# Interstitial lung disease (ILD): the journey from behind the microscope to the artificial intelligence platform

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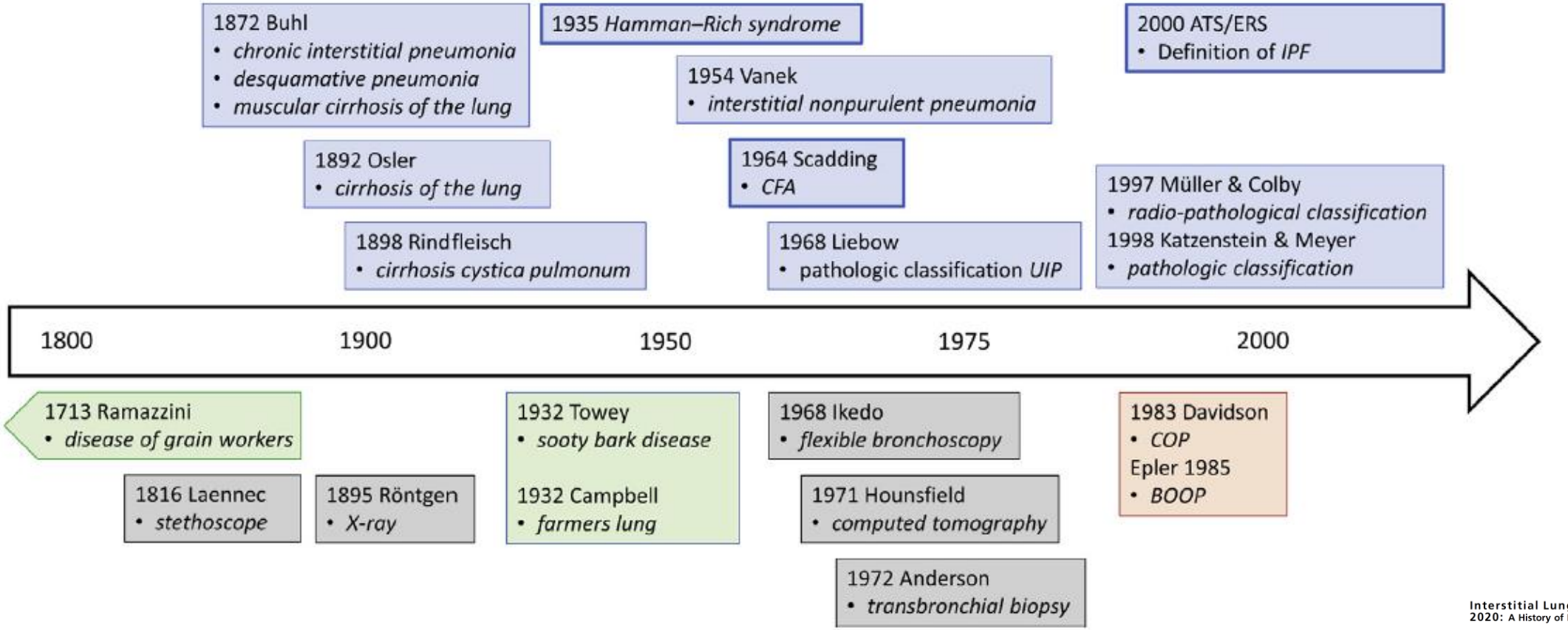
I often hear that I behave and communicate quite normally, so why did I have to become a pathologist?

# Interstitial lung disease (ILD): the journey from behind the microscope to the artificial intelligence platform

- Diffuse Interstitial Lung Disease
- This is a complex group of non-neoplastic pulmonary diseases that often require correlation of morphologic, clinical, and radiological findings.
- Idiopathic interstitial pneumonias account for a substantial subset of the diffuse lung diseases that a surgical pathologist is likely to encounter.

# History of Interstitial lung disease (ILD).





Interstitial Lung Disease in 2020: A History of Progress

Sabina A. Guler, MD, MHSc[a,*], Tamera J. Corte, MD, PhD[b]

KEYWORDS
• Interstitial lung disease • Idiopathic pulmonary fibrosis • History of medicine

KEY POINTS
• The understanding of underlying mechanisms of interstitial lung diseases has changed drastically over the last centuries.
• Changing terminology over the past decades has complicated communication and collaborative research, whereas progressively detailed clinical guidelines have been provided.
• Therapeutic successes over the last decade have been substantial.

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- Lung biopsies : shapes and sizes.
- The relative value of different procedures depends on the clinical and radiological setting.
- Know the clinical history and radiological findings, (communication).
- Wedge biopsies.
- Biopsy forceps (transbronchial biopsy) or a cryoprobe (cryobiopsy).
- Surgical lung biopsies are especially useful in patients suspected of having idiopathic interstitial pneumonias.

Open Access Article

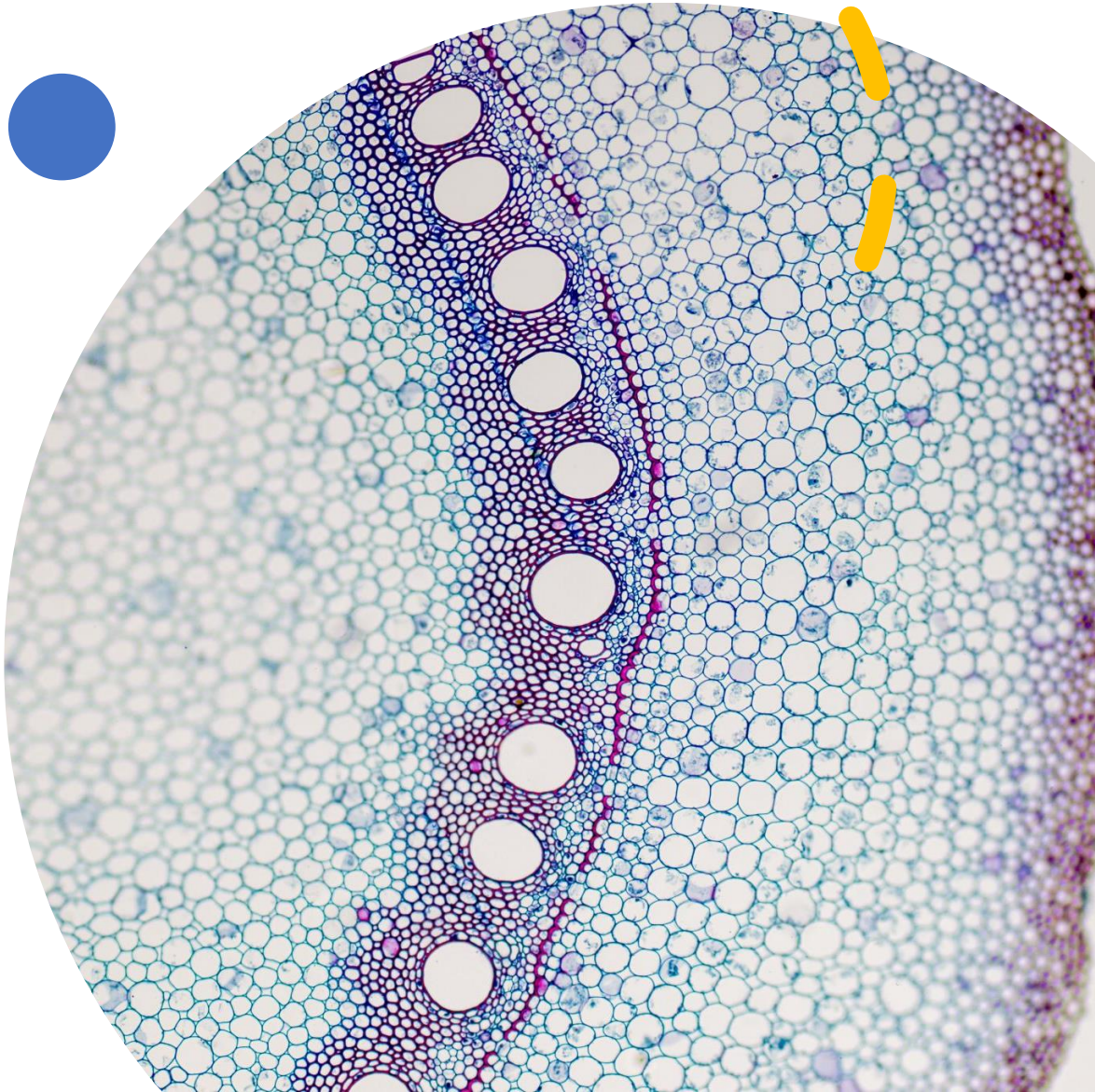
**Transbronchial Cryobiopsy Compared to Forceps Biopsy for Diagnosis of Acute Cellular Rejection in Lung Transplants: Analysis of 63 Consecutive Procedures**

