STATE-OF-ART IN
WHOLE BODY CRYOTHERAPY

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Outlines

• Low temperatures in medicine
• Cryochambers
• Construction overview
• Safety aspects
• Conclusions
Cryomedicine - introduction

CRYOMEDICINE

CRYOTHERAPY
- LOCAL
  - NITROGEN (vapor)
  - CO2 (vapor)
  - COOLED AIR

- WHOLE BODY
  - NITROGEN (liquid)
  - AIR (liquid)
  - REFRIGERANTS (pure and mixture)

CRYOSURGERY
- SPRAY
  - NITROGEN (vapor-liquid mix)
  - NITROUS OXIDE (vapor-liquid mix)

- CONTACT
  - NITROGEN (liquid)
  - NITROUS OXIDE (vapor-liquid mix)
  - CO2 (vapor-liquid mix)

Local cryotherapy is used to activate a defensive reaction. Whole body cryotherapy involves the use of pure or mixed refrigerants. Contact cryotherapy is used to destroy pathological cells.
Cryomedicine - introduction

CRYOMEDICINE

CRYOTHERAPY
- LOCAL
  - NITROGEN (vapor)
  - CO₂ (vapor)
  - COOLED AIR

- WHOLE BODY
  - NITROGEN (liquid)
  - AIR (liquid)
  - REFRIGERANTS (pure and mixture)

CRYOSURGERY
- SPRAY
  - NITROGEN (vapor-liquid mix)
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- CONTACT
  - NITROGEN (liquid)
  - NITROUS OXIDE (vapor-liquid mix)
  - CO₂ (vapor-liquid mix)

To activate defensive reaction
To destroy pathological cells
Market development for cryochambers in Poland

![Graph showing the number of cryochambers in Poland over the years from 1989 to 2011. The map of Poland highlights the distribution of cryochambers across the country.](image)

- Number of cryochambers in Poland
- Year range: 1989 to 2011
- Map of Poland with numerals indicating the number of cryochambers in each region.
Market development for cryochambers in Poland

![Graph showing the number of cryochambers in Poland from 1989 to 2011. The graph indicates a significant increase in the number of cryochambers over time, with a peak near 2011.]
Market development for cryochambers in Poland

Number of cryochambers in Poland

Year

1989  2008  2011

1  2  3

CRYOTHERAPEUTICAL TREATMENT
SPORT
Market development for cryochambers in Poland

- **Number of cryochambers in Poland**
- **Year**: 1989, 2008, 2011
- **Graph** showing the increase in the number of cryochambers from 1989 to 2011.
- **Map** of Poland with locations marked for cryochambers used for cryotherapeutical treatment, sport, and wellness/SPA.

**Legend**:
- Blue: Cryotherapeutical Treatment
- Yellow: Sport
- Green: Wellness, SPA
Cryochambers - introduction

1978: First cryochamber in Japan
1982: First cryochamber in Europe - Germany
1989: First cryochamber in Poland
1990: First cryosauna
2000: First cold retention cryochamber
2004: First mobile cryochamber
2015: First mobile cryochamber
Cryochambers

Cryochambers

CRYOCHAMBERS

WROCLAW-TYPE

STATIONARY

LIQUID NITROGEN

LIQUID SYNTHETIC AIR

COMPRESSOR UNIT

MOBILE

LIQUID NITROGEN

COOLING RETENTION

CRYOSAUNA

LIQUID NITROGEN

LIQUID SYNTHETIC AIR

Cryochamber stationary (liquid nitrogen)

Cryochamber (compressor unit)

Mobile cryochamber

Cooling retention cryochamber

Cryosauna

Courtesy of

Creator

Zimmer

KrioSystem Life

Metrum CryoFlex

JUKA
Cryochambers

CRYOCHAMBERS

WROCLAW-TYPE

SINGLE

COOLING RETENTION

CRYOSAUNAS

COLD GAS (NITROGEN)

Cryochamber stationary (liquid nitrogen)

Cryochamber (compressor unit)

Mobile cryochamber

Cooling retention cryochamber

Cryosauna

Courtesy of

Creator

Zimmer

KrioSystem Life

Metrum CryoFlex

JUKA
Cryochambers constructions

- Cryochambers
  - Wroclaw-Type
    - Fixed/Stationary
      - Liquid Nitrogen
      - Compressor Unit
      - Liquid Synthetic Air
    - Mobile
      - Liquid Nitrogen
  - Single
    - Cold Gas (Air)
  - Cooling Retention
    - Liquid Synthetic Air

