The importance of translational science within the respiratory field

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Shareable abstract (@ERSpublications)
The Translational Science Working Group @EuroRespSoc aims to bridge the gap between basic and clinical science and actively shape translational research. #ERS2023 included dedicated translational science and translational-tagged sessions. @SaraOcana1 https://bit.ly/3uDW5kK

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Abstract

The Translational Science Working Group at the European Respiratory Society (ERS) aims to bridge the gap between basic and clinical science by providing a platform where scientists, clinicians and experts in the respiratory field can actively shape translational research. For the 2023 Congress, dedicated translational science sessions were created and sessions of interest to many assemblies from the clinical and the scientific point of view were tagged as translational sessions, attracting clinical and scientific experts to the same room to discuss relevant topics and strengthening translational efforts among all ERS assemblies.

Introduction

The 2023 Nobel prize in medicine was given to Katalin Karikó and Drew Weissman for their discoveries that enabled the development of RNA vaccines that were critical for the successful fight against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The basic RNA scientist Karikó and the physician and virologist Weissman, who was working on HIV vaccines at that time, met at the copy machine of the University of Pennsylvania and discussed the potential of using RNA molecules for vaccination. This is a wonderful example of how translational science works. All you need is the willingness to talk and listen to each other, some of your time, crazy ideas and a copy machine to meet. With the new translational science initiative at the European Respiratory Society (ERS), we are aiming to provide a framework for basic and clinician scientists where they can meet, talk and listen to each other beyond copy machines. Specifically, we offer opportunities to discuss the gaps in knowledge in lung disease, new experimental technologies and challenges in diagnosis and (personalised) treatment, which will not only foster the understanding between basic and clinical scientists but will also enable the development of innovative ideas and projects for new diagnostic and therapeutic approaches in lung diseases (further content can be accessed online: https://youtu.be/DXD5ry4UQM4).

The Translational Science Working Group was initiated in 2023 by the ERS Science Council. It is led by Silke Meiners, as the current ERS Conference and Research Seminars Director, and Irene Heijink and Niki Reynaert as the head and secretary of Assembly 3 (Basic and Translational Sciences), respectively. Together with representatives of each assembly, the early career member spokesperson Sara Cuevas-Ocaña [1], the Science Council Chair Nicolas Roche and the Clinical Research Collaboration Director Salman Siddiqui, they form an active working group dedicated to strengthening translational initiatives at the ERS (further content can be accessed online: https://youtu.be/LK0AhOC2CnY).

Dedicated translational sessions at the ERS Congress

In an initial effort to foster translational science, a number of translational sessions were organised at the annual ERS Congress in Milan [2]. To create these sessions, topics were first identified within the Translational Science Working Group that would cover research from the bench all the way to the bedside. Topics needed to be of interest to researchers as well as clinicians, and research on these topics should be conducted in, or be applicable to, a variety of respiratory diseases. The chosen topics that fit these criteria included obesity, macrophages, omics technologies and extracellular vesicles (EVs). As such, the hot topic symposia "What did you always want to know about omics analyses for clinical practice?" (covered in the Assembly 3 congress highlights article [3]) and "Exocited: the importance of extracellular vesicles in lung diseases" combined insight into the pathogenesis of diseases such as asthma, COPD and idiopathic pulmonary fibrosis (IPF) obtained from *in vitro* and *in vivo* models, as well as clinical studies. These symposia highlighted potential avenues for disease biomarkers, disease phenotyping and treatment strategies and were attended by ∼350 participants.

"*Exocited: the importance of extracellular vesicles in lung disease*": a dedicated translational symposium at ERS Congress 2023

This symposium was chaired by Christopher Brightling (a clinical scientist based in the UK), Sara Cuevas-Ocaña (a scientist based in the UK) and Niki Reynaert (a scientist based in the Netherlands) and attracted 320 participants. There were four presentations concerning EV research in different respiratory diseases. EVs are important for cell–cell communication and play an emerging role in lung diseases. They consist of a phospholipid membrane that contains several molecules, such as nucleic acids, proteins or lipids, which can be delivered to and signal to other cells. EVs are divided into three major subpopulations:

- exosomes with a vesicle size from 30 nm to 150 nm,
- ectosomes (microvesicles) with a vesicle size from 100 nm to 800 nm, and
- apoptotic bodies with a vesicle size from 200 nm to 5 mm.