by Carolin Steinack [1,2,*], Ariana Gaspert [2,3], Fiorenza Gautschi [1,2], René Hage [1,2], Bart Vrugt [4], Alex Soltermann [5], Macé Matthew Schuurmans [1,2] and Daniel Franzen [1,2]

# Interstitial lung disease (ILD): the journey from behind the microscope to the artificial intelligence platform

Classification of idiopathic interstitial pneumonias:

| | |
|---|---|
| • Chronic fibrosing interstitial pneumonias | UIP |
| | NSIP |
| • Smoking-related interstitial pneumonias | RBILD |
| | SRIF |
| • Acute/subacute interstitial pneumonias | Diffuse alveolar damage |
| | Organizing pneumonia |
| • Rare interstitial pneumonias | LIP |
| | Pleuroparenchymal fibroelastosis |
| | Unclassifiable interstitial pneumonia |



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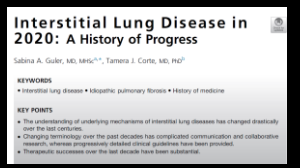
**Single-Cell Transcriptomic Analysis of Human Lung Provides Insights into the Pathobiology of Pulmonary Fibrosis** Paul. A Rayfman et al, December 2018.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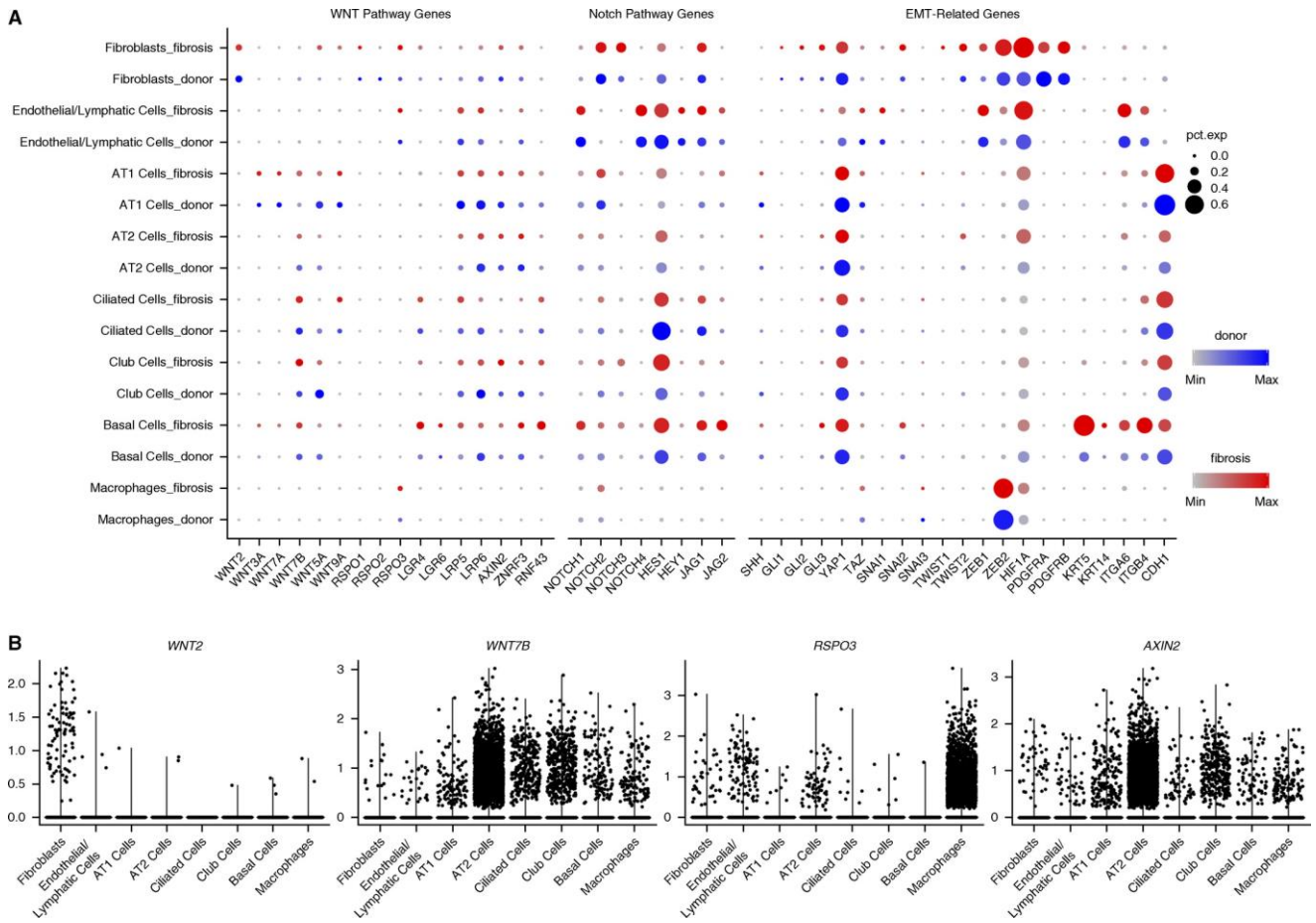

# History of Interstitial lung disease (ILD).

- The theory of impaired restoration of alveolar epithelial cells after repetitive lung injury leading to fibrosis was supported by electron microscopy studies that emphasized the role of epithelial cells in the pathogenesis of pulmonary fibrosis. After 2000, UIP was recognized as a distinct pathologic entity and not only a common final pathway of inflammatory ILDs. The paradigm changed from a model of inflammation leading to fibrosis to a model of repetitive alveolar epithelial injury and abnormal wound healing with predominant fibrosis and minimal inflammation.