- Cryosaunas
  - Cold Gas (Nitrogen)
Cryochambers constructions

- **CRYOCHAMBERS**
  - WROCLAW-TYPE
    - FIXED/STATIONARY
      - LIQUID NITROGEN
      - COMPRESSOR UNIT
      - LIQUID SYNTHETIC AIR
    - MOBILE
      - LIQUID NITROGEN
  - SINGLE
    - COLD GAS (AIR)
  - COOLING RETENTION
    - LIQUID SYNTHETIC AIR

- **CRYOSAUNAS**
  - COLD GAS (NITROGEN)
Wroclaw-type cryochamber

- PRECHAMBER: -60°C
- MAIN CHAMBER: -120°C to -160°C
- LN2 TANK
- HEAT EXCHANGERS
- AIR INLET
- AIR DRYER
- AIR OUTLET

Courtesy of KrioSystem Life and Creator
Wroclaw-type cryochamber

Courtesy of KrioSystem Life and Creator
Wroclaw-type cryochamber

Courtesy of KrioSystem Life and Creator
Cryochamber - compressor unit

icelab
Zimmer MedizinSysteme
Cryochamber constructions

- **CRYOCHAMBERS**
  - WROCLAW-TYPE
    - FIXED/STATIONARY
      - LIQUID NITROGEN
      - COMPRESSOR UNIT
      - LIQUID SYNTHETIC AIR
    - MOBILE
      - LIQUID NITROGEN
  - SINGLE
    - COLD GAS (AIR)
  - COOLING RETENTION
    - LIQUID SYNTHETIC AIR

- **CRYOSAUNAS**
  - COLD GAS (NITROGEN)
Single cold air cryochamber
Cryochambers constructions

- WROCLAW-TYPE
  - FIXED/STATIONARY
    - LIQUID NITROGEN
    - COMPRESSOR UNIT
    - LIQUID SYNTHETIC AIR
  - MOBILE
    - LIQUID NITROGEN

- SINGLE
  - COLD GAS (AIR)

- COOLING RETENTION
  - LIQUID SYNTHETIC AIR

- CRYOSAUNAS
  - COLD GAS (NITROGEN)
Cryochamber with cooling-retention effect

- RAIL
- MAIN CABIN
- WINDOW
- STEPS
- NOZZLE SYSTEM
- SYNTHETIC AIR TANK
Cryochamber with cooling-retention effect

-60°C

-120°C

SYNTHETIC AIR TANK

MAIN CABIN

RAIL

STEPS

WINDOW

NOZZLE SYSTEM
Cryochamber with cooling-retention effect

-60°C

-120°C

21% O₂
79% N₂

SYNTHETIC AIR TANK
Phase equilibrium of N2-O2 mixture
Cryochamber with cooling-retention effect

ODH ALERT!

-60°C

-120°C

90% N₂
Cryochambers constructions

CRYOCHAMBERS

WROCLAW-TYPE

FIXED/STATIONARY

- LIQUID NITROGEN
- COMPRESSOR UNIT
- LIQUID SYNTHETIC AIR

MOBILE

- LIQUID NITROGEN

SINGLE

- COLD GAS (AIR)

COOLING RETENTION

- LIQUID SYNTHETIC AIR

CRYOSAUNAS

COLD GAS (NITROGEN)
Cryosauna
Cryosauna

21% $\text{O}_2$, 79% $\text{N}_2$

?% $\text{O}_2$, ?% $\text{N}_2$

?% $\text{O}_2$, ?% $\text{N}_2$

?% $\text{O}_2$, ?% $\text{N}_2$
Cryosauna

Temperature Distribution:

- 128.0°C at 0 cm
- 113.8°C at 10 cm
- 97.5°C at 20 cm
- 87.4°C at 30 cm
- 77.5°C at 40 cm
- 68.0°C at 50 cm
- 2.7 – 4.5°C at 60 cm
- 0.1 – 0.3°C at 70 cm

Length:
- 70 cm
Cryosauna

ODH ALERT!

- 128.0°C
- 113.8°C
- 97.5°C
- 87.4°C
- 77.5°C
- 68.0°C

20.8°C

0.1–0.3

0.0–0.1

0.0

0.0–0.3

0.1–0.3

0.0

2.7 – 4.5

0.0–0.3

0.0

20.8

70 cm

50 cm

40 cm

30 cm

20 cm

10 cm

0 cm
24-Year-Old Salon Worker Found Dead Inside Cryotherapy Chamber

"Basically, the only person that does know what happened is Chelsea."

Rejuvenice Cryotherapy in Las Vegas, Nevada, offers several types of cryotherapy treatments — a therapy where patients step into an enclosed chamber for the "general use of low temperatures" to relieve inflammation and pain as well as to help them deal with depression and anxiety. According to the Las Vegas Review-Journal, 24-year-old Rejuvenice lead aesthetician Chelsea Ake-Salvacion was found frozen to death inside one of the chambers last Tuesday.

