

FIRST INSIGHTS OF PORTUGUESE PRIMARY SCHOOLS' FUNGAL ASSESSMENT – IS INDOOR AIR QUALITY COMPLYING WITH PORTUGUESE LEGAL FRAMEWORK?

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WHY TO ASSESS MICROBIAL CONTAMINATION IN

322.736 Children
in Portuguese Elementary
Schools^[1]

Spend on average of
6 h/day for **179 days/year**

Teaching staff, school workers
spent at least **8h** in schools

“The **school**, by constituting itself as a **safe and healthy space**, facilitates the adoption of **healthier behaviors**, being in an ideal position to **promote and maintain the health of the educational community** and the surrounding community.”^[2]

EXPOSURE TO BIOAEROSOLS

- Indoor Air Quality (IAQ) is an important determinant of human health, especially for children^[3]
- Children are exposed to fungal with pathogenic and toxigenic potential in Schools
- Bioaerosols assessment necessary to:
 - Create healthier school environments
 - Improve learning conditions
 - Improve children's health outcomes



PREVENTION AND CONTROL MEASURES



- International Guidelines
- WHO fungal priority pathogens list[4]: guidance for research and public health actions
- Compendium of WHO and other UN guidance on health and environment - Air Pollution[5]: Dampness and mould exposure assessment guidance
- United States Environmental Protection Agency[6]: Policy brief focusing on hygiene and overall structural condition to prevent mould development;



- Portugal Guidelines
- Ordinance n.º 138-G/2021[8]: Thresholds of protection and reference conditions for indoor air pollutants in commercial and service buildings, along with their respective assessment methodology.
- National School Health Program[9]: Promote and protect health and prevent disease within the educational community; Promote a safe and healthy school environment.



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Bioburden in health care centers: Is the compliance with Portuguese legislation enough to prevent and control infection?



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SAÚDE E AMBIENTE E AÇÃO CLIMÁTICA

Portaria n.º 138-G/2021

de 1 de julho

Sumário: Estabelece os requisitos para a avaliação da qualidade do ar interior nos edifícios de comércio e serviços, incluindo os limiares de proteção, condições de referência e critérios de conformidade, e a respetiva metodologia para a medição dos poluentes e para a fiscalização do cumprimento das normas aprovadas.

Protection thresholds and reference conditions for indoor air pollution, in commercial and service buildings and assessment methodology, **leaving schools neglected for such parameters^[2].**

NOVELTY

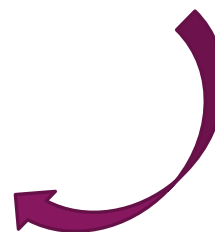
Condições de referência

Poluentes	Matriz	Unidade	Condições de referência
Bactérias	Ar	[UFC/m ³]	Concentração de bactérias totais no interior inferior à concentração no exterior, acrescida de 350 UFC/m ³ .
Fungos	Ar	[UFC/m ³]	Concentração de fungos no interior inferior à detetada no exterior.

I/O ratio

TABELA IV
Condições específicas para verificação da conformidade de fungos com base na perigosidade das diferentes espécies

Espécies	Condições específicas de conformidade
Espécies comuns (excluindo as produtoras de toxinas). <i>Cladosporium spp</i> <i>Penicillium spp</i> <i>Aspergillus spp</i> <i>Alternaria spp</i> <i>Eurotium spp</i> <i>Paecilomyces spp</i> <i>Wallemia spp</i> <i>Acremonium spp</i>	Mistura de espécies: concentração inferior ou igual a 500 UFC/m ³ .
Espécies pouco comuns <i>Chrysonilia spp</i> <i>Tricothecium spp</i> <i>Curvularia spp</i> <i>Nigrospora spp</i>	Cada espécie: concentração inferior a 50 UFC/m ³ . Mistura de espécies: concentração inferior ou igual a 150 UFC/m ³ .
Espécies patogénicas <i>Cryptococcus neoformans</i> <i>Histoplasma capsulatum</i> <i>Blastomyces dermatitidis</i> <i>Coccidioides immitis</i>	Ausência de toda e qualquer espécie.
Espécies toxigénicas <i>Stachybotrys chartarum</i> <i>Aspergillus versicolor</i> <i>Aspergillus flavus</i> <i>Aspergillus ochraceus</i> <i>Aspergillus terreus</i> <i>Aspergillus fumigatus</i> <i>Fusarium moniliforme</i> <i>Fusarium culmorum</i> <i>Trichoderma viride</i>	Cada espécie: concentração inferior a 12 UFC/m ³ (várias colónias por cada placa).



- Fungal contamination **should** be assessed in different school areas
- **Ensure** the qualitative analysis of the present contamination.

