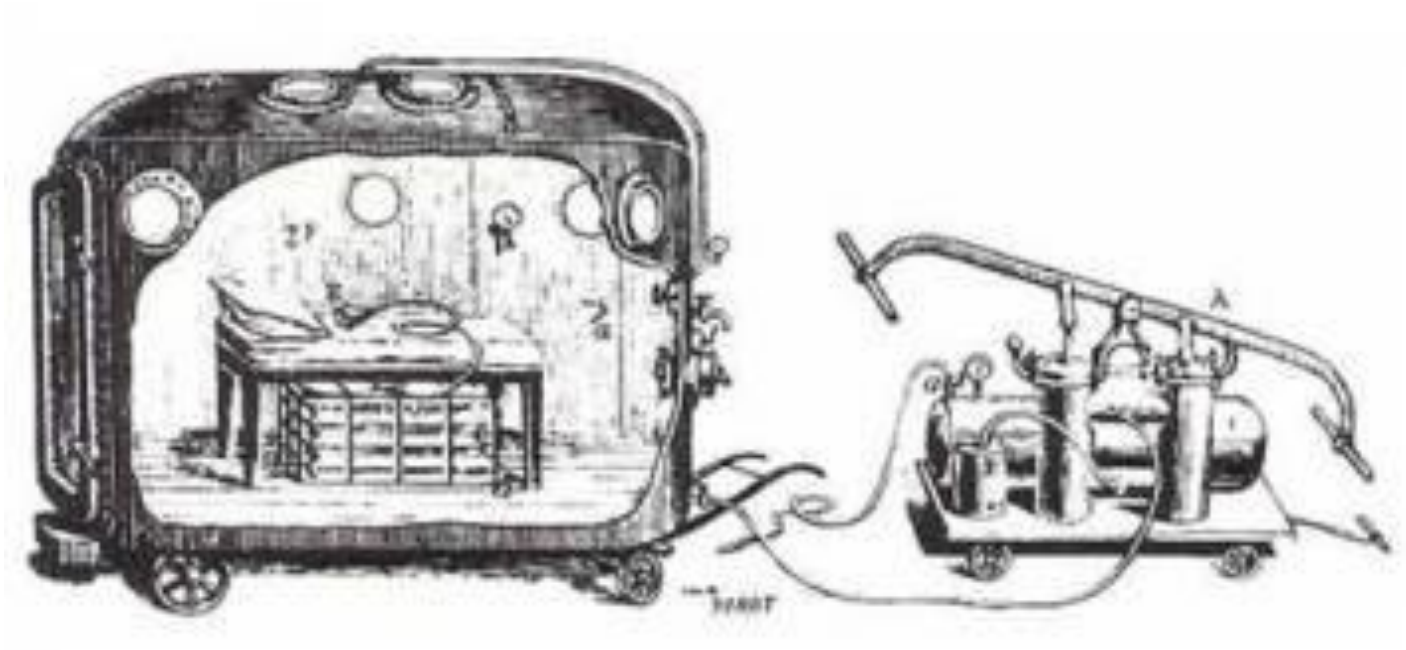
Fig. 2.—Bert's Apparatus for Inhaling Rarefied Air.

Paul Bert
In 1878, a French physiologist,

- discovered the link between decompression sickness and nitrogen bubbles.

- discovered that the pain from decompression sickness could be reversed with recompression.

