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Human presence and contamination in Antarctica
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Scientific bases
Leonid Ivanovich Rogozov

Russian: Леонид Иванович Рогозов, 14 March 1934 – 21 September 2000)

was a Soviet General Practitioner who took part in the sixth Soviet Antarctic Expedition in 1960–1961. He was the only doctor stationed at the Novolanzarevskaya Station and, while there, developed appendicitis, which meant he had to perform an appendicectomy on himself, a famous case of self-surgery.

“"A job like any other, a life like any other”

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Edward Leichester Atkinson
(South Upperwind Island, Nov, 23rd, 1881–Mediterranean Sea, Feb, 20th, 1929)

English surgeon and explorer.

1908 joins Royal Navy. 1910 party of the Terra Nova Expedition of Robert Falcon Scott in Antarctica. Will be Atkinson to lead the rescue expedition of remain party from South Pole and to find the tent with the body of the death Scott, Henry Robertson Bowers and Edward Adrian Wilson.

Atkinson is at the center of controversies about the managing of the sledge dogs to help the Scott party on their way back and about suspect signs of scurvy in the Scott group.

During the first world war he participates to the Gallipoli battle.

To Atkinson is dedicated the Atkinson Cliffs in the Victoria Queen Land in Antarctica.
BIBLIOGRAPHY


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Horizon Scan, 2014: 80 most important scientific questions on direction of Antarctica Science.

**BIOMEDICAL RESEARCHES:**

80. How will humans, diseases and pathogens change, impact and adapt to the extreme Antarctic.

56. How will climate change affect the risk of spreading emerging infectious diseases in Antarctica? (Cross-cuts “Human”)
Horizon Scan, 2014: 80 most important scientific questions on direction of Antarctica Science.

**BIOMEDICAL RESEARCHES:**

- Legal medicine issues

- International cooperation/autonomous health system

77. How will the use of Antarctica for peaceful purposes and science be maintained as barriers to access change?
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Biomedical research:
- Human adaptation
- Physiology
- Psychology
- Immunology
- Nutrition
- Telemedicine
- Medical personnel training
- Medical procedure techniques
- Medical equipments
- Legal medicine issues
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Peculiarity of biomedical researches:

- statistical data value: time.
- consensus
- invasiveness
- privacy
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- Environments ICE:
  - Isolated
  - Confined
  - Extreme

Concordia Station.

Many stressor characteristics of long duration deep space missions.
Extreme isolation and confinement, a useful analogue platform for research relevant to space medicine.

During the winter the crew are:
- without possibility of evacuation or deliveries for 9 months
- for a prolonged period in total darkness,
- at altitude almost equivalent to 4000m at the equator.
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\[ \text{Environments ICE:} \]
\[ \text{Isolated Confined Extreme} \]

Concordia Station.

The physiological and psychological strains on the crew are marked. Concordia station is particularly useful for the study of

chronic hypobaric hypoxia,
stress secondary to confinement and isolation,
circadian rhythm,
sleep disruption,
individual and group psychology,
telemedicine,
astrobiology.

Concordia station has been proposed as the one of the highest fidelity real-life Earth-based analogues for long duration deep space missions.
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From the past to the future:
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From the past to the future:

LONG TERM MEDICAL SURVEY

Concordia Station in Antarctica

The activity was approved by the Aurora Board of Participants within the Work Plan 2005-2006 and should be initiated by the end of 2005.

To support the human presence in Antarctica, it is essential to learn more on the physiology and psychology of human beings subjected to confinement and extreme environments.

The winter-over crews that will stay about eight months at the Concordia Station (Antarctica) for performing maintenance and scientific work offer a suitable analogue situation to the scenario on Mars. To prepare for a human mission to Mars, it is essential to learn more on the physiology and psychology of human beings when subjected to confinement and extreme environments.

The winter-over crews that will stay about eight months at the Concordia Station offer a suitable analogue situation to what could be an exploration stay on Mars. Collecting physiological and psychological data will provide extremely valuable information on not only adaptation to extreme environments but also on how to select the best psychological profiles.