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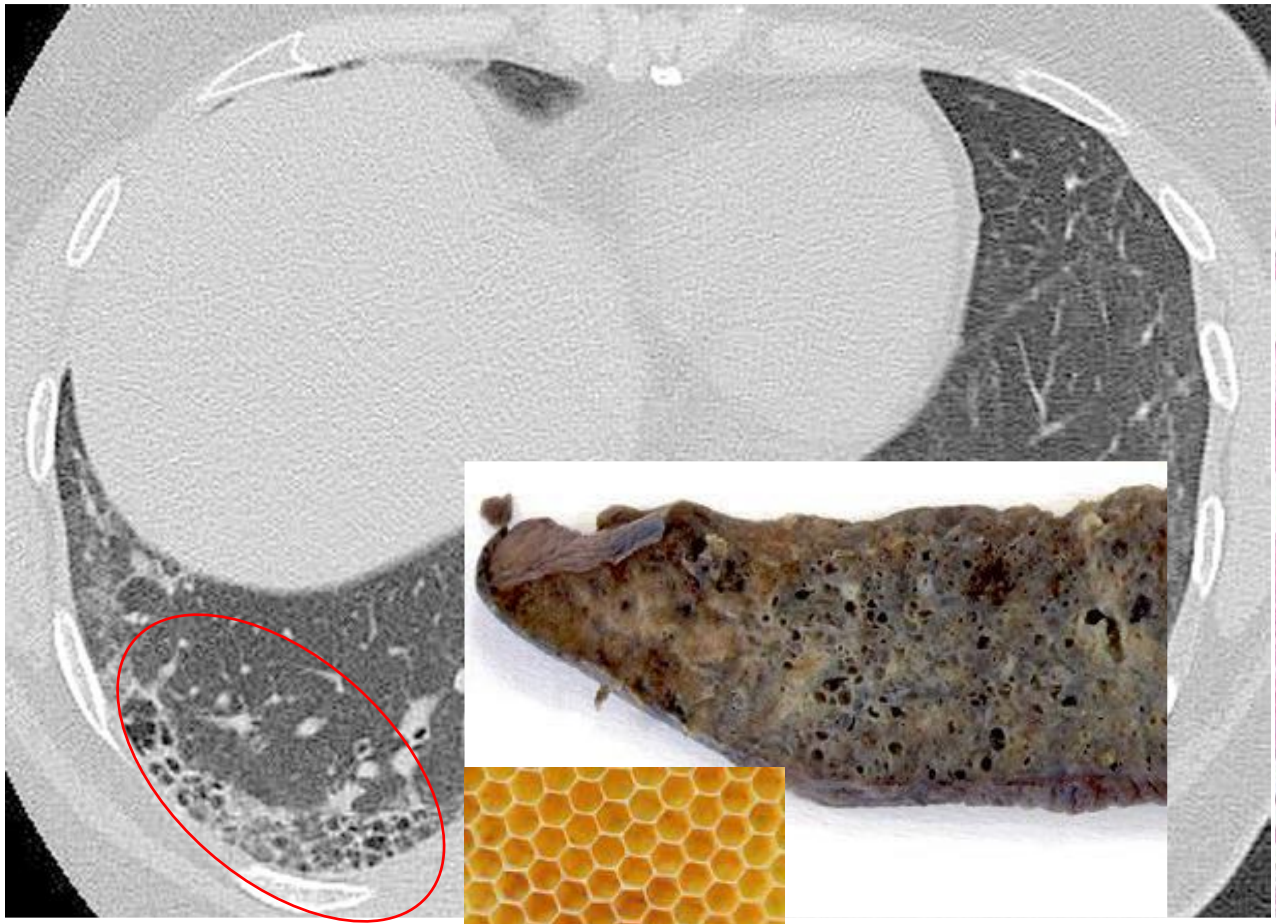
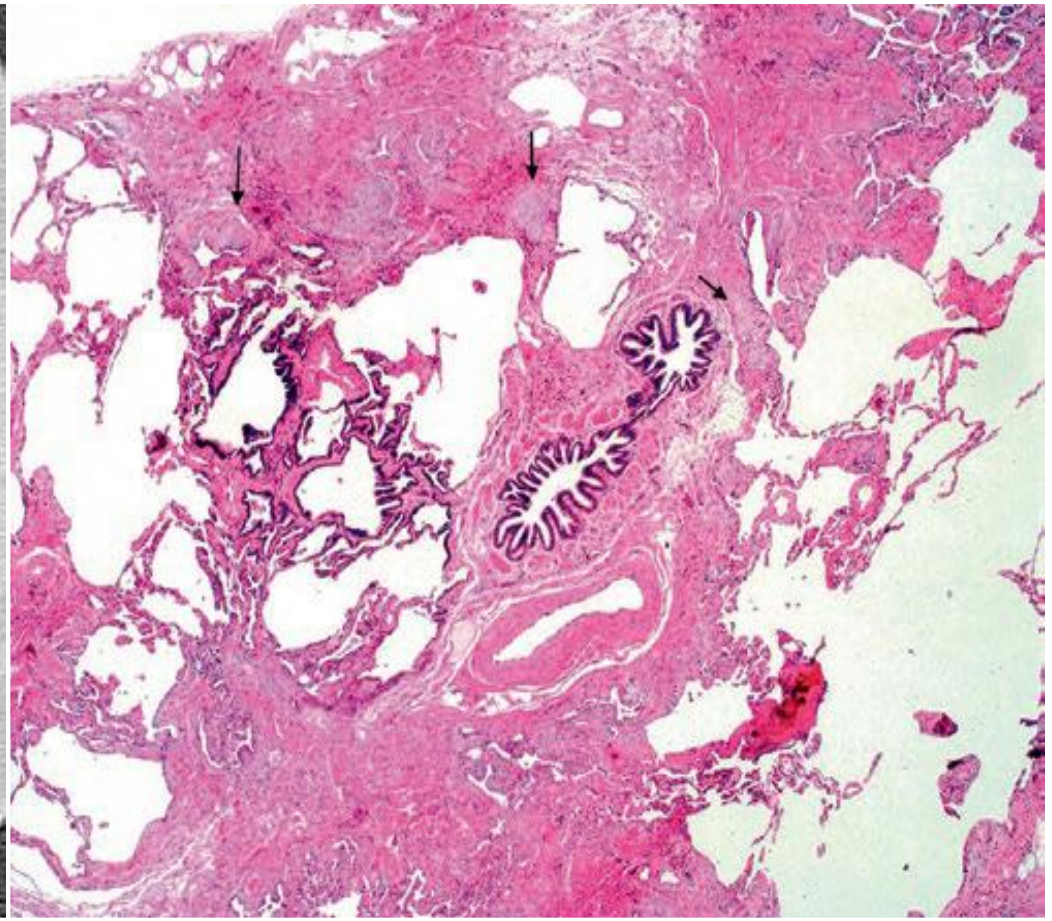
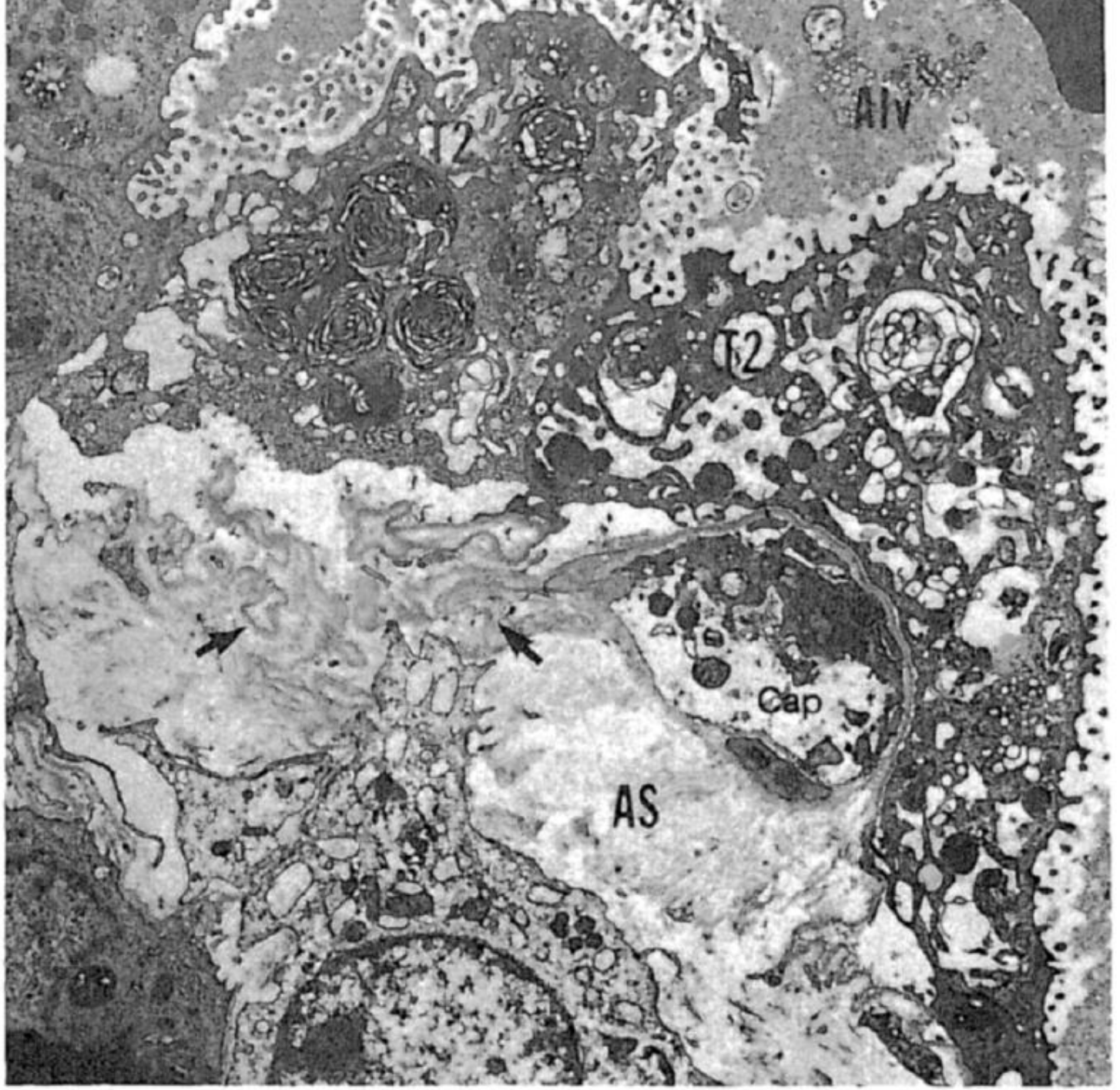
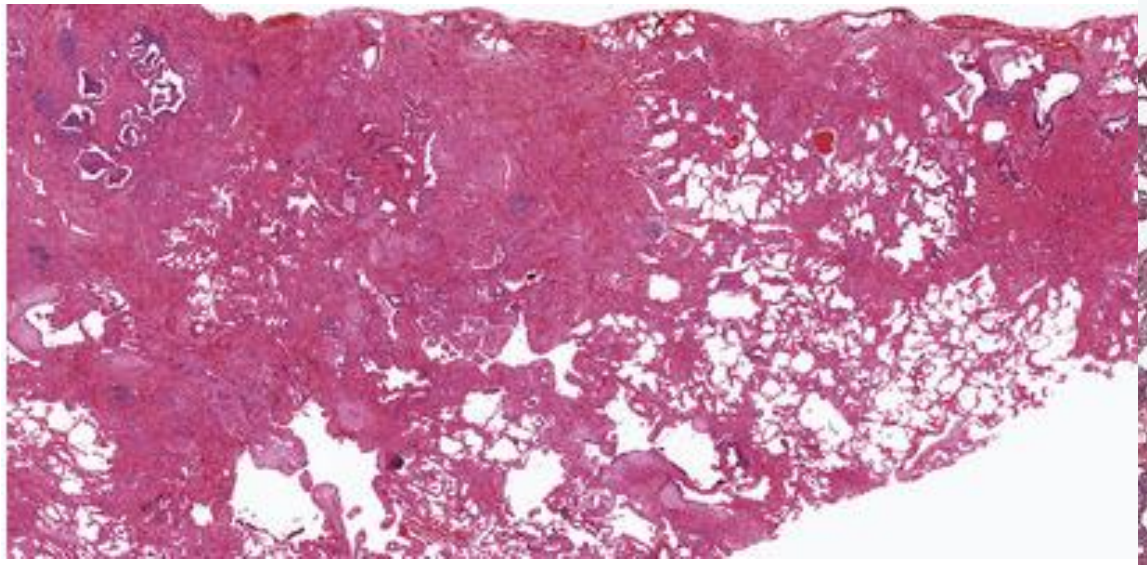