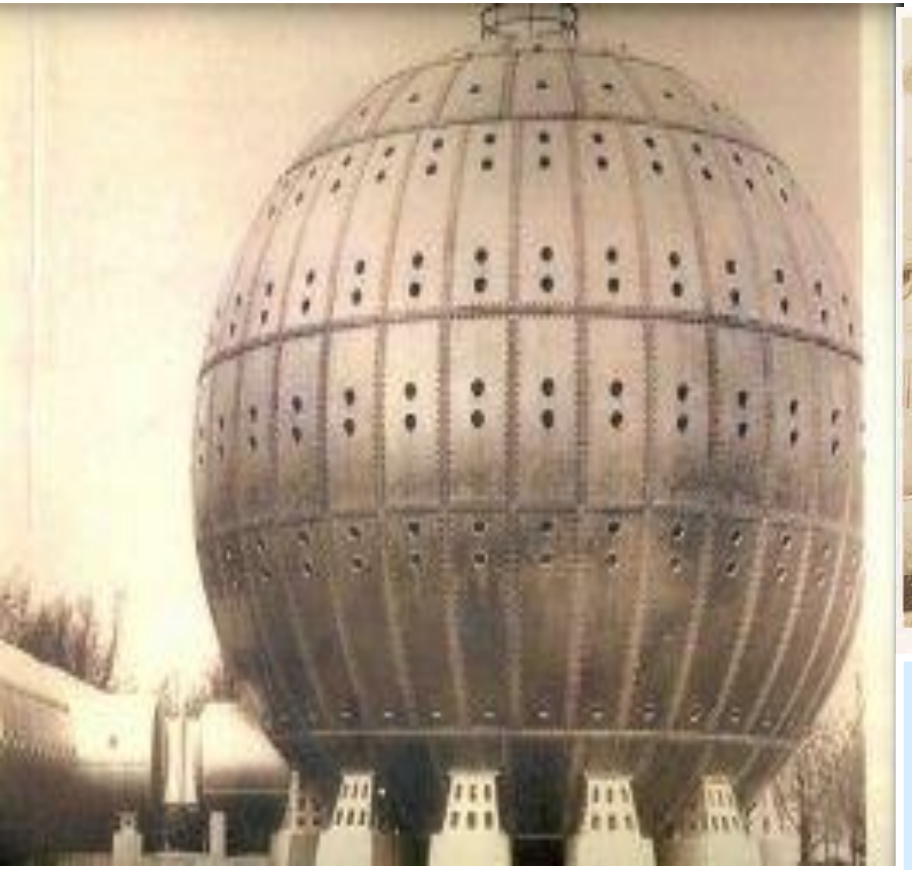
History & development



Fontaine ,

a French surgeon In 1879
- a mobile pressurized operating room
- inhaled nitrous oxide became more potent and resulted in deeper anesthesia.
- improved oxygenation.

History



Orville Cunningham in1926

Steel ball hospital in Cleveland

(64 feet in diameter, 12 bedrooms, 5-stories

history

COVER ARTICLE

ORIGINAL PAPERS

Foreword by Ken Locklear: The following paper is reproduced exactly as written. It was originally published in the Journal of Cardiovascular Surgery in 1959. This is one of the most often cited papers in all of hyperbarics, yet it is extremely difficult to find because of its age. We have reproduced it here as a reference, as well as foundational support for future indications that have anemia as a primary or secondary symptom. The ultimate findings of this paper are so profound that many don't realize how it underpins so many major diseases that we see today. I want to point out how crucial these findings are to sustaining or improving life in indications where oxygen transport has been compromised for any reason – frostbite, arterial occlusion of any kind, stroke, heart attack, chemotherapy, radiation therapy, etc.) Hyperbarics is not a cure in any of these indications, but as stated in this paper, it can sustain life until other interventions can be arranged.