Impact the school occupants
'health and well-being'^[9]



Impact learning
conditions^[9]



More efficiency, more
sustainability (at all levels)^[9]



Good IAQ, healthy buildings, healthy
environment^[9]



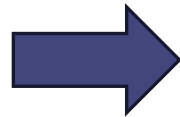
AIM

This study aims to assess **fungal load compliance** at various sites within schools located in the Lisbon area and to compare the results **in light of Portuguese air quality legislation**.

SAMPLING

- Public primary schools (children aged between 6 and 10 years old);
- Schools within rural or urban environments;
- Warm season (Jun – September 2023)

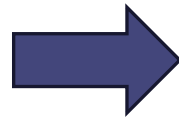
Setting	School
Rural	3
Urban	7
Total	10



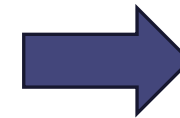
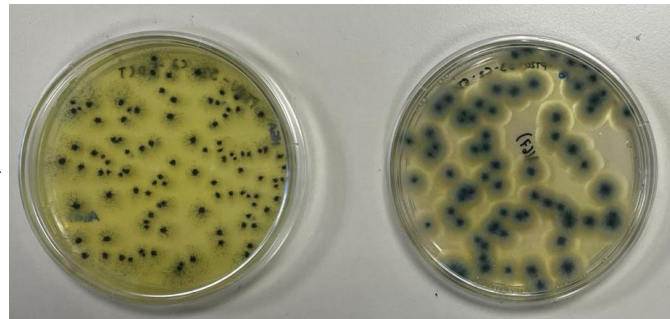
Bathroom	Classroom	Canteen	Gymnasium	Library
7	10	9	6	8

SAMPLING

- Active sampling
 - 1 MAS-100 air sampler
 - 2 min sampling/culture media
 - MEA and DG18 (inc. T. 27°C for 7 days).