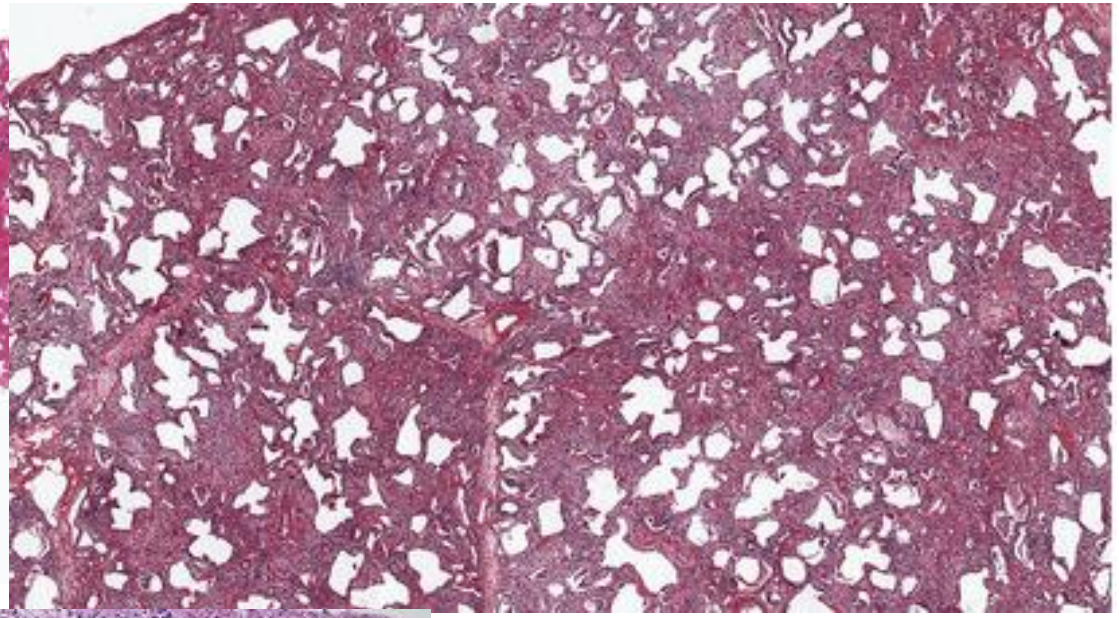


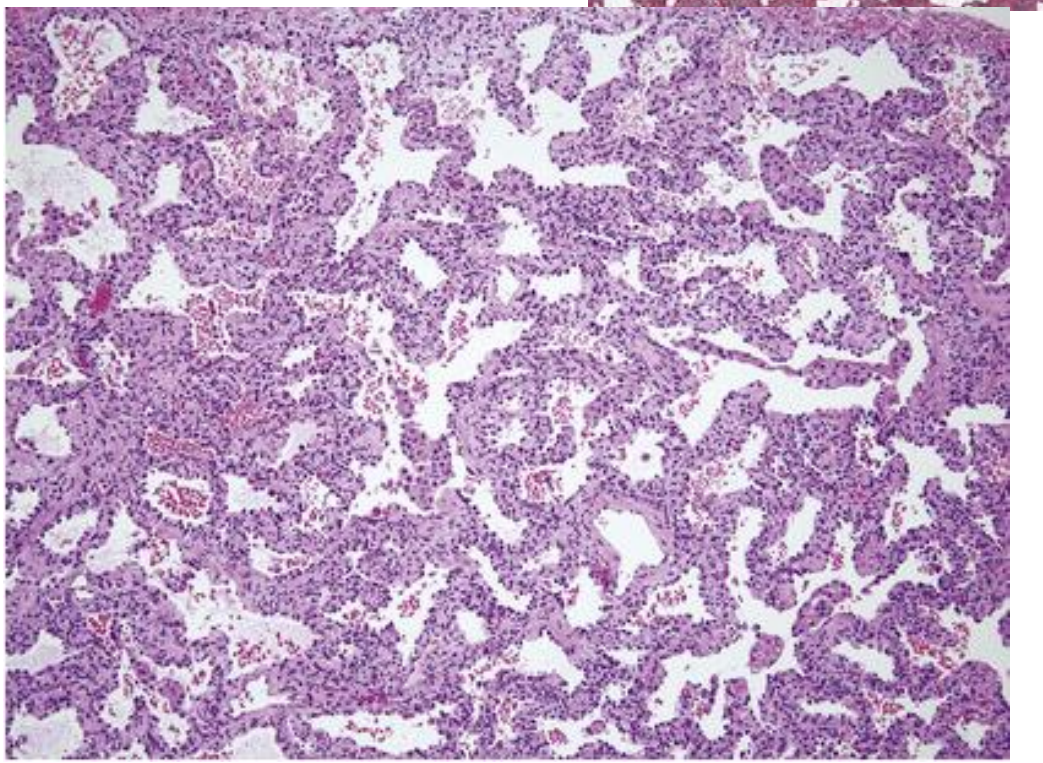
# History of Interstitial lung disease (ILD).