Translational research in the field is ongoing, focusing on how EVs are implicated in the pathophysiology of respiratory diseases and on how these particles could act as novel biomarkers or even therapeutic targets and/or agents [4–7]. This session of the ERS Congress 2023 thoroughly covered this hot topic and enhanced the participants' understanding of the implication of EVs in respiratory medicine, with the four speakers giving examples of cutting-edge studies describing the possible contribution and applications of these particles in pulmonary fibrosis, ageing, coronavirus disease 2019 (COVID-19) and acute lung injury (ALI).

The first talk by Olivier Burgy (France) highlighted the role of the EV cargo in pulmonary fibrosis. IPF is a progressive lung disease with high morbidity and mortality, characterised by the accumulation of extracellular matrix. Thus, the development of efficient therapeutic strategies is imperative [8, 9]. It was shown that EVs are increased in the bronchoalveolar lavage fluid (BALF) of IPF patients and experimental models, and that EVs in IPF mediate WNT5 signalling by transporting WNT5 [10]. Moreover, it was reported an abnormal miRNA cargo of sputum exosomes in IPF patients, and specifically miR-142-3p, was negatively correlated with the diffusion capacity of the lungs [11]. The speaker discussed further investigation of the proteome profile of EVs in pulmonary fibrosis [12]. Using a bleomycin-induced fibrosis model in mice, it was shown that the EVs obtained from the fibrosis model had a distinct proteome profile. Furthermore, EVs from fibrotic samples contained secreted frizzled related protein 1 (SFRP1), while lung mesenchymal cells in these patients also highly expressed SFRP1. Deficiency of SFRP1 in the mouse model prevented lung fibrosis. This study showed that EVs contain a specific cargo, which is related to fibrosis, and can possibly be targeted in the treatment of IPF [12].

The second talk was given by Louise Donnelly (UK) and focused on EVs as a biomarker in ageing-related lung disease. It was presented that senescent cells are the source of the senescence-associated secretory phenotype inflammatory proteins, which are responsible for the low-grade inflammation in ageing. A

central role in ageing is occupied by sirtuin-1 and -6, which are reduced in a mechanism involving phosphoinositide 3-kinase, mammalian target of rapamycin and miRNA-34a [13]. In 2009, it was suggested that COPD is a condition characterised by accelerated lung ageing [14]. Unpublished data presented by L. Donnelly suggested that COPD is characterised by increased EVs with a specific cargo containing miRNA-34a and capable of converting healthy cells into senescent cells.

The third talk by Kenneth Witwer (USA) introduced an EV-based vaccine against SARS-CoV-2. The study was based on the guidelines presented in the position statement of the International Society for Extracellular Vesicles [15]. Outer membrane vesicles, EVs derived from Gram-negative bacteria, bearing the recombinant SARS-CoV-2 spike receptor-binding domain were used in a Syrian hamster model that was intranasally immunised and infected with the virus. The immunised animals exhibited high titres of plasma IgG, high mucosal antibody production, and decreased virus titres in the lung and BALF, and they were protected against the adverse effects of the virus [16]. This study underlined the potential role of EVs in vaccine engineering. However, it was highlighted that EVs are not immune inactive and that the administration of foreign EVs themselves can induce the production of antibodies by the host, as shown by mammalian EVs administered to *Macaca nemestrina* [17].

