

NEWSLETTER

APRIL 2023

Welcome to the 3rd issue of the EXIMIOUS newsletter!

In this issue, through an interview with our project partner Dr. María-Jesús Cruz, based at the Vall d'Hebron Research Institute in Barcelona, we explore how parrots have become an invasive species in the city and why their presence is of interest to EXIMIOUS and research on environmental health. You will find out more about two cohorts studied in EXIMIOUS that are linked to exposure to substances derived from birds and fungi: the park workers (occupational cohort) and the hypersensitivity pneumonitis cohort (disease cohort). In addition, you can learn more about our overall project updates and latest events. Enjoy the read!

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The EXIMIOUS Project

Mapping Exposure-Induced Immune Effects:
Connecting the Exposome and the Immunome

EXIMIOUS in numbers

15



partners from
7 countries
collaborating

5



years of research and
innovation funded by
the EU

12



cohorts covering
the entire lifespan,
including prenatal life

1 of 9



projects within the
European Human
Exposome Network

News



EXIMIOUS AT EPICOH AND SOT 2023 CONFERENCES

Partners recently presented the EXIMIOUS data management plan and research on immune effects of crystalline silica particles.

[Read our event recap.](#)



TAKE-AWAYS FROM THE 4TH EXIMIOUS SYMPOSIUM

Our guest experts discussed different routes through which chemicals can penetrate human skin. Did you miss it?

[Watch the recording.](#)



PARTNER IN THE SPOTLIGHT: BIOGENITY

Biogenity is a Contract Research Organisation focusing on making bioinformatics, Machine- and Deep Learning accessible.

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The birds of Barcelona and their surveillants

An interview with Vall d'Hebron Research Institute's Dr. María-Jesús Cruz

In November 2022, the EXIMIOUS researchers at the [Belgian Center for Occupational Hygiene](#) (BeCOH) paid a visit to the [Vall d'Hebron Research Institute](#) (VHIR) in Barcelona to learn more about the occupational cohort study on park workers, led by the [Pneumology Department](#) of VHIR.

We took this opportunity to have a chat with **Dr. María-Jesús Cruz**, senior researcher and Head of the Pneumology Research Group at VHIR, about their colleagues' visit, the park workers' daily activities, and the various birds that dominate Barcelona's parks and gardens.



What was the main purpose of your BeCOH colleagues' visit to Barcelona?

Our BeCOH colleagues came to Barcelona to observe how the professionals who deal with the maintenance of parks and gardens in Barcelona work. They were specifically interested in observing and evaluating how these workers remove parrot nests from the city's trees.

Why is this of relevance to EXIMIOUS?

During the felling of the nests, workers may be exposed to multiple allergens and substances that can affect their health. Our BeCOH colleagues, with expertise in standards, sampling techniques, and analysis methodologies for occupational hygiene, came to evaluate the possible risks of exposure to such substances that these workers face. This information is required to set up the exposure sampling plan that will be used in EXIMIOUS to collect data from the park workers cohort (read more on pages 5-6 of this newsletter).

Why are there so many birds in Barcelona? Where do they come from?

The most common bird species in Barcelona are pigeons. However, in the last two decades, parrots have become an invasive species that is increasingly taking on a leading role in the city. Seven species of parrots have acclimatised

Parrots have become an invasive species that is increasingly taking on a leading role in the city.

to living in the city of Barcelona and have come to breed naturally. In addition to the ubiquitous Argentine parrots (*myiopsitta monachus*), which have been observable for

MONK PARAKEET (*myiopsitta monachus*)

is the only parrot species that builds a stick nest instead of using a hole in a tree. One nest houses an entire colony. When kept in captivity, monk parakeets can learn to mimic human speech. Originating from South America, the monk parakeet is one of the few parrot species that can survive temperate-zone winters.



© Cornell Lab of Ornithology / Photo: Bernard Dupont

two decades near any palm tree, five other species of parrots have emerged in recent years.