Life Without Blood

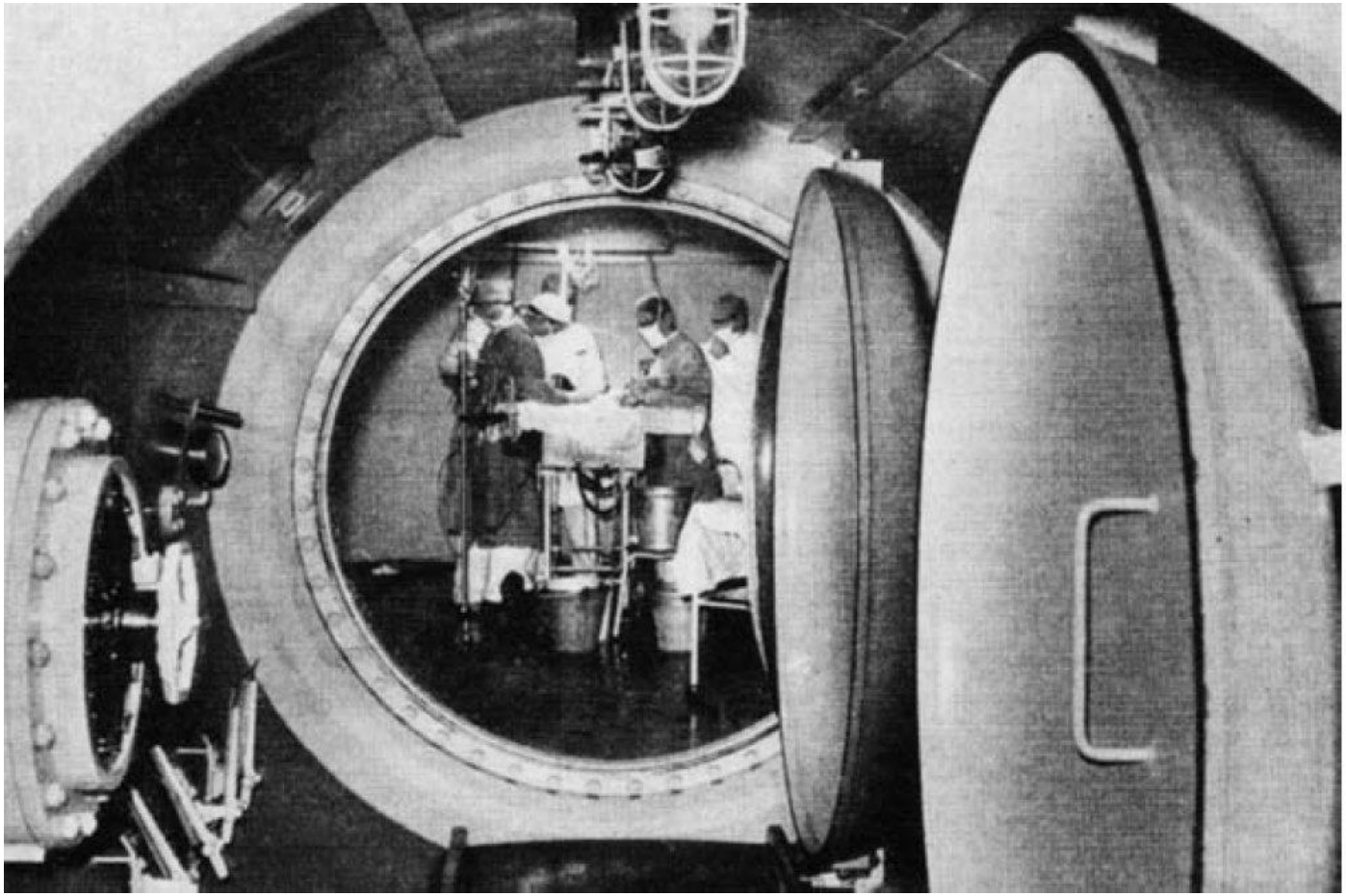
(A study of the influence of high atmospheric pressure and hypothermia on dilution of the blood)

by

I. BOEREMA(*), N. G. MEYNE, W. K. BRUMMELKAMP
S. BOUMA, M. H. MENSCH, F. KAMERMANS, M. STERN HANF
and W. VAN AALDEREN
(from the Surgical Department of the University of Amsterdam)

When in 1948 we (first al research) started our experiment on hypothermia[11 13] our ultimate aim was to reduce the metabolism of a warm-blooded animal to such an extent that all the physiological processes would almost come to a standstill.

history



Hyperbaric Oxygen Therapy

Humour

"First tried on Human…

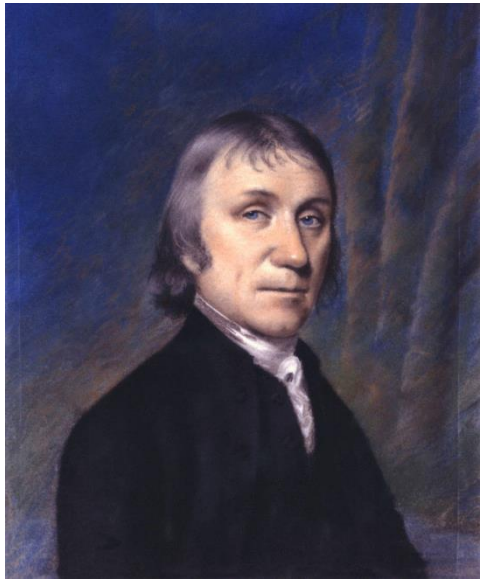
Now being successfully used on animals"