- Damaged Type II pneumocytes cover tangled and collapsed basal lamina (arrows) in the alveolar septum. (x 4,000.)









# Usual interstitial pneumonia as a stand-alone diagnostic entity: the case for a paradigm shift?

*Moisés Selman, Annie Pardo, Athol U Wells*

*Lancet Respir Med* 2023; 11: 188–96

Published Online January 11, 2023 https://doi.org/10.1016/S2213-2600(22)00475-1

See Comment page 117

**Instituto Nacional de Enfermedades Respiratorias Ismael Cosío Villegas, Mexico City, Mexico** (M Selman MD); **Facultad de Ciencias, Universidad Nacional**

Usual interstitial pneumonia (UIP) is characterised by a distinctive morphological and radiological appearance that was considered the pathognomonic hallmark of idiopathic pulmonary fibrosis (IPF). However, this peculiar lung remodelling pattern is also seen in other fibrotic interstitial lung diseases, including hypersensitivity pneumonitis, and connective tissue diseases. In this Personal View, we advocate the designation of a UIP pattern as a single, discrete diagnostic entity, amalgamating its primary form and secondary processes in disorders such as hypersensitivity pneumonitis (hypersensitivity pneumonitis with UIP), rheumatoid arthritis (rheumatoid arthritis with UIP), and others. The current separation between primary and secondary UIP is in keeping with the view that every individual interstitial lung disease must be viewed as a separate entity but does not reflect striking similarities between primary and secondary UIP in the morphological or radiological appearance, clinical behaviour, pathogenic pathways, and the efficacy of anti-fibrotic therapy. We believe that the unification of UIP as a single diagnostic entity has undeniable advantages.

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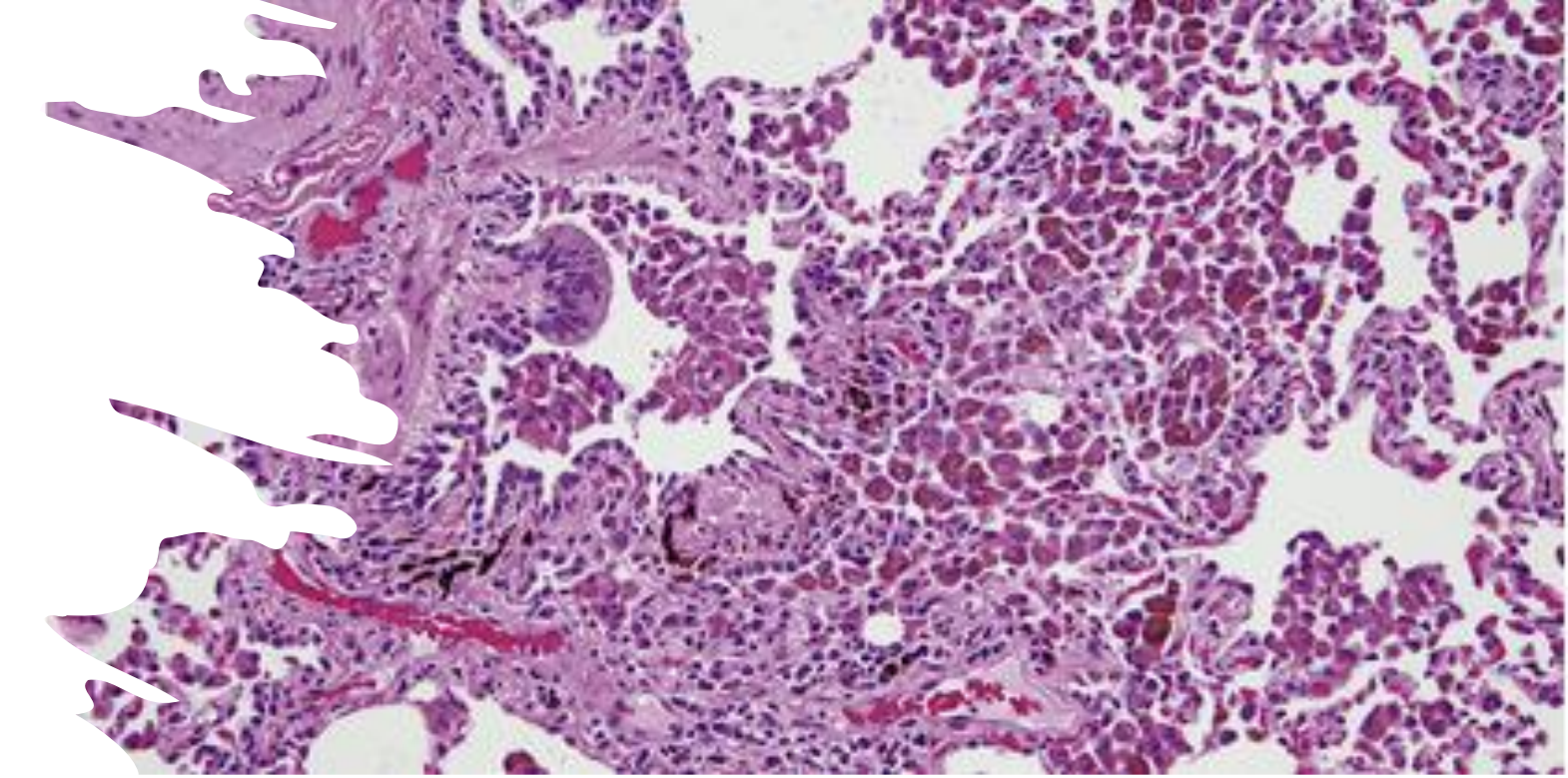
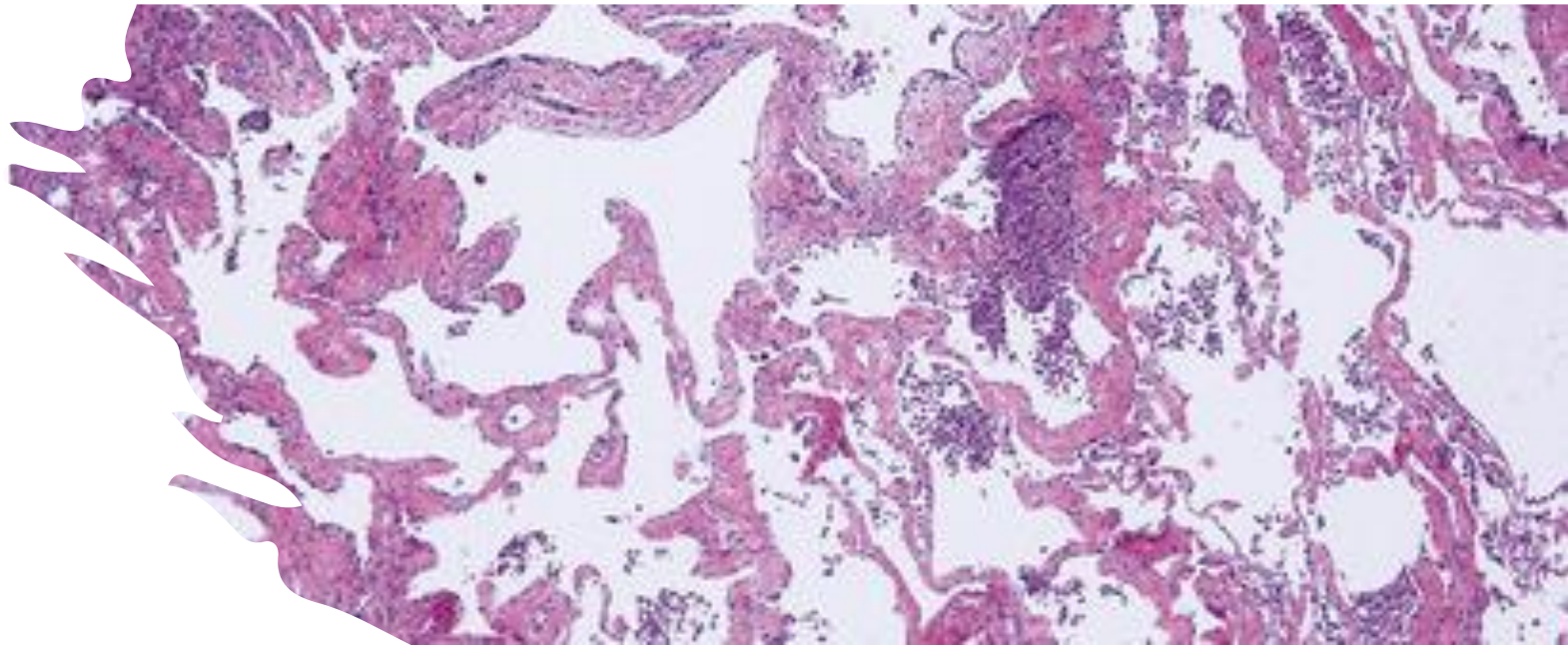
- RBILD
- SRIF