Authorities believe it was a freak accident that killed Ake-Salvacion in seconds, News3LV reports. Ake-Salvacion’s friend Shae-Lynn Bee told the station Ake-Salvacion had been closing up the shop that night “and then did go into the machine and apparently did not turn off [sic] ... There are no cameras in there. Basically, the only person that does know what happened is Chelsea.”
Whole Body Cryotherapy (WBC): A “Cool” Trend that Lacks Evidence, Poses Risks

Your rheumatoid arthritis is flaring up? A trainer at your local gym suggests a safe and easy way to treat it: a three-minute session in a freezing tank, called whole body cryotherapy (WBC). He says not only will WBC help you put an end to rheumatoid arthritis pain better than an ice bath or pack, but also promises that a couple sessions will help with depression and weight loss!

Not so fast. The problem is, this so-called “treatment” hasn’t been proven to do any of these things.

And despite claims by many spas and wellness centers to the contrary, the U.S. Food and Drug Administration (FDA) does not have evidence that WBC effectively treats diseases or conditions like Alzheimer’s, fibromyalgia, migraines, chronic pain, or rheumatoid arthritis, multiple sclerosis, stress, anxiety, or chronic pain.

“Based on purported health benefits seen in many promotions for cryotherapy spas, consumers may incorrectly believe that the FDA has cleared or approved WBC devices as safe and effective to treat medical conditions,” says Alan Zemin, M.D., a medical officer in the FDA’s Center for Devices and Radiological Health. “That is not the case.”

In fact, not a single WBC device has been cleared or approved by the agency in support of these claims.

Nevertheless, a quick Internet search for the term “whole body cryotherapy” turns up a wealth of websites extolling the praises of WBC for a number of serious illnesses and conditions, including:

- Asthma
- Alzheimer’s
- Arthritis
- Chronic pain
- Depression
- Fibromyalgia
- Insomnia
- Migraines

A person stands alone in an individual-size can-like enclosure that is open at the top. A person’s torso and legs are encased in the device and exposed to frigid temperatures while the head remains above the enclosure at room temperature. Several people sit or stand in a totally enclosed chamber for two to four minutes. The entire body, including the head is exposed to frigid temperatures, generated by liquid nitrogen. Some cryotherapy devices work by way of cooling the air in a circuit.

What actually happens physiologically to the body when a person stays within these chambers for two to four minutes? What effects do such cold temperatures have on the blood pressure, heart rate, and metabolism? “We simply don’t know,” says FDA scientific reviewer Anna Chamburyan, M.D., Ph.D. “At this time, there is insufficient public available information to help answer these questions.”

However, she notes that while the healing benefits of cryotherapy remain unconfirmed, the potential risks are readily apparent.

Potential hazards include asphyxiation, especially when liquid nitrogen is used for cooling. “Cryotherapy devices can result in a closed room, the amount of oxygen in the room can result in hypoxia, or oxygen deficiency, which could lead to loss consciousness. Moreover, subjects run the risk of frostbite, burns, and eye injury from the extreme temperatures. Talk to Your Doctor First! If you decide to cryoWBC, know that the FDA has not cleared or approved any of these devices for medical treatment of any specific medical conditions. The FDA is also concerned that patients who opt for WBC treatment, especially in place of other treatment options with established safety and effectiveness, may experience a lack of improvement or a worsening of their medical conditions.

Yusen says it’s a good idea to discuss using WBC with your physician before you try it or if you’re using it already.

Find this and other consumer updates at: www.fda.gov/ForConsumers/ConsumerUpdates

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Supply systems of chambers

**SUPPLY SYSTEM**

- **OPEN**
  - Direct contact between user and cooling medium
  - COOLING RETENTION EFFECT
    - Synthetic air
  - CRYOSAUNA
    - Liquid nitrogen

- **CLOSED**
  - NO direct contact between user and cooling medium
  - WROCLAW-TYPE (stationary and mobile)
    - Liquid nitrogen
    - Compressor unit
  - SINGLE - COLD AIR
    - Nitrogen and air
Supply systems of chambers

SUPPLY SYSTEM

OPEN
- Direct contact between user and cooling medium
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    - Nitrogen and air
Summary

1. Poland is a country where cryotherapy is well recognized, developed and appreciated both from medical and technical point of view. Accumulated number of cryotherapeutical treatments in Poland approaches 3 millions (in comparison of 500 k for the rest of Europe).

2. Four different constructions of chambers dedicated to the cryotherapeutical sessions have been developed and are commercially available right now.

3. Supply systems of cryochambers shouldn’t allow for direct contact between user and cooling medium (nitrogen) due to the safety reasons. Therefore, cryosaunas shouldn’t be considered as whole body cryochambers.