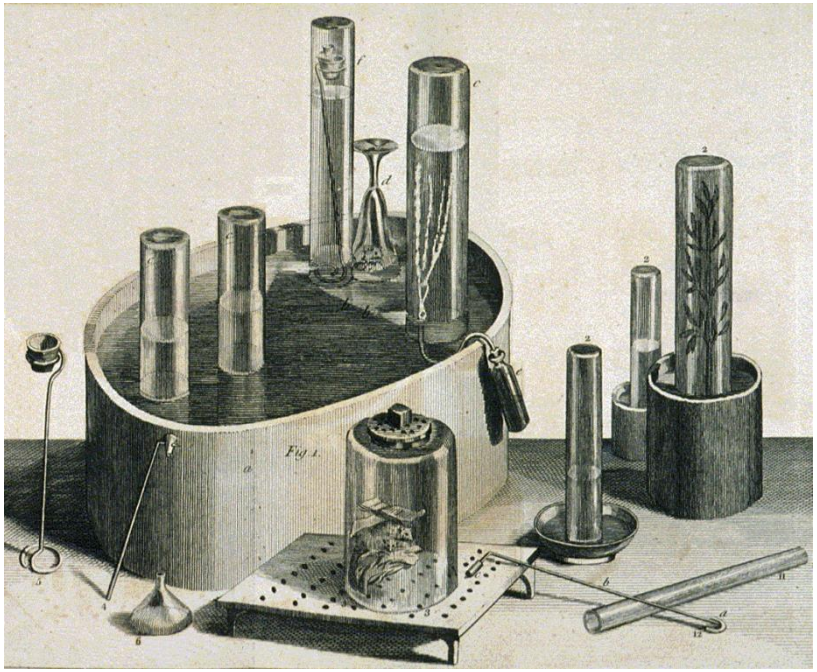
Oxygen history

- In 1774, English theologian-chemist **Priestley** heating mercuric oxide and obtaining 'dephlogisticated air'

"From the greater strength and vivacity of the flame of a candle, in this pure air, it may be conjectured, that it might be peculiarly salutary to the lungs in certain morbid cases, when the common air would not be sufficient to carry off the putrid effluvium fast enough."

- the Swedish apothecary Karl W. Scheele in 1772,





Oxygen history

- The name oxygen was coined in 1777 by **Antoine Lavoisier** in combustion.

- air is a mixture of two gases; 'vital air' essential to combustion and respiration, and azote("lifeless")

- renamed 'vital air' to oxygène (oxys, acid and –genēs, producer)

- "father of modern chemistry".

Oxygen history

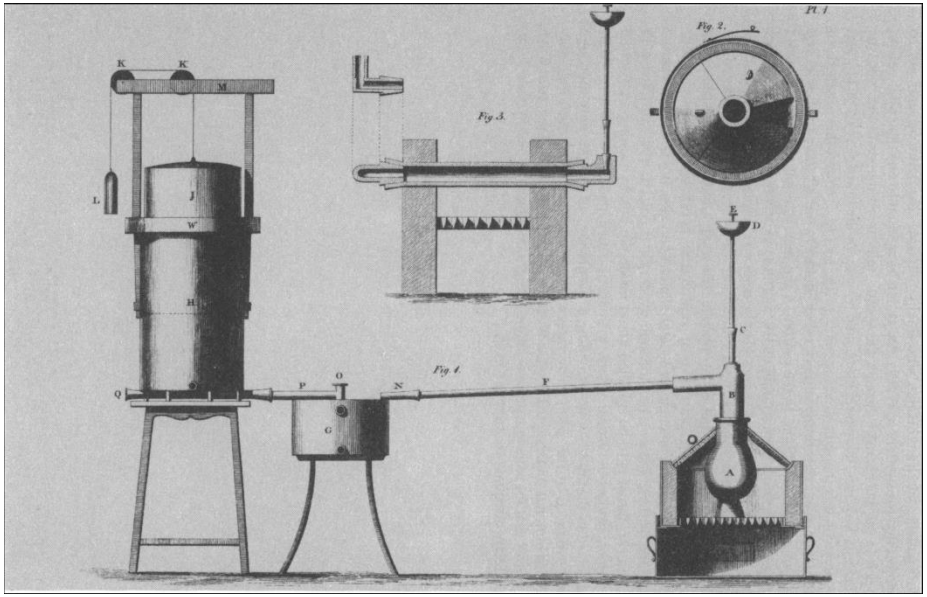
- In 1783, the French physician Caillens was the first doctor reported to have used oxygen therapy as a remedy.

