Human health consequences of long term exposure to gaseous emissions produced by Sargassum seaweed decomposition

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Rationale

In the past two years,

- 200 patients seen at CHU Martinique for clinical symptoms potentially associated with exposure to gaseous emissions issuing from sargassum decomposition
- Most frequent clinical signs & symptoms
  - General reddening and irritation to the skin and eyes, mucous membrane irritation
  - Upper respiratory tract irritation with cough and wheezing
  - Headache, moderate abdominal pain and intestinal transit disorders
- Patients originating from geographical areas neighbouring massive sargassum stranding sites
- Sargassum invasion episodes associated with concomitant increase in the number of medical visits at CHU Martinique

What we know

- Acute high dose H_2S exposure is lethal
  - Professionals (industries)
  - Inhabitants in geothermically area

What we don't …

- What do we know about low dose and repeated exposures ?
- Sargassum emissions : cocktail of gases not limited to H_2S

Overarching Goal

- Conduct a detailed study of the clinical, biological, functional and socio-anthropological consequences of gaseous emissions produced by decomposing sargassum seaweed in the Caribbean

The consortium

- EA7525 Cardiovascular research team, Université des Antilles
- Multidisciplinary team, CHU Martinique
- Multidisciplinary team, CHU Guadeloupe
- Observatoire Santé Martinique (OSM)
- INSERM UMR 1168 "Aging and chronic diseases Epidemiological and public health approaches", Université Paris-Versailles
- Laboratory of Experimental Air Pollution University of Sao Paulo, Brazil

Project management outline

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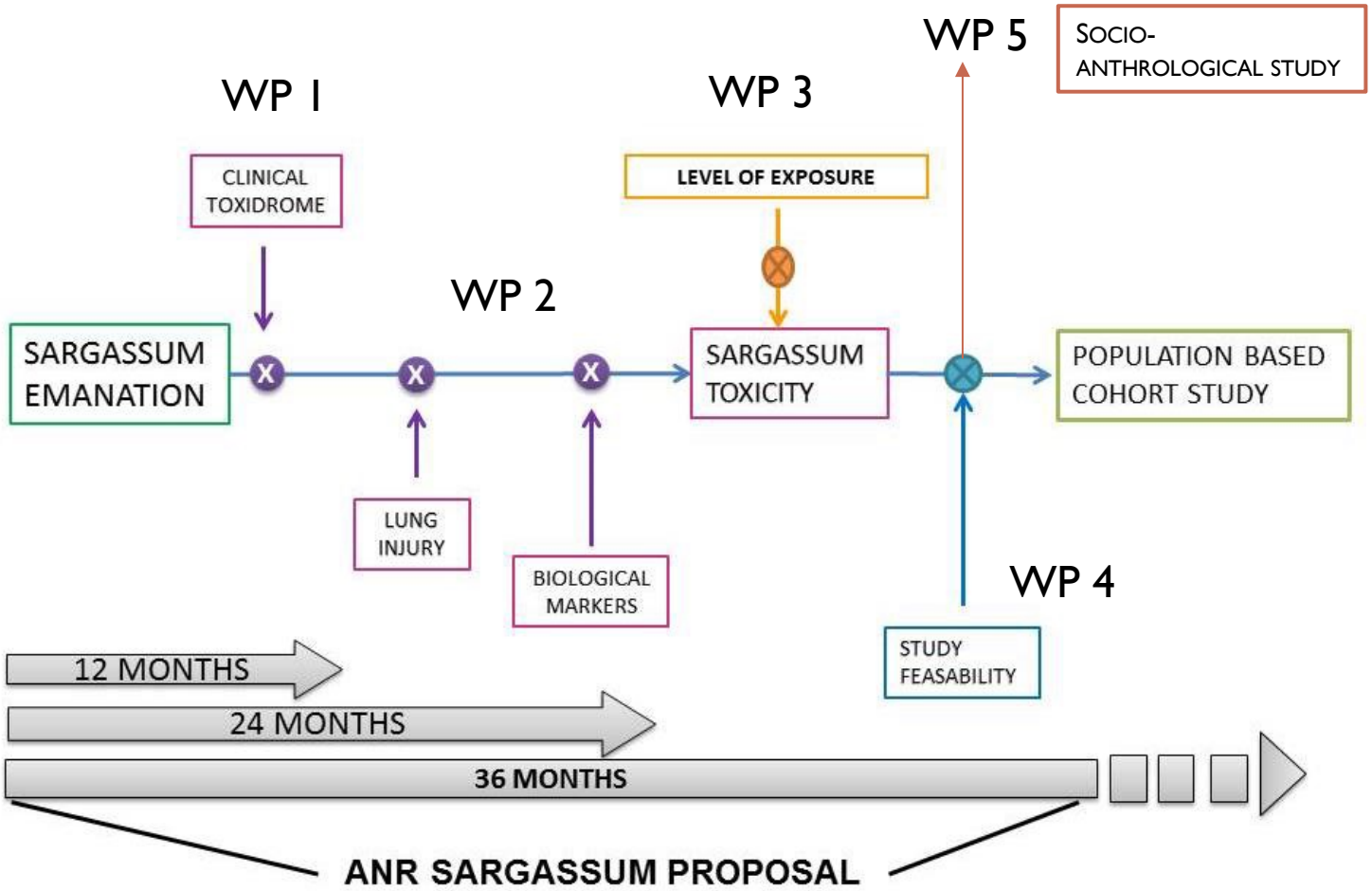
Exposition to emissions	Toxicological syndrome	Lung health Biomarkers	Epidemiological studies	Anthropo–sociology