All parrots are specimens that escaped from private cages or were released unconsciously, plus their descendants. The Barcelona phenomenon is common to other large Mediterranean cities; the great diversity may simply be because there are capricious buyers who release the animals after buying them. However, in Barcelona, the influence of the presence of a major port and airport as well as urban parks with many exotic trees cannot be



Figure 1: Park workers felling a parrot nest

ruled out. These birds are capable of tolerating the noise of a city and the pollution that may exist there. Moreover, the number of species that can prey on them in cities is greatly reduced, giving them higher chances of survival.

How is the relationship between the birds and the local population? Do the birds cause many problems?

Parrots are usually considered friendly animals. It is a sedentary and social species. However, when they reproduce excessively, they can become a problem for the city. Parrots build large nests in the treetops. These birds weave their nests based on small branches that are well-fixed to the base of palm trees. They have a complex construction and are made up of one or several chambers depending on the number of parrot couples there are. These nests can weigh tons and are hence a danger in large cities due to the risk of detachment, which is mitigated by the park workers who have to cut them down periodically. The nests also destroy the new shoots of all the vegetation around them. In addition, the parrots compete for food with the animals that already lived in the spaces they now occupy, like pigeons.

These nests can weigh tons and are hence a danger in large cities due to the risk of detachment.

From a health perspective, it has been shown that *psittacidae* (the family of birds that includes parrots, parakeets, cockatoos, etc.) can transmit a disease called psittacosis, which causes pneumonia in humans. When there are sick animals in the environment with a very high microbial load, transmission to humans can occur. On the other hand, the workers in charge of felling the nests may be exposed to various substances that may cause allergies or even hypersensitivity pneumonitis.

Sources

- Photo 'Monk parakeet (*Myiopsitta monachus*)' by Bernard Dupont, CC BY-SA 2.0, <https://commons.wikimedia.org/w/index.php?curid=50340187>
- Info box about monk parakeet: https://www.allaboutbirds.org/guide/Monk_Parakeet/overview, accessed on 27 March 2023, © Cornell Lab of Ornithology.

The park worker cohort

Protecting Barcelona's parks and gardens from bird pests

One of the [occupational cohorts](#) studied within the EXIMIOUS project is the park and garden workers cohort. In large cities like Barcelona, the structure of bird populations is not ecologically balanced, causing certain species to proliferate out of control and become pests [1]. They are monitored and controlled by municipal services, private pest control firms, or research groups. Given the staff's high exposure to noxious agents derived from birds and fungi, these workers form a possible risk group for the development of hypersensitivity pneumonitis (HP).



Figure 1: Park and garden workers in Barcelona

Risky business

One of these park workers' most important functions is the surveillance and control of the bird population. This involves tasks such as felling bird nests, more specifically, parrot nests. Parrots build large nests in treetops. These nests can weigh tons and they form a danger in large cities due to the risk of detachment. For this reason, this group of workers has to cut down these nests periodically. During the felling of nests, workers may be exposed to multiple allergens and substances that can affect their health.



Figure 2: A parrot nest in a palm tree

During the felling of nests, workers may be exposed to multiple allergens and substances that can affect their health.

Assessing the risk of disease

In EXIMIOUS, a cohort of park and garden workers with high exposure to antigens derived from birds and fungi is being studied by researchers at the [Vall d'Hebron Research Institute](#) (VHIR) in Barcelona. Through questionnaires and the collection of biological samples from the cohort participants, the researchers aim to determine the workers' degree of sensitisation to these antigens and

the potential risk of developing HP. In the next weeks, 100 park and garden workers of the Barcelona Public Health Agency will be recruited for the study. These individuals will undergo a medical interview regarding their professional and domestic exposure to birds and fungi. Blood and urine samples will be collected to identify specific immune signatures or biomarkers related to exposure.

The comparison of this cohort with patients diagnosed with HP due to bird or fungi exposure may serve to identify the potential risk of disease.