The fourth talk by Anna Krasnodembskaya (UK) described the role of mesenchymal stromal cell (MSC)-derived EVs in acute respiratory distress syndrome (ARDS). EVs derived from MSCs have beneficial effects in pre-clinical ARDS models, such as anti-inflammatory properties and increased survival rates [18]. Based on three sequential studies, the protective role of MSC-derived EVs against ARDS was described and thus their therapeutic potential was highlighted. From a mechanistic point of view, it was shown that MSCs polarise macrophages towards the M2-phenotype by transferring mitochondria *via* EVs. Two models were used in this study: in the first model, human monocyte-derived macrophages were co-cultured with human MSCs and treated with either lipopolysaccharide (LPS) or BALF from patients with ARDS; in the second, murine alveolar macrophages treated or not treated with human MSC-derived EVs were transferred to LPS-injured mice [19]. It was shown that MSC-derived EVs improve mitochondrial dysfunction and oxidative phosphorylation *via* mitochondrial transfer, and thus act beneficially in hypo-inflammatory ARDS by restoring the membrane integrity and cell functionality. Several models were described including an *ex vivo* model with human cells, human lung slices and human BALF, as well as an *in vivo* model consisting of LPS-injured mice treated with MSC-derived EVs [20]. Finally, it was shown in both the *ex vivo* and *in vivo* models that the macrophage modulation by MSC-derived EVs is executed by the transfer of miRNA181a and the PTEN–pSTAT5–SOCS1 axis [21].

"*Mechanisms underlying the influence of obesity on respiratory diseases*": a dedicated translational oral presentation session at ERS Congress 2023

The dedicated translational oral presentation session, chaired by Niki Ubags (a scientist based in Switzerland) and Niki Reynaert (a scientist based in the Netherlands), attracted 120 participants and was based on some of the abstracts submitted to the congress. This session comprised short presentations highlighting obesity, defined as an abnormal or excessive fat accumulation, as a risk factor for respiratory diseases across the lifespan and discussing various potential underlying mechanisms. Obesity poses a preventable health hazard and is unequivocally implicated in the exacerbation and adverse prognosis of respiratory diseases [22]. Childhood obesity has repercussions in adult life, with a higher risk of premature death and disability; this field of study requires further diligent exploration [23]. Notably, maternal dietary choices during gestation and lactation have emerged as pivotal determinants of shaping a healthy neonatal metabolism and pulmonary homeostasis.

The first speaker, Jaco Selle (Germany), presented a pre-clinical study describing that maternal obesity influenced the offspring by increasing their body weight, adipocyte hypertrophy and plasma interleukin (IL)-6, and by decreasing the numbers of alveolar progenitor and alveolar type 2 cells [24]. Perinatal obesity enhanced the DNA damage response, transcriptional stress and ageing-associated pathways [25]. IL-6 emerged as a central modulator of these effects, as substantiated by the protection observed in IL-6-null mice and pharmacologically inhibited IL-6 signalling against the repercussions of perinatal obesity [26]. The second speaker, Mina Ali (Denmark), delivered several insightful observations underscoring the perils of a westernised dietary pattern during pregnancy [27], manifesting as an augmented risk of recurrent wheezing, asthma-like symptoms, childhood asthma and the number of exacerbations in the offspring [28]. This association was further validated in the external VDAART cohort. The plasma metabolic profile of the pregnant progenitor under a westernised diet could be used to predict the increased risk of asthma and exacerbations. Low social circumstances were associated with an amplified risk of recurrent wheezing and the number of asthma-associated exacerbations.