Oxygen history

- **THE LUNAR SOCIETY**
  - Joseph Priestley, Erasmus Darwin(grandfather of Charles), James Watt, Thomas Beddoes

- **THE PNEUMATIC INSTITUTION**
  - Pneumatic Institution in Bristol in 1799
  - administered oxygen free of charge to 'out-patients... in consumption, asthma, palsy, dropsy, obstinate venereal complaints, scrophula or King's Evil and other diseases.
  - the investigation of the efficacy of oxygen in treatment of disease.
  - corrugated non-crushable breathing tubes, mouthpieces and the method for mass production of gases devised by Watt.

Oxygen history



Oxygen history

- in 1869 oxygenated bread and water

THE NEW HAVEN STEAM HEATING CO.

As Bread is Called the "Staff of Life"

ROOT'S BREAD

W. F. GILBERT,

OXYGENATED WATER.

E. HEWITT & CO.'S, Apothecaries, 744 Chapel St.

THE ELM TREE INN,

HILL BROTHERS' HOMESTEAD

HINMAN HOUSE,

OLAM ISLAND HOUSE

RAILROAD GROVE RESTAURANT.

FOR SALE,

L. F. COMSTOCK & CO.

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JOHN T. SLOAN,

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GEORGE F. NEWCOMB,

$1500 Will Buy a 30 Acre Farm

WOODBRIDGE

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CALIFORNIA, TEXAS AND MEXICO.

NOTICE.

JOURNAL AND COURIER

ONE CENT A WORD

The Carrington Publishing Co.

BUY A HOUSE.

ANNOUNCEMENT.

WILLIS L. MIX,

JOHN H. BOND,

JOHN H. BOND,

Oxygen history

- In 1890 Dr **Albert Blodgett** reported in the Boston Medical and Surgical Journal a new variant of oxygen therapy, in a woman of 46 with pneumonia about 6 L/min.

'The dealer who supplied the gas was astonished at the amount required, and, thinking to do me a service, sent me a cautionary message, implying that no human being could possibly stand so great an amount of oxygen, on account of the dangerous degree of stimulation to the system and the increased combustion of tissue.'

Fig. 4.—The Inhaling Flask, and Method of Using.

Henry's Law

Increase in atmospheric pressure allows more gas to be dissolved into any given liquid.

Increase in more oxygen pressure allows more oxygen to be dissolved in body fluids.

1. Hyper oxygenation:

Breathing room air renders 21% oxygen at 1 ATA.

Hyperbaric chamber provides up to 20 times 100% oxygen to all tissues within the body.

2. Direct Pressure to Oxygen Molecules:

Normally only the red blood cells are capable of transporting oxygen.

During HBOT, Oxygen molecules become more soluble obeying the scientific principles of Henry's Universal Gas Law.

Oxygen crosses cell membranes and enter all of the body's fluid systems, including plasma, synovial, lymphatic, interstitial (between cells) and cerebrospinal fluids.

3. Mechanical effect:

Any free gas trapped in the body will decrease in volume as the pressure on it increases"

Successfully applied to air embolism and decompression sickness

MECHANISM OF ACTION:

4. Gas Wash out effect:

The flooding of the body with any one gas tends to "wash out" all others.

Treatment for CO intoxication and cyanide poisoning

5. Vasoconstriction:

Causes vasoconstriction without creating hypoxia which decreases edema

Useful in burns, crush injuries, interstitial bleeding, Acute brain and spinal cord injuries

6. Bacteriostasis

Organisms that cannot survive in an oxygen rich environment are bacteria, fungi and viruses

White blood cells (leukocytes) become supercharged with Oxygen in the battle against bacteria responsible for causing infection and illness.

MECHANISM OF ACTION

7. Superoxide Dismutase (SOD) Stimulation

A Surge of Antioxidant Capabilities:

Hyperbaric Oxygen stimulates superoxides
(SOD production)

Helps the body to rid itself of the byproducts of inflammation and damaging free radicals.

8. Angiogenesis

The Formation of New Blood Vessels:

Stimulates the growth of new capillaries (angiogenesis) building a new collateral to serve injured and healthy tissues alike.

Neovascularization is helpful for reaching tissues and organs that have restricted blood flow to ischemic areas.

9. Fibroplast and Collagen Production

Fibroblast, Collagen reproduction and growth are aided by the added availability of increased oxygen provided during hyperbaric conditions.