Figure 3: A parrot nest that has been cut down

Glossary

- **Hypersensitivity pneumonitis (HP):** a disease characterised by an inflammation of the bronchi. To learn more about HP, read the article about the HP disease cohort on pages 7-8.
- **Antigen:** any substance that causes the immune system to produce antibodies against it because the system does not recognise the given substance
- **Immune signature:** a person's unique signature showing changes in their immune system, which may reflect the person's disease state and/or environmental exposures
- **Biomarker:** a defined characteristic that is measured as an indicator of normal biological processes, pathogenic processes or responses to an exposure or intervention

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The hypersensitivity pneumonitis cohort

A disorder linked to the inhalation of bird and fungi proteins

EXIMIOUS aims to shed light on the association between environmental exposures and immune-mediated diseases. To better understand this interaction, we study exposure effects both in individuals without any disease and in individuals with a potentially exposure-related disease. The occupational cohorts, such as the park worker cohort discussed above, belong to the former group. The immunological data from these cohorts will be compared to those from the disease cohorts, consisting of people diagnosed with a specific disease. After having presented EXIMIOUS' general population and birth cohorts ([first newsletter issue](#)) and the occupational cohorts ([second](#) and present issue), we will now start introducing the disease cohorts. The first one is closely connected to the park worker cohort: the cohort of patients with hypersensitivity pneumonitis (HP).

What is hypersensitivity pneumonitis?

Hypersensitivity pneumonitis is a disorder characterised by bronchioalveolar inflammation that, in some genetically predisposed individuals, occurs after the inhalation of a wide variety of organic and inorganic compounds. The causes of the disease are very diverse. Currently, more than 100 substances present in the environment have been identified as causing the disease, although the substances most frequently involved are proteins from birds and fungi [1]. The reported prevalence of HP is highly variable, though several studies agree that it could represent between 0.5 - 7.5% of individuals exposed during their lifetime to the substances mentioned above [2-3], thus being a first-level health problem.

More than 100 substances present in the environment have been identified as causing the disease.

Early detection matters

In the early stages of the disease, inflammation occurs in the lungs due to exposure to these harmful substances. This phase is normally reversible if exposure is avoided. However, if the exposure persists, an irreversible phase of pulmonary fibrosis is reached. This fibrosis is characterised by progressive scarring that causes the lung to lose flexibility. The lung's functioning deteriorates over time, leading to increased difficulty in breathing [3-4].

If the exposure persists, an irreversible phase of pulmonary fibrosis is reached.

Unfortunately, in patients with chronic forms of the disease, the disease can progress despite therapy efforts, with the resulting loss of lung capacity and the appearance of respiratory failure resulting from the development of pulmonary fibrosis [5]. Indeed, pulmonary fibrosis has been shown to be a predictor of mortality in these patients, with a 5-year mortality of 27% and a median survival of 12.8 years [5]. In this sense, it is of vital importance to make a correct and early diagnosis, allowing the affected person to avoid exposure to the substance that causes the disease, and to initiate the treatment with corticosteroids as early as possible.

Connecting disease and exposure through the immune system

In the EXIMIOUS HP cohort study, the participants consist of 100 patients with HP caused by exposure to substances from fungi and birds. All participants have already been recruited and are treated at the [Vall d'Hebron Hospital](#) in Barcelona since it is a reference centre for the diagnosis and treatment of this pathology. Blood and urine samples have been collected from all participants by the EXIMIOUS

researchers based at the [Vall d’Hebron Research Institute](#) (VHIR) in Barcelona, to identify specific immune signatures or biomarkers related to exposure-associated disease. The patients have also been interviewed by an expert in occupational and environmental medicine using a detailed questionnaire. The interviews will reveal the possible occupational and/or environmental exposures that the patients have been experiencing.

The next steps in the study include analysing various biomarkers in the biological samples obtained, which will allow us to determine whether certain immunological markers induced by exposure are predictive of the disease.