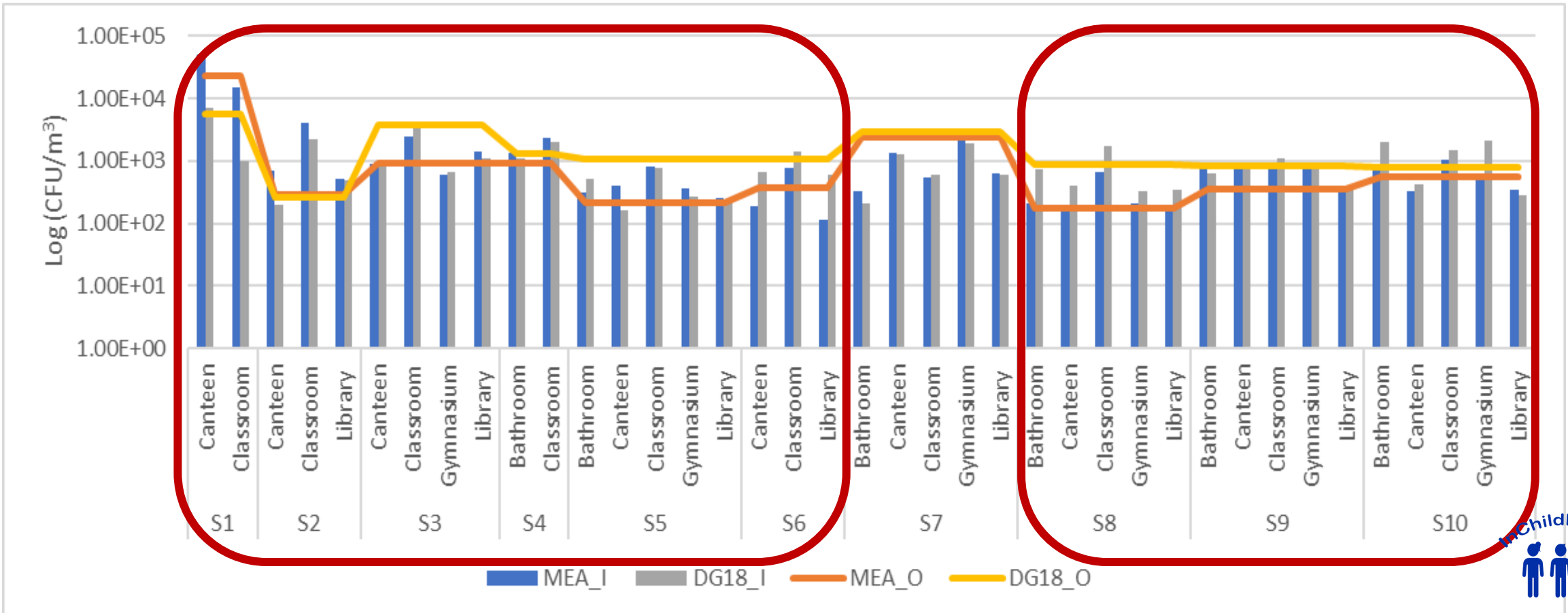


28 °C for 7 days



RESULTS AND DISCUSSION

- MAS-100 contamination results

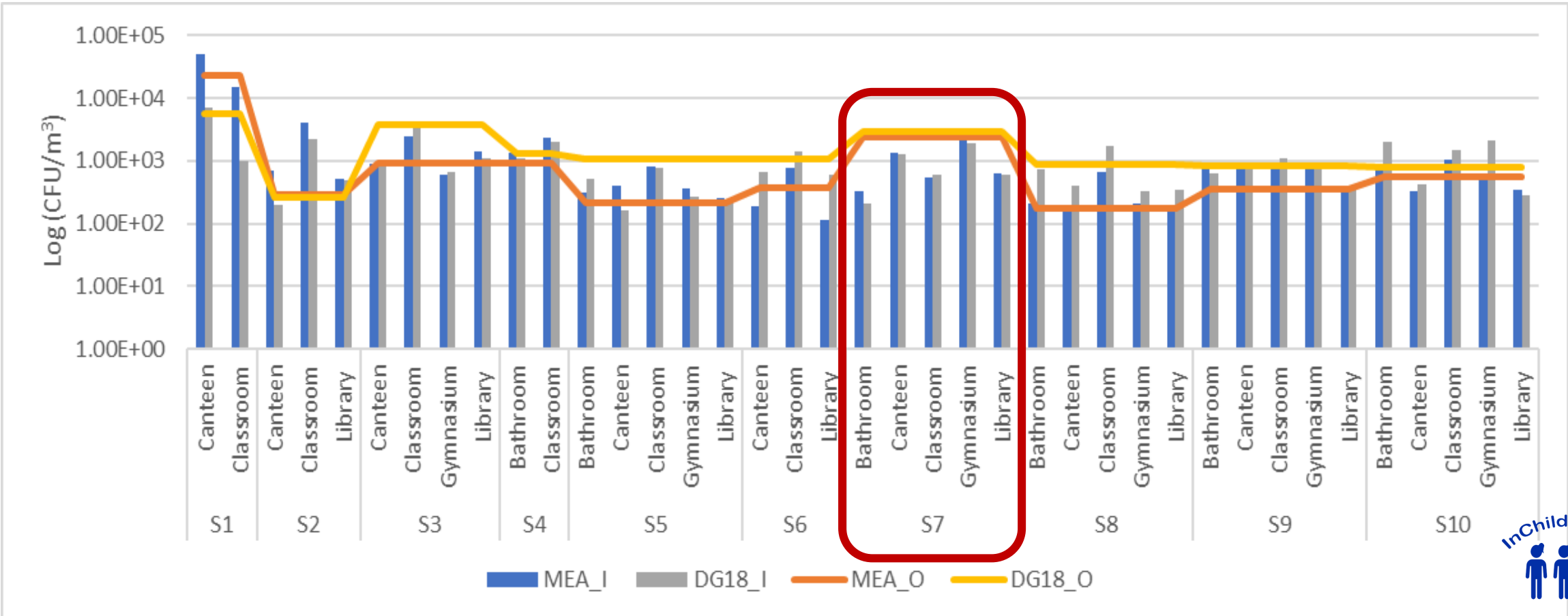


RESULTS AND DISCUSSION

- 9 / 10 did not comply with the Portuguese legal framework in at least one site
 - 8 / 10 in the classrooms
 - 5 / 7 in the bathroom
 - 4 / 9 in the canteen
 - 4 / 6 in the gymnasiums
 - 3 / 8 in the library