General objectives

- Characterize the toxicological syndrome induced by decomposing sargassum gaseous emissions
- Investigate the associations between exposure levels to gaseous emissions and the toxicological syndrome
- Assess via an anthropo-sociological approach, the knowledge, belief and practices of populations confronted with the problem of sargassum invasion in the French Caribbean islands (Martinique, Guadeloupe) and Mexico

WP outline


WP 5
SOCIO-ANTHROLOGICAL STUDY
WP 1
WP 3
CLINICAL TOXIDROME
LEVEL OF EXPOSURE
WP 2
SARGASSUM EMANATION
SARGASSUM TOXICITY
POPULATION BASED COHORT STUDY
LUNG INJURY
BIOLOGICAL MARKERS
WP 4
STUDY FEASABILITY
12 MONTHS
24 MONTHS
36 MONTHS
ANR SARGASSUM PROPOSAL

Specific research questions (1)

- **First study** evaluating the cumulative health effect of prolonged and repeated exposure in real life conditions
- Precise insight into the short, mid- and long-term health effects of exposure to decomposing Sargassum algae emissions in populations of the French Caribbean islands of Martinique and Guadeloupe
- Comparison of exposed and non exposed individuals to gaseous emissions according to geographical zones and fixed ambient H_2S and NH_3 sensors (2 year follow-up)

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Specific research questions (2)

- Determination of ambient H_2S and NH_3 exposure metrics
  - Continuously measured daily H_2S concentration levels by fixed sensors (MADININAIR, GWAD'AIR) will be used as a surrogate of global gaseous emissions from decomposing sargassum
  - Exposure metrics will be based on use of dispersion models and time-series models, which are routinely used to provide reliable estimates of air pollutant concentrations over wide timescales and areas.

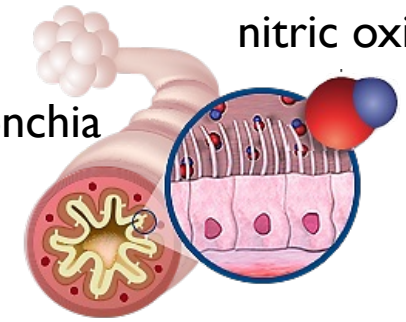
Specific research questions (3)

- Air–lung interface determines oxidative stress and inflammatory lung injury

Lung function tests

Exhaled nitric oxide NO (FeNO)

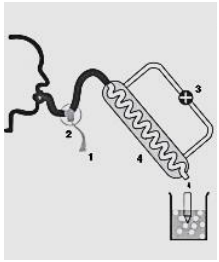
Bronchial production of nitric oxide (NO)



Exhaled breath condensate

non volatile organic compounds including

- nitrite-nitrate
- 8-isoprostanes
- 3-nitrotyrosine
- cytokines



Cooling system

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Inserm

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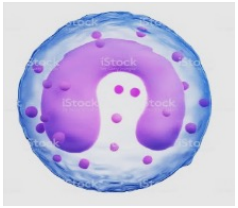
Specific research questions (4)