The third speaker, Signe Kjeldgaard Jensen (Denmark), shed light on the genetic underpinnings of high body mass index (BMI) susceptibility [29]. She introduced a polygenic risk score (PRS) derived from genetic data, demonstrating a significant association between BMI PRS and asthmatic exacerbations and lower respiratory tract infections in early childhood, regardless of the child's BMI [30]. Nicola Adderley (UK) then shifted the focus to adult populations and delved into the incidence rates of asthma-related hospital admissions [31]. Around 1% of adults with asthma experienced at least one asthma-related hospital admission. Female sex, ethnicity, being a smoker, ⩾6 short-acting β-agonist inhaler prescriptions and being socioeconomically deprived increased the risk of hospital admission. Among various risk factors, obesity emerged as the main contributor, followed by depression, allergies and smoking, emphasising the necessity to address these issues to reduce hospital admissions. The fifth speaker, Holger Garn (Germany), scrutinised plasma EVs from obese and non-obese low type-2 asthma patients unveiling miRNA signatures that correlated with inflammatory cytokine and metabolic signalling pathways specific to obesity-associated low type-2 asthma patients [32]. The identified plasma EV miRNA signatures, particularly miR-17~92 and miR-106a~363, held potential as predictive biomarkers of obesity-associated low type-2 asthma, inversely correlating with clinical manifestations. In the sixth talk, Patricia Ramos-Ramírez (USA) focused on unravelling the role of adipokines, cytokines generated by the adipose tissue, in the body's metabolic status [33]. She explained the contribution of adiponectin and its receptors in the context of asthma. They used a pre-clinical asthma mouse model by challenging BALB/c mice with ovalbumin on five consecutive days. In asthmatic animals, adiponectin levels were reduced in plasma and bronchoalveolar lavage, and adiponectin receptor 1 expression increased in CD4 T-cells and regulatory T-cells (Tregs) [34]. Allergic inflammation modulates the adiponectin/adiponectin receptor axis in the lung, where the IL-10 produced by a subset of Tregs may mediate the allergic response. In the next talk, Armin Frille (Germany) described the intricate network of adipokines in cancer patients with malnutrition and cachexia, offering profound insights into the metabolic alterations associated with these conditions [35]. Metastatic lung cancer patients showed reduced levels of leptin and NRG4 compared with COPD patients, and increased levels of activin A, FGF21 and adiponectin compared with healthy and COPD patients. Increased leptin was related to a lower muscle tissue area, and reduced adiponectin and activin A levels were associated with both lower adipose area and muscle tissue. Nutritional status plays a pivotal role in the prognosis of diverse diseases, *e.g.* cystic fibrosis (CF) [36]. The eighth speaker, Christian Taube (Germany), presented an investigation that used cutting-edge deep learning technology to unveil the preferential modulation of adipose tissue rather than muscle tissue by cystic fibrosis transmembrane conductance regulator modulators in CF patients [37], emphasising the need for personalised nutritional strategies. The final speaker, Renaud Tamisier (France), scrutinised the physiological impact of chronic intermittent hypoxia (CIH) in non-obese healthy individuals in a prospective, double-blinded, cross-over study, where nine healthy subjects underwent the two phases of exposure of 14 nights randomised to CIH *versus* air [38]. Unveiling CIH-induced heightened sympathetic tone, altered lipid profiles, and lipolysis and lipogenesis gene expression in adipose tissue, the study brought forth a comprehensive picture of the systemic effects of CIH [39].

The multidisciplinary investigations presented during this translational science oral session shed light onto the diverse spectrum of intricacies surrounding obesity and its profound health implications. These studies will pave the way for innovative therapeutic strategies and a deeper understanding of this complex intersection of health and metabolism.

"*Inflammatory endotyping: the macrophage across disease areas*": a dedicated translational poster session at ERS Congress 2023

Similar to the oral presentation session on the influence of obesity on respiratory diseases, several abstracts were selected to create a dedicated translational poster session "Inflammatory endotyping: the macrophage across disease areas", which took place on Tuesday morning. A recurrent theme in this poster session was the observation of alterations in the cellular metabolism of macrophages in response to various triggers related to their polarisation state. Macrophages or macrophage-related processes were furthermore considered as disease biomarkers or targets for therapy. Uniquely, this session covered research on macrophages across a wide variety of respiratory diseases, including SARS-CoV-2, interstitial lung diseases (ILDs)/IPF, ALI/ARDS, COPD, asthma and lung cancer, as well as in relation to air pollution.

