



ERS | *monograph*

Occupational and Environmental Lung Disease

Edited by Johanna Feary,
Hille Suojalehto
and Paul Cullinan

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Johanna Feary, Hille Suojalehto and Paul Cullinan

Editor in Chief
John R. Hurst

This book is one in a series of *ERS Monographs*. Each individual issue provides a comprehensive overview of one specific clinical area of respiratory health, communicating information about the most advanced techniques and systems required for its investigation. It provides factual and useful scientific detail, drawing on specific case studies and looking into the diagnosis and management of individual patients. Previously published titles in this series are listed at the back of this *Monograph*.

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Preface

John R. Hurst 



Given that we spend perhaps 20% of our waking hours across a 75-year life span at work, it is hardly surprising that our work environment can affect our health, including our respiratory health. As respiratory professionals, we are used to taking a careful occupational history but, perhaps, when that suggests an environmental or occupational factor causing or exacerbating respiratory disease, we feel less comfortable and seek extra help and advice. In this context, it is a pleasure to introduce this much-requested latest *ERS Monograph*, which addresses the clinical science and practice that underpins environmental and occupational respiratory medicine.

The Guest Editors Johanna Feary, Hille Suojalehto and Paul Cullinan are giants in the field, and have commissioned and edited a fascinating, informative, comprehensive and state-of-the-art collection across the spectrum of environmental and occupational respiratory diseases. My sincere thanks and appreciation to them, on behalf of the European Respiratory Society, for producing this work, which I have no doubt will be of interest and value to our members and more widely. I also share their hope that the enthusiasm for their subject that shines throughout this work will encourage and support early career clinicians and researchers to consider and pursue a career in this fascinating area.

Wherever you work, in whichever branch of respiratory medicine and science, there is a topic here that will be of interest and importance to you. But don't just take my word for it, read on ...

Disclosures: J.R. Hurst reports receiving grants, personal fees and non-financial support from pharmaceutical companies that make medicines to treat respiratory disease. This includes reimbursement for educational activities and advisory work, and support to attend meetings.



Guest Editors

Johanna Feary

Johanna Feary is a relative newcomer to occupational lung disease, having arrived in her current position at the Royal Brompton Hospital (London, UK) in 2014 following a series of happy twists. She is a consultant in respiratory medicine and holds an academic position at Imperial College London (London, UK), a combination of roles that allows her to carry out clinical work as well as research and teaching. She enjoys unpicking the close interplay between an individual's health, their work and the environment, and has a particular interest in occupational asthma and other airways diseases and in the aetiology of hypersensitivity pneumonitis. She was previously a member of the British Thoracic Society Specialist Advisory Group on Occupational and Environmental Medicine and is an active member of GORDS UK (Group of Occupational Respiratory Disease Specialists).



Hille Suojalehto

Hille Suojalehto has worked with occupational respiratory diseases for 15 years, and is currently Chief Respiratory Physician at the Finnish Institute of Occupational Health (Helsinki, Finland) and Associate Professor at the University of Helsinki (Helsinki, Finland). In clinical practice, she examines patients with suspected occupational respiratory diseases. Her research interests include occupational asthma, the mechanisms of allergic airway diseases and indoor air-related symptoms. In 2015, she co-chaired a European Respiratory Society (ERS) task force on specific inhalation challenge testing in the diagnosis of occupational asthma.



Hille is currently a member of the European Academy of Allergy and Clinical Immunology's (EAACI) Environmental and Occupational Allergy Interest Group and of the EAACI exam committee. She is also a member of the Finnish National Indoor Air and Health Programme expert panel, which aims to improve the treatment of those experiencing indoor air-related symptoms.

Paul Cullinan



Paul Cullinan cannot clearly remember how he became interested in occupational lung diseases but after almost 30 years in the field, he has no regrets. He is a consultant physician at the Royal Brompton Hospital (London, UK) – in some senses, the birthplace of the specialty in the UK – and holds a chair at Imperial College London (London, UK). These posts combine clinical practice with research and teaching. Formerly a member of the Industrial Injuries Advisory Committee – and chair of its research working group – he is now a member of the Health and Safety Executive (HSE) Workplace Health Expert Committee and of the Independent Medical Expert Group, which advises on matters of compensation for members of the UK Armed Forces. In 2015, he co-chaired, with Hille Suojalehto, a European Respiratory Society (ERS) task force on specific inhalation challenge testing in the diagnosis of occupational asthma.



Introduction

Johanna Feary^{1,2}, Hille Suojalehto³ and Paul Cullinan^{1,2}

 @ERSpublications

The *ERS Monograph on Occupational and Environmental Lung Disease* includes chapters on global view, many old and some newer diseases, as well as diving, high altitude and outdoor and indoor air. Useful for general respiratory physicians and experts alike. <https://bit.ly/3n0d3RK>

Respiratory clinicians lucky enough to work in the field of occupational lung disease(s) enjoy an endlessly fascinating specialty. Rarely a week goes by without them encountering either an entirely new condition or a familiar one in a new setting, a reflection largely of seemingly ceaseless developments in industry and in employment patterns. This *Monograph* will, we hope, not only educate but also enthuse other clinicians to take an increasing interest in the subject. It has been designed for use by the general respiratory physician sitting in a clinic but will also be of sufficient interest to be picked up and read as a standalone text.