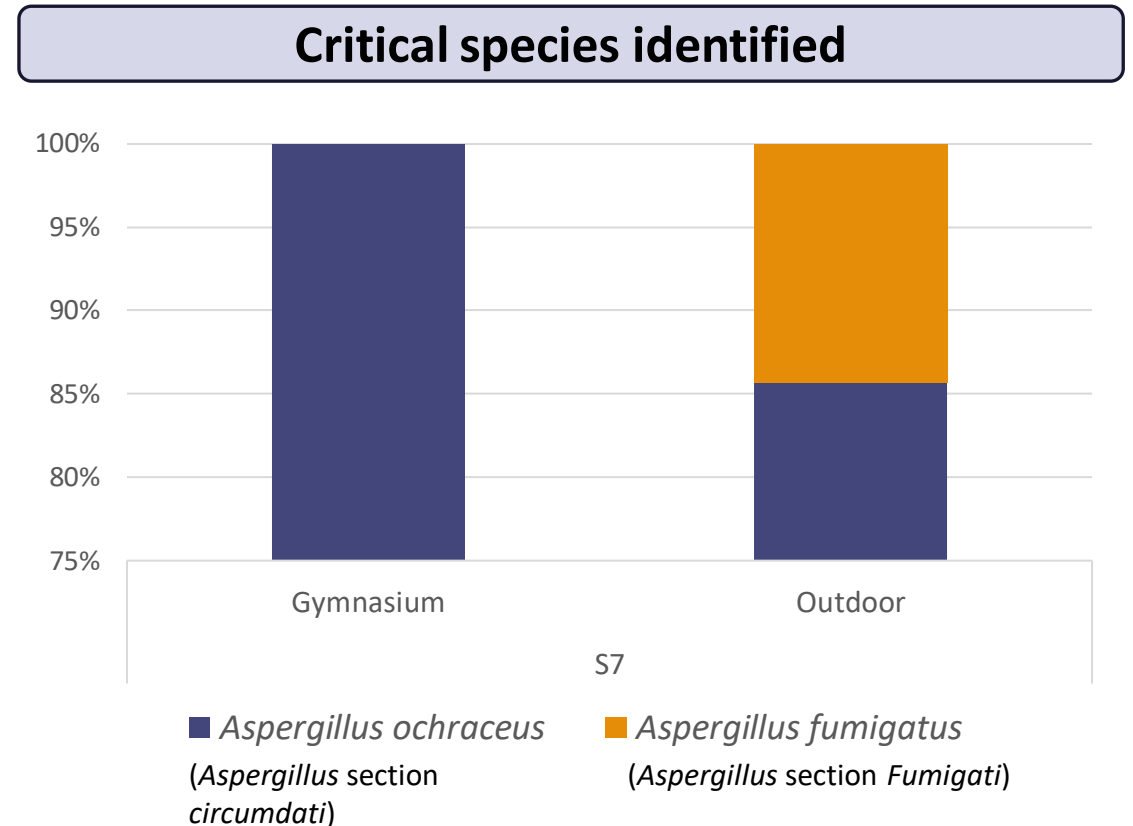
NON-COMPLIANCE

RESULTS AND DISCUSSION



RESULTS AND DISCUSSION

- 1 / 10 (S7) complies with the Portuguese legal framework! **But...**
 - High outdoor load
 - Nearby an airport
 - Vegetation surrounding the school
 - Located in a high populated urban social neighbourhood
 - Small classrooms with a high number of children
 - Visibly dirty indoors



Does not meet the toxigenic species quantitative cut-off

CONCLUSIONS

- Not complying with the Portuguese IAQ legal framework (quantitatively and qualitatively)
 - *Aspergillus* sections are widespread (clinical relevance and toxicological potential)
 - Cleaning procedures revision and guidance on this matter
 - Microbial air quality surveillance in need!
- Legal framework discussion/Specific for schools?
 - Staff education regarding the best cleaning practices?



NEXT STEPS?

Contextual and operational information collection

- Contamination sources identification
- Cleaning procedures applied

Corroborating data from:

- Personal air samplers
- 6-stage air sampler
- Passive samples (EDC, EDCT, Settled dust, Dust filers, Mops)

Risk assessment

Fill the gaps in IAQ policies, supporting regulators and exposure assessors on primary schools' IAQ improvement.



IMPROVE CHILDREN'S LEARNING CONDITIONS AND HEALTH OUTCOMES

The risk of exposure to pathogenic fungi poses a **major public health threat** for school-age children impacting not only **treatable fungal infections** but also **students' learning conditions and outcomes**⁽³⁾

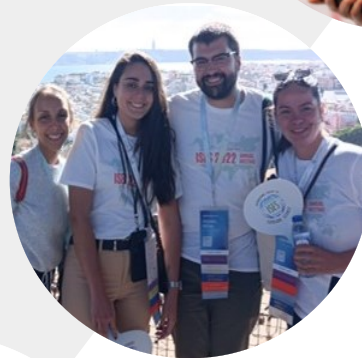
OUR TEAM

PI



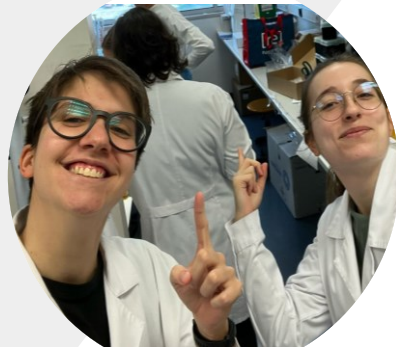
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THANK YOU

Thanks for your attention and looking forward to
hearing your questions.

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