Increasing the visibility of translational science at the ERS Congress

To make translational science at the ERS more visible, translational tags were introduced to highlight these sessions and to attract the right audience. Previously, congress sessions were tagged as either basic or clinical to indicate the target audience of each session, as can be observed in previous congress highlights articles [40–42]. However, sessions that contain a mix of basic and clinical science are encouraged, as is research that is translational in nature. A total of 97 sessions were labelled as translational, indicating that

translational research bridging basic and clinical research is highly prevalent at ERS. Two of the symposia that were tagged as translational were "Air pollution, pollen and lung health in the climate change era" and "Kidney–lung crosstalk in pulmonary disease". The sessions attracted a wide and multidisciplinary audience with a research interest in multiorgan diseases and the effect of climate change ranging from epidemiologists and basic scientists to clinicians, fostering a lively, multidisciplinary panel discussion.

"*Air pollution, pollen and lung health in the climate change era*": a symposium with the translational tag at ERS Congress 2023

This symposium, chaired by Christopher Carlsten (a clinical scientist based in Canada), Sergio Alfonso Harari (a clinical scientist based in Italy) and Maria Rosaria Bonsignore (a clinical scientist based in Italy), brought together multiple perspectives on how air pollution, allergy and climate change are intimately linked. The four speakers highlighted important developments such as the characteristics of pollutants and pollen, the role of environmental and geographical factors on their impact, recent important methodological developments in the field, the effect of pollution on paediatric health and the role of sex differences in determining disease outcome and treatment. This popular session attracted 400 participants, and was in line with the theme of the congress in addressing the need to tackle the ongoing climate change crisis and its detrimental impact on respiratory health.

The first speaker, Adrian Lowe (Australia), gave a state-of-the-art review on epidemiological research surrounding pollen and pollution exposure, and the impact on asthma exacerbation. He highlighted the importance of the nature of pollen/pollutants as well as the geographical and climatic factors that influence the impact of allergens and pollutants on respiratory health. Different species of pollen, such as ragweed pollen and birch pollen, show varied seasonal, geographical and temporal distribution [43, 44]. Similarly, the distribution of fungal spores also follows a similar trend of varied distribution [45, 46]. For example, both *Alternaria* and *Cladosporium* exhibit a longer seasonal length in the south-westerly regions of Europe when compared with other regions of Europe, such as the north-easterly regions [47]. The detrimental impact of short-term exposure to pollen on lung health was highlighted and the burden on health services was emphasised [48]. For instance, exposures to grass pollen and fungal spores are associated with deteriorating lung function as well as asthma-associated hospitalisations in childhood and adolescence [49, 50]. Importantly, fungi and grass pollen are among several factors that aggravate symptoms of thunderstorm asthma, which is defined as an "acute bronchospasm" which occurs after a thunderstorm [51]. The constantly rising temperature and carbon dioxide levels increases the duration of the allergy season, aeroallergen quantity and the associated allergenicity [47, 52]. Moreover, extreme weather events associated with climate change also aggravate the spread of fungal spores. Consequently, there is a more severe impact on respiratory health [47].

The second speaker, Antonio Gasparini (UK) elaborated further on the short-term effects of pollen/pollutant exposure, discussing novel methodological perspectives. The presence of accessible health data at the population level, cohort level and individual level, along with associated environmental data allows us to accurately assess the effects of short-term pollen/pollutant exposure in a detailed manner. Recent years have witnessed the development of revolutionary technologies. For example, reanalysis data sets have been extremely useful in providing a comprehensive and accurate understanding of data on a global scale. Remote sensing and smartphone technologies enable us to link geographical data with direct measurements assessed in the field and at an individual level. Data collection at the area level (area-level data) or at cohort/individual level (point-location data) enables a more precise modelling using different data sets. Ultimately, the wealth of data obtained by these methods can be efficiently used to reconstruct individual longitudinal profiles for risk factors (*e.g.* pollen exposure) for a large population on a spatial and temporal level. In line with this, the speaker highlighted a recently developed study design called a "case time series" which efficiently incorporates longitudinal structures and temporal variables [53]. This method has been elegantly applied in a study based on a Tasmanian cohort which used a combination of smartphone-based data collection linked with environmental measurements to model the effect of pollen exposure at an individual level for a large population [53].