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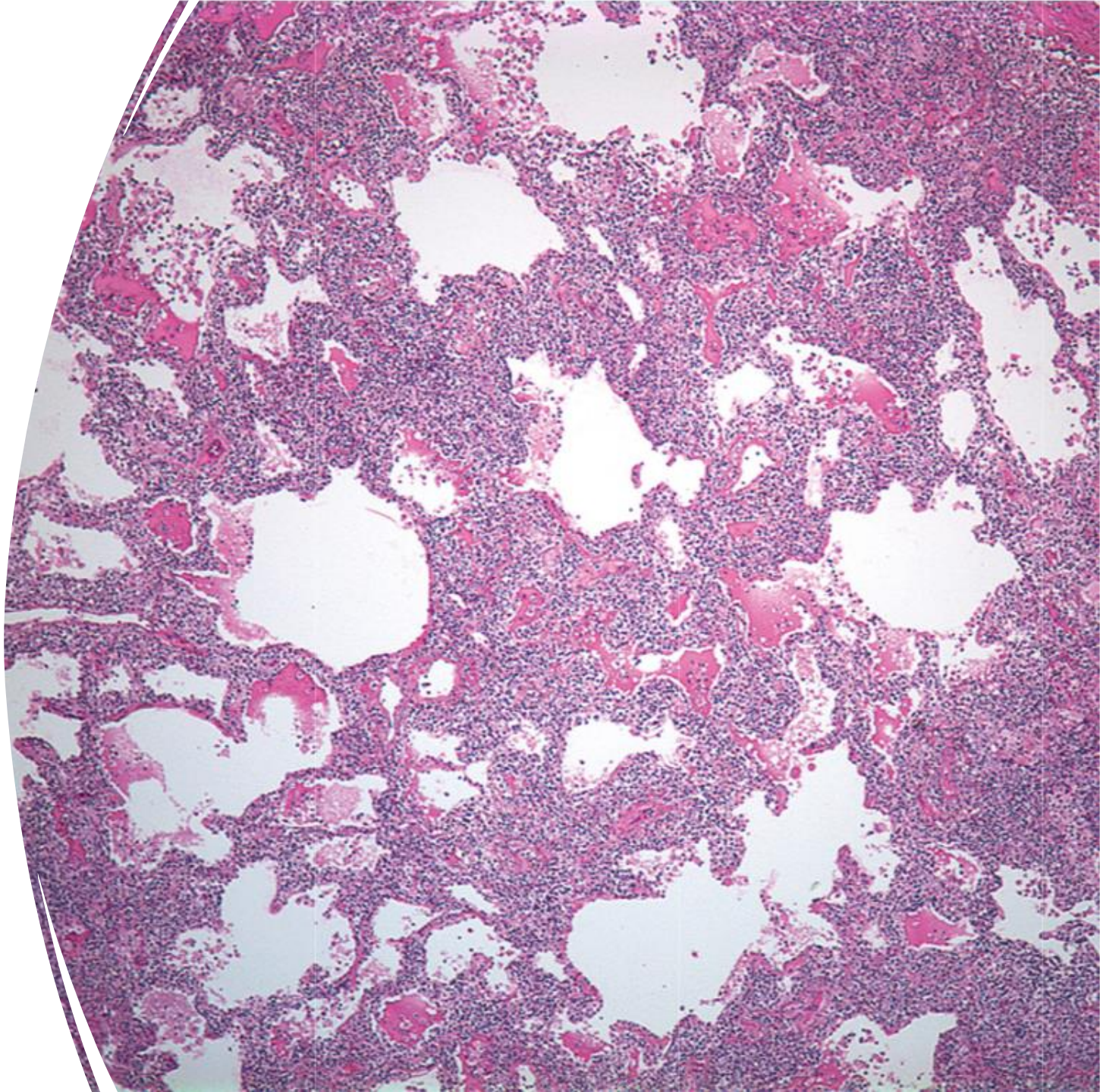
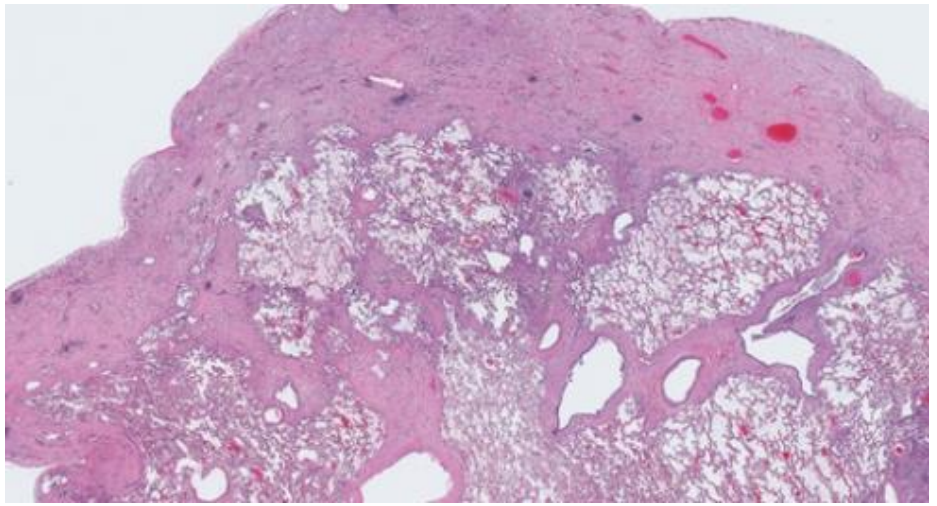
- **Lymphoid (lymphocytic) interstitial pneumonia (LIP)** is characterized by a lymphocytic infiltrate with associated lymphoid follicles, often admixed with histiocytes and plasma cells, that expands alveolar septa and peribronchiolar interstitium.