To support that activity, ESA has decided to team up with the Concordia partners in order to study the behaviour and medical parameters of the Concordia Station crews. Under that agreement, ESA will supply and support a system used to monitor the life and well-being (fitness) parameters of the Concordia Station crews. The data will be available for the medical doctor on site, and recorded data will be transferred to ESA for further processing by scientists.

A competitive study has already been placed for a definition phase of the LTMS system (sensors, data processing and archiving). It is essential to supply the Concordia Station with a LTMS activity, to make sure that the system is ready to be used at an early stage of the mission. A competitive study has already been placed for a definition phase of the LTMS system (sensors, data processing and archiving). It is essential to supply the Concordia Station with a LTMS activity, to make sure that the system is ready to be used at an early stage of the mission.

The LTMS prototype is intended to be used on human beings to test the wireless data transmission and demonstrate its usefulness in the context of the project. The LTMS should be highly representative of the final version of the LTMS and should also demonstrate all the data processing capabilities, such as extraction of parameters, warnings, and data analysis.

The LTMS prototype will have to undergo safety assessment to clear it for use on human beings. Later, the prototype will be validated by experts for all physiological parameters. After validation, it is intended to test the LTMS prototype operationally in situ at Concordia, in order to collect additional data for further optimisation and improvement of the LTMS system.

Note: The priority for development is the LTMS sensors, hardware and data processing software. Depending on the effort actually required to build these, the development of the data management system and data processing software may be scaled down but a system for safely storing, retrieving, distributing and reprocessing the data will be developed.

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CSNA

ESA

European Space Agency
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Currently on the field:
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Currently on the field:
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BIOMEDICAL RESEARCHES:

emerging issues:

“concordance”

“citizen science”

Human adaptation
- Immunology
- Psychology
- Neurotoxicology (endocrine disruptors)
- Physiology
BIOMEDICAL RESEARCHES:

Immunology:

Stress affects immune functions resulting in increased risk of immune-related diseases.

Salivary IgA levels are potential biomarkers to evaluate the effects of environmental stress.

IgA is the predominant antibody present in mucosal fluids distinguished into IgA1 and IgA2 subclasses.

**We propose to evaluate the effects of environmental stress at Concordia station by:**

- Periodically monitoring IgA1 and IgA2 levels in comparison with IgM and IgG levels both in blood serum and saliva
- Quantifying IgA⁺-B cells
- Evaluating the expression level of the polymeric Ig Receptor involved in the transcytosis of secretory IgA
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BIOMEDICAL RESEARCHES:

Stress, physiology, psychology and behaviour:

- Stressful factors regulating cognition (e.g. attention, memory, execution of tasks)
- Role of social group (e.g. how the group influences individual performance)
- Individual adaptation to ICE (Isolated, Confined and Extreme) environment
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BIOMEDICAL RESEARCHES:

Neurotoxicology (in close collaboration with “human presence and contamination”):

Role of endocrine disruptors on physiology and behaviour.

- Investigate whether and how endocrine disruptors influence individual behaviour and stress physiology in experimental models.
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BIOMEDICAL RESEARCHES:

Physiology:

(Mal) adaptation to chronic hypoxia.

- Crews selection
- Possible treatment on the field
- Enormous relevant feed back on general population: cardiovascular and degenerative neurologic pathologies.
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BIOMEDICAL RESEARCHES:

- Telemedicine
  - Communications
  - Video Assisted Procedures
  - Robotic surgery
- Medical personnel training
  - Different Medical Specialties
- Medical procedure techniques
  - Evidence based medicine
- Medical equipments/procedures
  - eg. blood analogues
- Legal medicine issues
  - International cooperation/autonomous health system
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"Literature was formerly an art and finance a trade; today it is the reverse”

Joseph Roux (1834-1905)
MANY THANKS FOR YOUR ATTENTION.