The third speaker, Jonathan Grigg (UK), shed light on the effects of air pollution on paediatric lung health. The detrimental effects of particulate matter with an aerodynamic diameter <10 μm (PM_{10}) on respiratory health was highlighted. Specifically, the study presented characterised the structure of kerbside and underground PM_{10} particles and assessed their effects on pulmonary health. Three-dimensional confocal imaging revealed that these diesel PM_{10} particles have a jagged shape rather than a spherical shape, which was considered the norm [54]. Long-term exposure to traffic-derived particulate matter pollutants have been associated previously with clinically low lung function, aggravated symptoms of asthma and deteriorating respiratory health in children [55–58]. It was further emphasised that there is a need for

betterment of the air quality index to improve the health of children as well as to prevent onset of cardiovascular diseases, which can already set in during fetal development. In line with this, it was shown that exposure of pregnant women to particulate matter elevates the risk of early onset of asthma-associated respiratory deterioration in children [59]. Moreover, particulate matter has the ability to hone in on the placenta, causing threatening effects *in utero* [54, 60]. Studies have revealed that exposure to such particulate matter also increases susceptibility to infection [61, 62]. For instance, exposure to particulate matter increases angiotensin-converting enzyme 2 (ACE2) receptor expression in vero-E6 cells and enhances their susceptibility to SARS-CoV-2 [61].

The fourth speaker, Meghan Rebuli (USA), discussed how sex modifies the effects of environment and occupation on respiratory disease. Increasing evidence from the literature suggests that sex differences influence disease outcome and treatment [63]. Moreover, sex differences are temporally dependent and influence the respiratory physiology at an anatomical level, and thus disease incidence and prevalence may differ between different sexes [64]. Apart from sex-associated factors, gender-specific exposures are also key influencers of disease [65]. For example, in developing nations, women and children suffer from a higher exposure to household wood smoke, while first responders such as firefighters are primarily male. Thus, gender-dependent exposures and sex differences need to be considered when studying diseases. This is corroborated by a randomised, parallel-group, controlled-exposure study which revealed that wood smoke showed sex-specific effects on the baseline respiratory immune gene expression profiles in response to a vaccine dose of live attenuated influenza virus [66]. In conclusion, the potent effect of inhaled pollutants was emphasised on various host defence mechanisms and responses to infection [67].

"*Kidney–lung crosstalk in pulmonary disease*": *a symposium with the translational tag at ERS Congress 2023*

This symposium, chaired by Salman Siddiqui (a clinical scientist based in the UK), Silke Meiners (a basic scientist based in Germany) and Julie Bastarache (a clinical scientist based in the USA), attracted 200 participants to hear four talks covering key areas in kidney–lung crosstalk. Wolfgang Kübler (Germany) presented the importance of lung–kidney crosstalk in homeostasis and disease. The lung has a critical role in maintaining oxygen delivery and carbon dioxide removal, and in the renin–angiotensin–aldosterone system (RAAS), while the kidneys are responsible for urinary excretion and produce the erythropoietin hormone. Haemodynamic state and pH balance are under the control of both organs through the RAAS and urinary excretion. However, the interaction between the two organs is more complex and also involves molecular crosstalk.

The next talk focused on the lung–kidney axis. Interventions to improve ALI such as mechanical ventilation (MV) can have deleterious effects on kidney function [68]. This study highlighted that MV is associated with a threefold increased risk of developing acute kidney injury (AKI). Different hypotheses have been proposed to explain the occurrence of AKI during ARDS. The first aetiology is haemodynamic in origin. Positive end-expiratory pressure is associated with decreased renal blood flow (RBF) leading to decreased kidney perfusion and finally renal ischaemia. The second putative mechanism is hormonal activation of the RAAS by the sympathetic system, which deceases RBF and glomerular filtration rate. The latest suggested mechanism involves inflammation, related to lung injury barotrauma, known as biotrauma [69]. One episode of ALI can also have long-term effects on the kidney [70]. Pneumococcal pulmonary infection was an independent risk factor for developing a chronic disease over decades, with an overall incidence rate ratio 23% higher in those with pneumococcal pneumonia than in those without pneumococcal pneumonia [71]. The kidney–lung axis was the next topic to be discussed. AKI can initiate and perpetuate lung injury, notably through osteopontin that can trigger lung endothelial leakage and inflammation [72]. Patients with chronic kidney disease (CKD) are at a higher risk of developing pulmonary hypertension (PH), mainly with a post-capillary pattern [73, 74]. A possible molecular mechanism involved in PH and CKD could be renal Klotho protein deficiency.