- Lung–blood interface allows peripheral mononuclear cell PBMC priming

  - Plasma biomarkers
  - Human PBMC



INFLAMMATION

STRESS OXYDANT

MITOCHONDRIAL DYSFUNCTION

Oxygraph-2k and O2k MultiSensor system

Respiration, membrane potential, ROS production

H_2S alters mitochondrial respiration

- ⇩ by complex IV inhibition
- ⇧ by soluble GC (AMPc) activation

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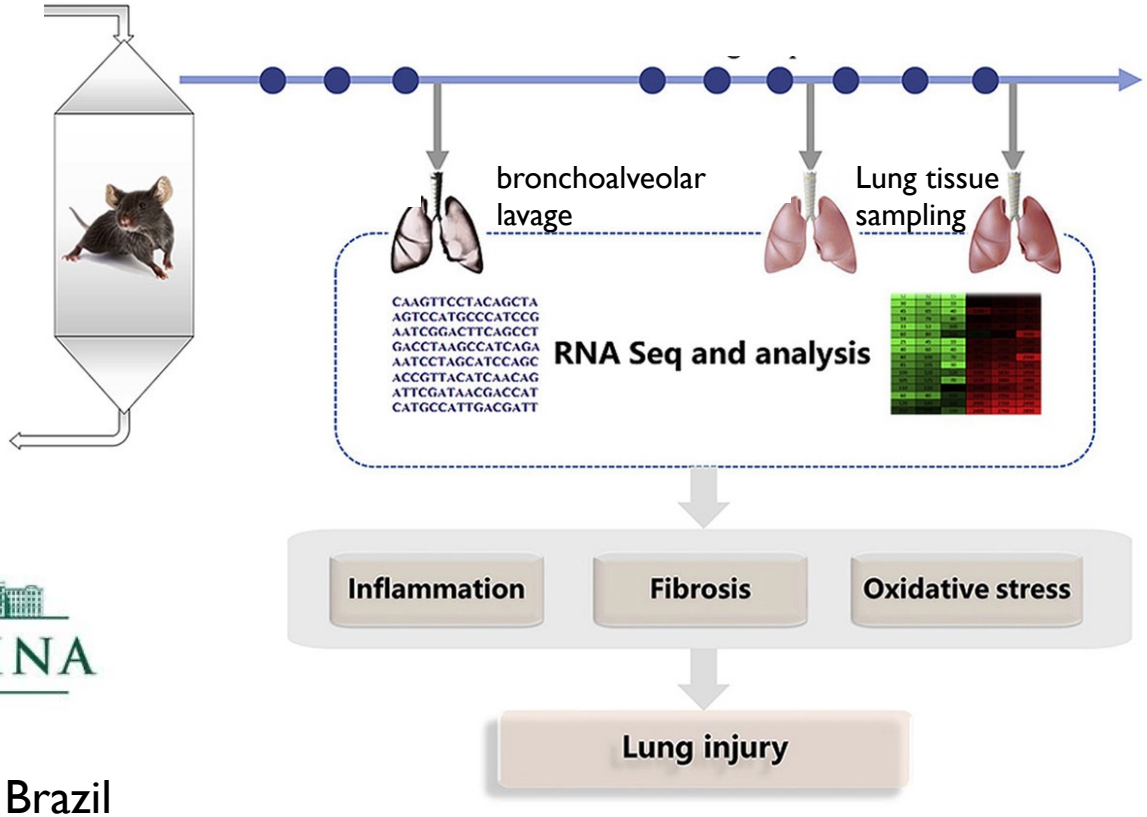
Specific research questions (5)

- Specific insights into the molecular mechanisms of lung injury induced by gaseous exposure in mice

Anaerobic decomposition of fresh alguae in vitro in order to mimic gas emission from the seaweed stranding on the seashore.



MEDICINA USP

Sao Paulo Brazil

Expected results

BRIDGING knowledge gaps

- Precise **novel information** pertaining to the **human health** consequences of long term exposure to gaseous emissions produced by sargassum seaweed decomposition
- Description of knowledge, beliefs and **perceptions of health risks** related to sargassum stranding in impacted populations
- Laying the scientific foundations advising targeted **public health/preventive measures** taking into account the specificities of impacted territories and populations
- Preconization of medical guidelines and protocols for **vulnerable populations** such as asthmatic children, the elderly and pregnant women.

Dissemination/perspective for development

- Project consortium members are opinion leaders in their respective fields
- Scientific publications
- Optimized large-scale dissemination of vulgarized scientific knowledge to impacted populations
- Set up of an international scientific collaboration platform for worldwide health-related research associated with algae stranding

Acknowledgements

Sargassum Working Group

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Guadeloupe
Martinique

FAPESP SÃO PAULO RESEARCH FOUNDATION

THANK YOU
FOR YOUR
ATTENTION