- Pleuroparenchymal fibroelastosis (PPFE) is a rare pattern of diffuse lung fibrosis.
- PPFE: upper lobes, peripheral subpleural parenchyma and broncho vascular bundles.
- PPFE is not a specific disease: lung and stem cell transplants, drug-induced lung disease, and connective tissue disease.
- PPFE MAY coexist with other forms of diffuse fibrotic lung disease: UIP.



Respirol Case Rep. 2015 Jun; 3(2): 82–84.
Published online 2015 May 22. doi: 10.1002/rcr2.108
PMCID: PMC4469148
PMID: 26090119

Pleuroparenchymal fibroelastosis: a rare interstitial lung disease

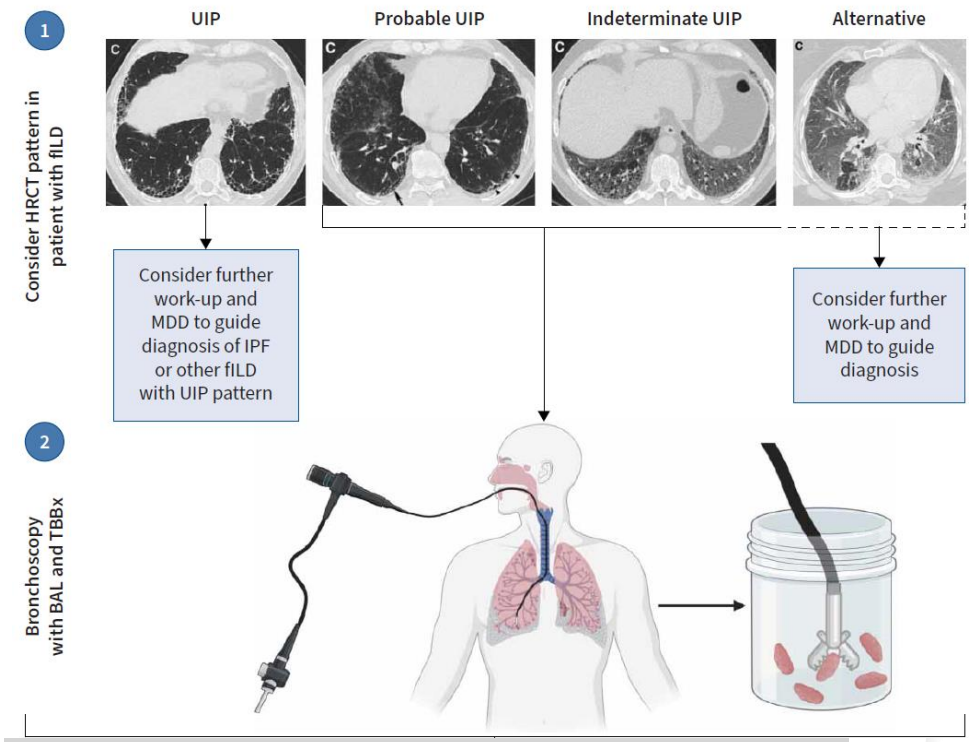
John C English,[1,2] John R Mayo,[2,3] Robert Levy,[2,4] John Yee,[2,5] and Kevin O Leslie[6,7]



Abstract Go to: ▸

Pleuroparenchymal fibroelastosis (PPFE) is a newly described form of interstitial lung disease that originates in the upper lung zones and typically progresses to involve the entire lung. The disease may be idiopathic but is often associated with other pre- or coexisting conditions. Pneumothorax is a common complication and can occur at presentation or at other times during the course of the disease. Pathologically, interstitial fibrosis takes the form of a dense consolidation with some preservation of alveolar septal outlines and demonstrates a distinctly abrupt interface with residual normal lung. Unrecognized cases of PPFE may be incorrectly diagnosed as sarcoidosis, atypical idiopathic pulmonary fibrosis, or other unclassifiable interstitial pneumonias.

**Keywords:** Pleuroparenchymal fibroelastosis (PPFE)

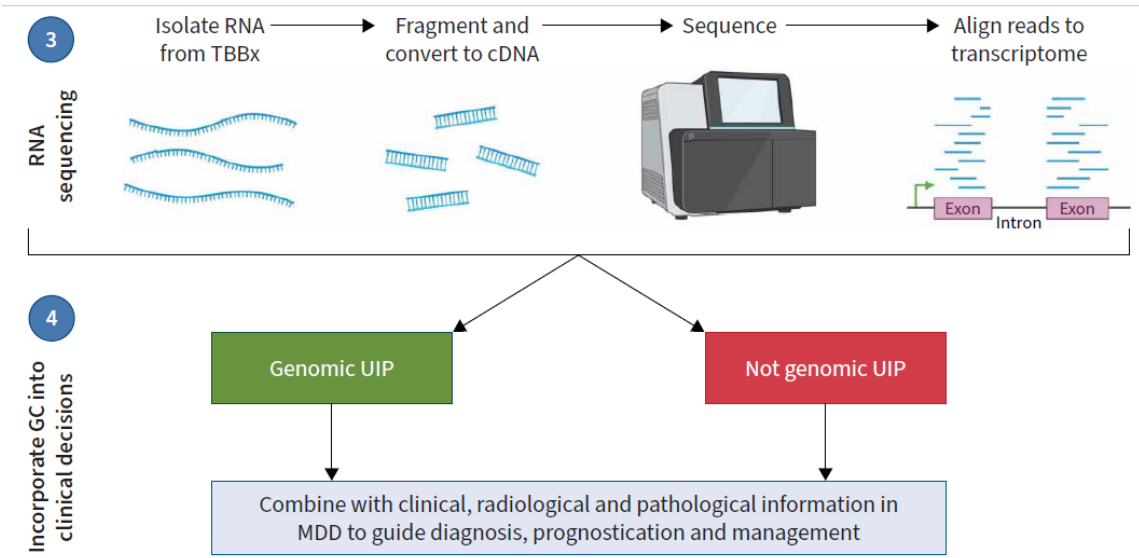



EUROPEAN RESPIRATORY JOURNAL
EDITORIAL
G.C. GOOBIE AND S.A. GULER

# The alternative approach: genomic classifiers for prognostication in interstitial lung disease

Gillian C. Goobie [1,2,3] and Sabina A. Guler [4,5]

[1]Division of Respiratory Medicine, Department of Medicine, University of British Columbia, Vancouver, BC, Canada. [2]Centre for Heart Lung Innovation, St. Paul's Hospital, Providence Healthcare, University of British Columbia, Vancouver, BC, Canada. [3]Division of Pulmonary, Allergy and Critical Care Medicine, Department of Medicine, University of Pittsburgh, Pittsburgh, PA, USA. [4]Department of Pulmonary Medicine, Inselspital, Bern University Hospital, University of Bern, Bern, Switzerland. [5]Department of BioMedical Research, University of Bern, Bern, Switzerland.



# Interstitial lung disease (ILD): the journey from behind the microscope to the artificial intelligence platform

- The diagnosis of interstitial lung diseases (ILDs) can be straightforward for some experienced experts without biopsy data, but not so straightforward to others.

**Prognostic impact of typical and probable usual interstitial pneumonia pattern in idiopathic pulmonary fibrosis: is the debate about biopsy a *Star Wars* saga?**

Martin Kolb [1], Ganesh Raghu[2] and Athol Wells[3]

# AI in Interstitial Lung Diseases

- In every operation and while performing any task, a law of service is the trigger behind every step along the way; satisfaction of the “customer” is fundamental for any success.
- The Department of Pathology and Laboratory Medicine at the American University of Beirut Medical Center has well established core values inspired by the Vision and Mission of the Department and aligned with the strategy, Vision and Mission of the American University of Beirut.