John Laffey (Ireland) explained the cellular and molecular mechanisms of kidney–lung crosstalk in ALI. Epidemiological data from patients hospitalised in intensive care units for ARDS without any renal comorbidity at baseline, showed that nearly 40% of the patients will develop an AKI within few days, which is associated with an increase in mortality in patients [75]. It was demonstrated how the lungs can harm the kidneys in an acute fashion [76]. It was shown that, in an *in vivo* rabbit model of ARDS, injurious MV led to increased rates of epithelial cell apoptosis in the kidney and the intestine. In both the plasma of patients and in the animal model there was an increase of the circulating soluble Fas ligand, produced by the airway epithelial cells. Fas ligand/Fas receptor is an apoptosis pathway. Indeed, injured cells can release endogenous mitochondrial damage-associated molecular patterns (DAMPs) [77]. Mitochondrial DAMPs can activate neutrophils that are able to migrate into organs and to degranulate,

leading to organ injury. Cellular disruption by trauma in the lung leads to the release of these mitochondrial DAMPs into the circulation and there is experimental evidence that AKI can induce lung injury through the same pathway [78].

Francesca Polverino (USA) explained the role of endothelial cells in lung–kidney interactions in COPD. Chronic kidney injury is an underestimated comorbidity in COPD patients. Cigarette smoke induces systemic endothelial dysfunction in both the lungs and kidneys. COPD patients have glomerular, tubular and vascular damage irrespective of cigarette smoke status [79]. Microalbuminuria, a marker of endovascular dysfunction, is frequent in patients with COPD and is associated with hypoxaemia, and also increases during COPD exacerbations. Based on these two observations, it was shown that patients with COPD and cigarette smoke-exposed mice have pulmonary and renal endothelial cell injury, linked to increases in the oxidative stress–receptor for advanced glycation end-products pathway [80]. Interestingly, angiotensin-converting enzyme inhibitor and metformin could attenuate cigarette smoke-induced kidney dysfunction [81]. In the Lovelace cohort of pre-COPD patients, a subset of patients with a high rate of forced expiratory volume in the first second decline was identified. In this group, patients also had a higher risk of developing CKD, suggesting that COPD is a systemic disease and possibly related to premature ageing. Microalbuminuria may be used a biomarker to define a subgroup of COPD patients with an early decline renal function, that could benefit from dedicated clinical trials and early therapeutic interventions.

Gabriela Riemekasten (Germany) described the role of the kidney in ILD. Kidney disease is more frequent among ILD patients compared with the general population and is a negative survival prognostic factor [82, 83]. The high prevalence of both lung and kidney disease suggests a common molecular mechanism between the two organs. The RAAS is a central player in autoimmune diseases. Interestingly, systemic sclerosis patients had increased blood levels of autoantibodies against the angiotensin and endothelin receptors, which are correlated with overall survival, but also vascular disease such as digital ulcers and PH [84]. Transfer of peripheral blood mononuclear cells from systemic sclerosis patients into immunocompromised mice induced severe lung inflammation and ILD, kidney injury and skin fibrosis [85]. The mice developed autoantibodies against the angiotensin II receptor 1/endothelin-1 receptor type A (ATR1/ETAR), suggesting an unexpected role of the RAAS pathway in ILD and renal-associated vasculopathy associated with systemic sclerosis.