We are of the firm belief that occupation can be relevant and should at least be considered in most subspecialties of respiratory medicine, and that all respiratory physicians should be aware of the spectrum of diseases caused by exposures encountered at work. Often neglected in training programmes, we are passionate about increasing the profile of occupational lung diseases.

The specialty has its own complexities. Most clinical practice involves just two sets of actors, the patient and their health carers. In occupational disease, the cast is broader and includes, potentially, not only the patient in front of you but also their colleagues – occupational respiratory diseases rarely occur in isolation – their employers, other employers in the same sector, regulators, compensators and (regrettably) lawyers. Juggling the often disparate needs of these players is frequently difficult but never dull. It is also why one should never make an occupational diagnosis without firm evidence. While we endlessly exhort clinicians always to consider occupational issues, at the same time we remind them that false-positive diagnoses can have disastrous and widespread consequences. This is especially true for occupational diseases of short latency, such as asthma, infections and many instances of hypersensitivity pneumonitis that arise soon after a new workplace exposure and while a patient is still in employment. Moreover, a failure to identify a current occupational aetiology will make it difficult – if not impossible – to both manage a patient's condition successfully and to prevent other cases arising.

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Occupations and respiratory disease intersect in three ways. First, and most familiar, are those instances where a workplace exposure has given rise, *de novo*, to a condition that would not otherwise have occurred; a truly “occupational” disease. Second, exposures or other circumstances encountered at work may worsen a pre-existing condition – a common example is work-exacerbated asthma, covered in chapter 4 [1]. Third, a pre-existing disease may render a patient relatively or completely unfit to carry out their job. This last, more properly the domain of the occupational health specialist, is brought into sharp relief by an ageing workforce but is a matter also in some specialist areas such as commercial diving (covered in chapter 17 [2]) and work at altitude (chapter 18 [3]).

The *Monograph* opens with a global perspective, a reminder that in a rapidly industrialising world the hazards of work are not only increasing but are too often unregulated and are responsible for literally countless cases of crippling disease (chapter 1) [4]. We then include a chapter that provides an overview on exposure assessment in the workplace (chapter 2) [5]. The chapters that follow cover the full spectrum of occupational respiratory diseases, including: those that are specific to work (such as silicosis in chapter 10 [6], coal worker’s pneumoconiosis in chapter 11 [7] and mesothelioma in chapter 9 [8]); those that can arise from work but are clinically indistinguishable from cases occurring otherwise (COPD in chapter 6 [9], lung cancer in chapter 16 [10] and, arguably, asbestosis in chapter 8 [11]); and those where a workplace aetiology can be determined on a case-by-case basis (occupational asthma in chapter 3 [12]). Finally, we include two chapters on “environmental” exposures. The first, concerned with “outdoor exposures”, includes the often ignored but surely important topic of environmental allergens (chapter 19) [13]. The second weaves a skilful path through the minefield of misconceptions that characterise the issue of “indoor” domestic exposures (chapter 20) [14].

Throughout, we have asked authors to cover the most recent advances in their subject. They have risen to the task with great skill and provided us with a stark reminder that this is a field that never stands still. Few, if any, predicted, for example, that two of the oldest occupational lung diseases would have shown a resurgence in what we had believed to be well-regulated societies. Chapter 10 covers the very recent epidemics of aggressive silicosis among stonemasons and kitchen fitters in countries such as Australia, Spain, Italy and Israel, attributable to the invention of “engineered” stone, a lethal material that could hardly be bettered as a vector for the disease [6]. The depressing return of progressive massive fibrosis in US coalminers, arising from the dysregulation of small mines in the Appalachians, is ably described in chapter 11 [7]. Unpredicted these may have been but unpredictable they were not. After all, we know enough about most occupational lung diseases to prevent them (almost) entirely but, collectively, we lack the will.

We recognise that this *Monograph* has been written primarily from the perspective of a high-income country; that is not to ignore the tremendous importance of occupational and environmental diseases in low- and middle-income countries, but much of the content here is generalisable to all settings.

This *Monograph* was written, reviewed and edited during the height of the first wave of the COVID-19 pandemic. Most of its authors and reviewers were at the forefront of the clinical response and we are especially grateful for their grace and tireless effort in what we know were exhausting times. We thank, too, John R. Hurst (Editor in Chief), Rachel Gozzard (ERS Monograph Managing Editor) and Caroline Ashford-Bentley (ERS Editorial and

Library Services Coordinator) who have, throughout, provided wise and patient counsel and support.

We very much hope you find this *Monograph* both a useful resource and an enjoyable read.

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List of abbreviations

ARDS	acute respiratory distress syndrome
BAL	bronchoalveolar lavage
CO	carbon monoxide
CO ₂	carbon dioxide
CT	computed tomography
D _{LCO}	diffusing capacity of the lung for carbon monoxide
F _{ENO}	exhaled nitric oxide fraction
FEV ₁	forced expiratory volume in 1 s
FVC	forced vital capacity
HRCT	high-resolution computed tomography
IPF	idiopathic pulmonary fibrosis
LEV	local exhaust ventilation
NO ₂	nitrogen dioxide
NO _x	oxides of nitrogen
O ₂	oxygen
P _{aO₂}	arterial O ₂ tension
PEF	peak expiratory flow
PET	positron emission tomography
PM	particulate matter
UIP	usual interstitial pneumonia
VOC	volatile organic compound