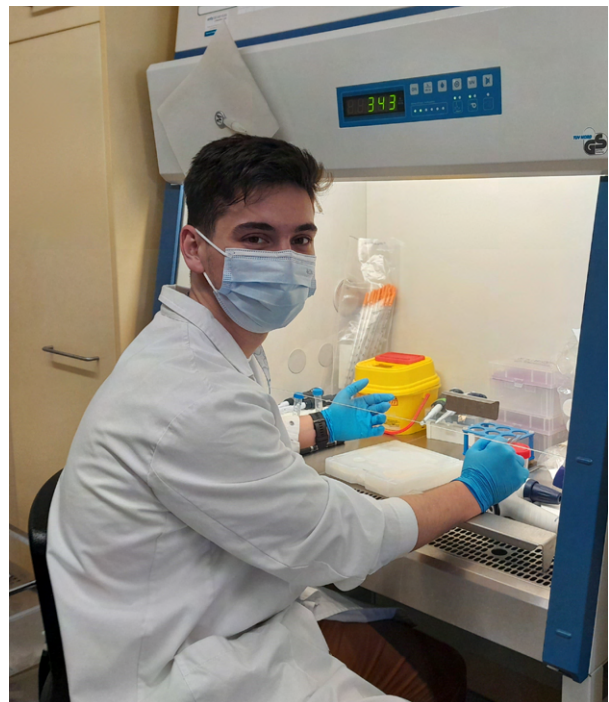


Figure 1: Doctoral researcher performing sample preparation in the pneumology lab at VHIR

Glossary

- **Bronchioloalveolar inflammation:** inflammation of the bronchi, the airways that carry oxygen to the lungs
- **Pulmonary fibrosis:** a lung disease that consists of progressive scarring (fibrosis) of the lung tissues
- **Immunological marker:** a biological indicator of changes in one’s immune system

References

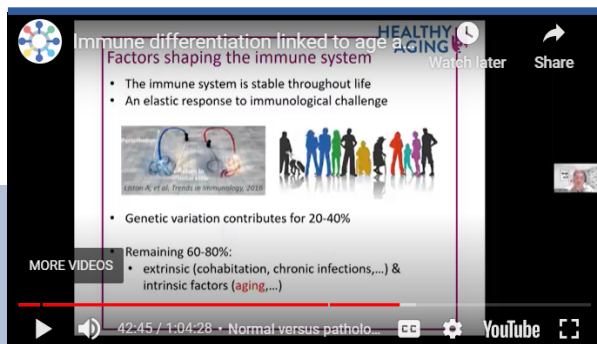
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The EXIMIOUS Symposium

Our own topical webinar series continues

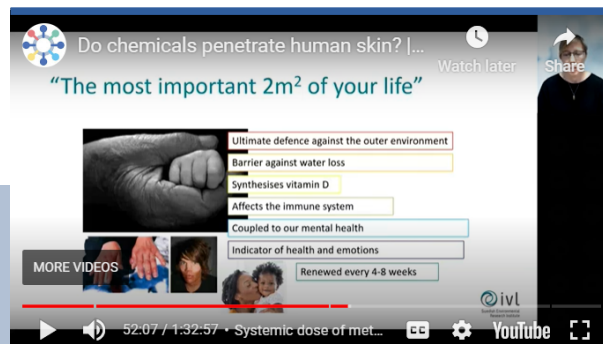
As part of the EXIMIOUS project, the Symposium covers topics related to environmental and occupational exposures and measurements, exposure and immunity, and gene-immune-environment interactions.

Immune differentiation linked to age and exposure | 23.06.2022



The third EXIMIOUS Symposium explores the effects of age and exposure on the immune system. The invited guest speakers discuss the notion of immune aging, its causes, and ways to measure it and examine different sources and mechanisms of immunological changes: from climate change and air pollution to the interaction between particles and biological cells during particle-induced lung inflammation.

Do chemicals penetrate human skin? How skin absorption of chemicals contributes to human exposure | 26.01.2023



This fourth EXIMIOUS Symposium highlights the diversity of chemicals that can penetrate the skin and the role they might play in the body and immune system. The invited guest speakers discuss the important role of the internal dose in creating toxicity in the body, how different metals can enter the skin, and how firefighter instructors' skin exposure to carcinogenic chemicals can be measured and reduced.

Upcoming Events and Symposia

- 30 May - 1 June 2023
European Human Exposome Network Scientific Meeting | Leuven, BE
- 1 June 2023, 09:00-12:00 CEST
European Human Exposome Network (EHEN) event "Exposome Research: Understanding and Addressing Policy Challenges" | Leuven, BE (hybrid)
[Register](#) today and join us!

- 1-2 June 2023
EXIMIOUS General Assembly | Leuven, BE
- September 2023, date to be defined
5th EXIMIOUS Symposium | online

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