# What is the prognosis?

## Distinguishing UIP from the other interstitial pneumonias?

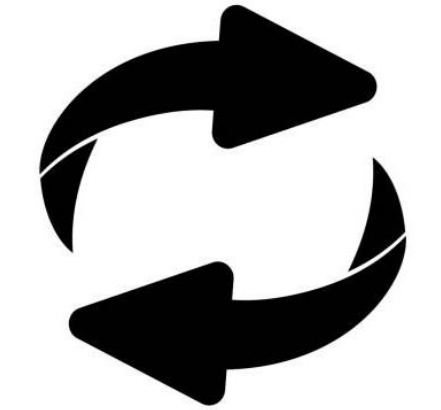
AI

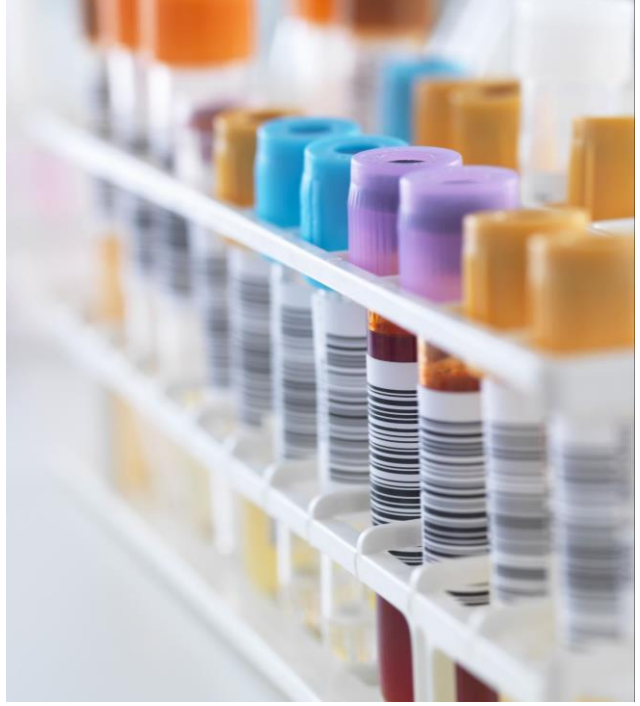
Questions

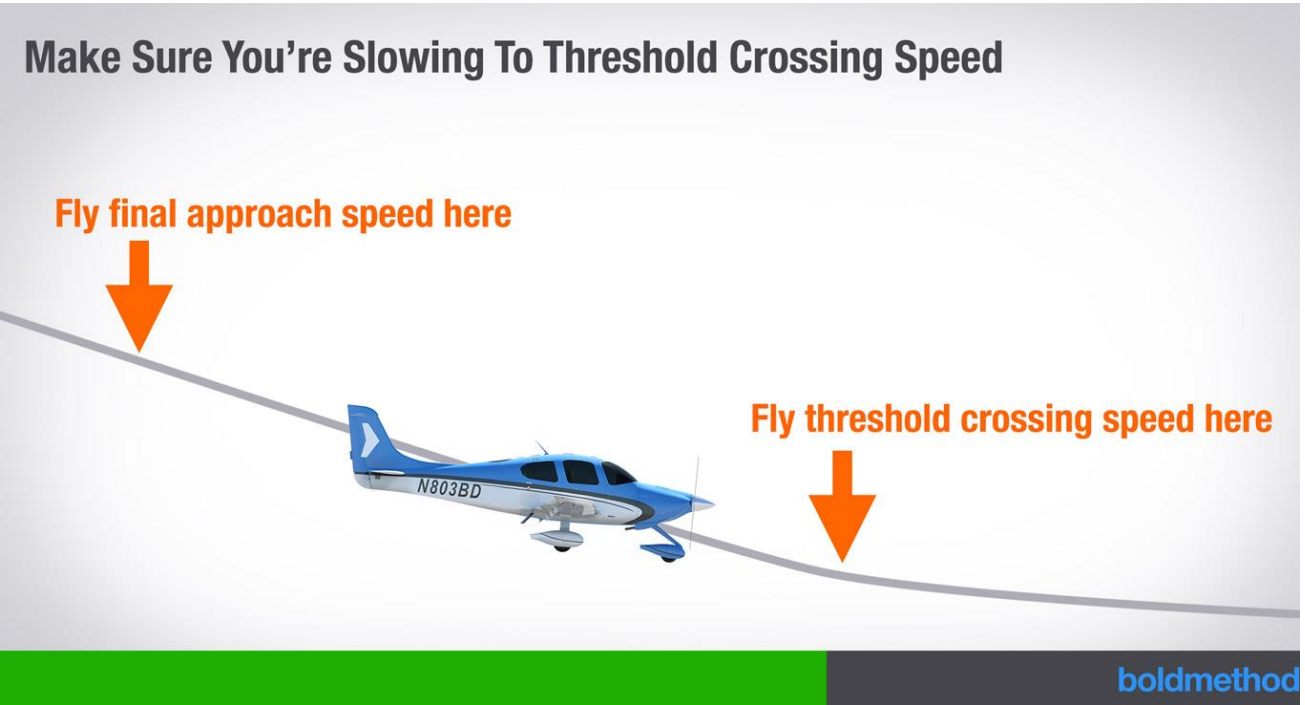
Know the questions for which we want to have answers

Want to help the clinician in treating patients with Interstitial Lung Diseases

? Diagnosis ? Issues






# Implementation of AI in **Interstitial Lung Diseases**

- Establishing a comprehensive and definitive diagnosis on the biopsy may be difficult.
- Stick to a binary classification :
  - Active
  - Chronic

- **Aim:** to build a machine learning powered model **(MLM)** that classifies an interstitial lung disease case as **Chronic** or **Active**.
- The model would rely on the following:

# LUNG PATHOLOGY

Recognize the categories of interstitial lung attributes that can be identified on the biopsy.

**Biopsy:**

- **Fibrosis: Regional variation**

**nature- degree- mixture-peripheral- central-fibroblastic foci-**

- **Architectural derangement**

**Scarring-honeycomb**

-

-

# Building the data model

- Identifying the **attributes** that we are going to use to train the MLM
- On a first phase we will label/annotate the data **manually**
- Is the MLM **concordant** with the pathologist diagnosis?
- If the **accuracy** of the MLM prediction is **high** →
- We will proceed in developing the different image recognition components that allow us to obtain the data **robotically** from images at a later stage: Convolutional Neural Network (CNN).

# Building the data model

System that allows us to prioritize based on the most active category

# Active vs. Chronic

| ACTIVE | CHRONIC |
| --- | --- |
| Uniformity of fibrosis | Patchwork |
| Inflammation | Absence of inflammation |
| Macrophages in lumen airways | Fibroblastic foci |
| Elastosis of pleura | Intact pleura |
| Lamellar eosinophilic thickening | Honeycomb |
| May be seen in active and in chronic status of Interstitial lung Diseases | |
| Overlapping and combined features ! | |

# Interstitial lung disease (ILD): the journey from behind the microscope to the artificial intelligence platform

- We need to look at AI not as a more intelligent competitor that is aimed at replacing human input, but as a buddy to reduce our workload and guide us in challenging clinical scenarios. Humane touch of a doctor, an integral part of medicine, goes a long way in treating a patient that cannot be replaced by machines.

Editorial

## Artificial intelligence in the practice of pulmonology: The future is now

*Nishant Kumar Chauhan[1], Shahir Asfahan[2], Naveen Dutt[1], Ram Niwas Jalandra[1]*

*[1]Department of Pulmonary Medicine, All India Institute of Medical Sciences, Jodhpur, Rajasthan, India, [2]Nference, Bengaluru, India*
*E-mail: nishant97@gmail.com*

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**Published:** 28-Dec-2021


**"I've narrowed the diagnosis down to 16 possibilities."**

AI

- SI: An entity that surpasses humans in overall intelligence. A speed superintelligence could do everything a human mind could do, but much faster. Apr 13, 2023