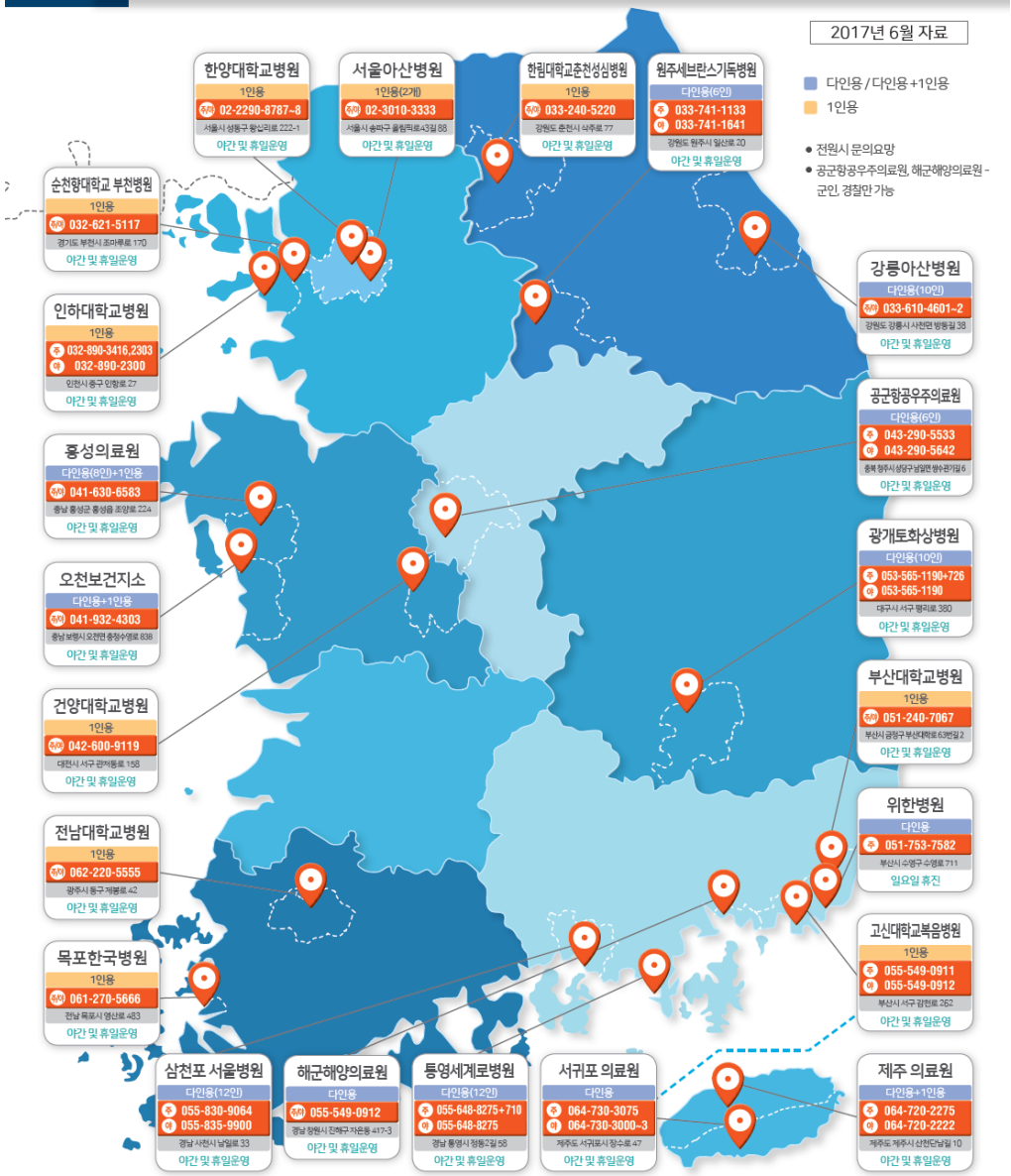
Plays a critical role in wound healing.

전국 고압산소챔버 운영 현황

2017년 6월 자료

- 다인용 / 다인용 +1인용
- 1인용

- 전원시 문의요망
- 공군항공우주의료원, 해군해양의료원 - 군인, 경찰만 가능



대한응급의학회 THE KOREAN SOCIETY OF EMERGENCY MEDICINE

대한고압의학회 Korean Association of Hyperbaric Medicine

FUTURE

- 정보제공, 교과서 편찬
- 교육과정의 다양화
- 고압산소치료센터의 인증
- 다른 임상과와의 교류
- 보험제도의 개선
- 고압산소치료센터의 전문화

Breath of Life