Concluding remarks

The translational value of each of the sessions highlighted above is apparent from the combination of fundamental and clinical research and/or by clearly defining the clinical relevance of the topic. The overall goal of the translational science initiative was to bridge the gap between clinical and basic science, bringing these scientists together during the annual ERS Congress in Milan to talk and listen to each other. The Translational Science Working Group of the ERS strives to strengthen translational efforts among all ERS assemblies (further content can be accessed online: https://youtu.be/O7OKmew1LX8). As described above, dedicated translational sessions were organised and translational sessions were tagged as such in the programme. Three of the highlighted sessions were selectively scheduled as translational sessions, while the other two were tagged as translational and selected because of an excellent fit within the conference theme (Pollution, climate change and sustainable development), and Assembly 3's priority topic (Crosstalk: inter-organ and cell-to-cell communication strategies in lung health and disease). To attract clinicians to basic and translational sessions, it is important to illustrate the relevance of the pre-clinical models used, explain how to perform novel technologies and complex data analysis (*e.g.* single cell RNA sequencing) [42], and describe the therapeutic perspectives. This will facilitate interpretation of the findings and thus help to overcome the gap. *Vice versa*, attracting basic scientists to clinical sessions can be achieved by including fundamental talks, and this will facilitate obtaining novel insights into disease mechanisms.

The translational sessions covered important topics of translational research. They were very well attended by both basic and clinical researchers. Potential improvements for future sessions would be to better consider the different backgrounds of the audience and to provide conceptual and/or technological insight to ensure optimal translation and explain the clinical relevance of basic knowledge and *vice versa*, for instance by including a visual presentation of the research models and objectives. Additionally, active participation of the audience as well as specific feedback on the delivered content needs to be further encouraged. Stay tuned for new developments at the ERS Congress in 2024!

The translational science initiative aims to further shape translational research at the ERS, for example by identifying topics that are of interest to all assemblies [86, 87], by introducing the Sunday morning pass at the annual Lung Science Conference (with a morning session focusing on clinical applications accessible *via* live streaming) (https://channel.ersnet.org/hp-60-1-home-replay), by offering financial support for a

research seminar dedicated to translational science, and by organising the continuing medical education (CME) online module focusing on "The role of epithelial cell biology in pulmonary disease" (https://new.ersnet.org/cme-online/modules/the-role-of-epithelial-cell-biology-in-pulmonary-disease). We aim to improve collaboration between clinical and basic scientists, not only by attracting them to the same sessions, but also by defining highlight notices for translational clinical research collaborations (https://www.ersnet.org/science-and-research/the-ers-translational-science-initiative/). Moreover, continuing our effort to extend translational research to the wider ERS membership, we have developed the HOW TO? webinar series where basic scientists explain how to store and use clinical samples for novel technologies, as an example of our developing comprehensive programme of ERS webinars on translational topics. The ultimate goals of this approach are to facilitate translational research and improve insight into disease mechanisms, integrating data from different patient subsets and different types of samples, and to facilitate diagnosis and personalised treatment by developing patient-specific models. To achieve this, let us start by bringing potential future Nobel prize winners in the respiratory field together!

S. Meiners, N.L. Reynaert, I.H. Heijink and S. Cuevas-Ocaña are members of the ERS Translational Science Core Working Group.

Conflict of interest: S. Meiners is the ERS Conference and Research Seminars Director. She declares ERS support to attend the ERS Congress. N.L. Reynaert is the Secretary of ERS Assembly 3. She declares ERS support to attend the ERS Congress. A.M. Matthaiou has nothing to disclose. R. Rajesh has nothing to disclose. E. Ahmed has nothing to disclose. R. Guillamat-Prats has nothing to disclose. I.H. Heijink is the Chair of ERS Assembly 3. She declares ERS support to attend the ERS Congress. S. Cuevas-Ocaña is the Early Career Member (ECM) Committee Chair and the ECM representative of ERS Assembly 3. She declares ERS support to attend the ERS Congress.

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