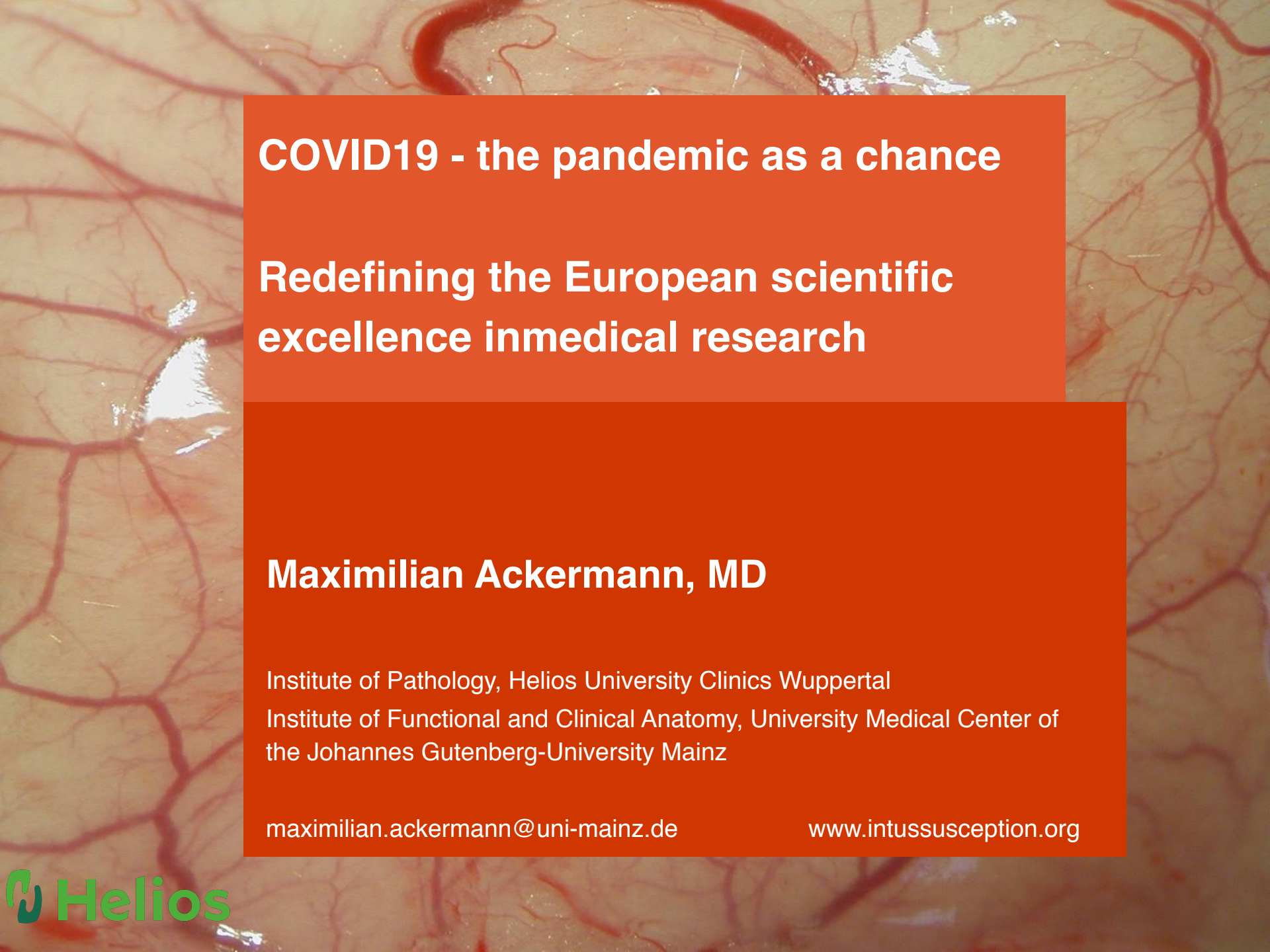




COVID19 - the pandemic as a chance

Redefining the European scientific excellence in medical research

Maximilian Ackermann, MD

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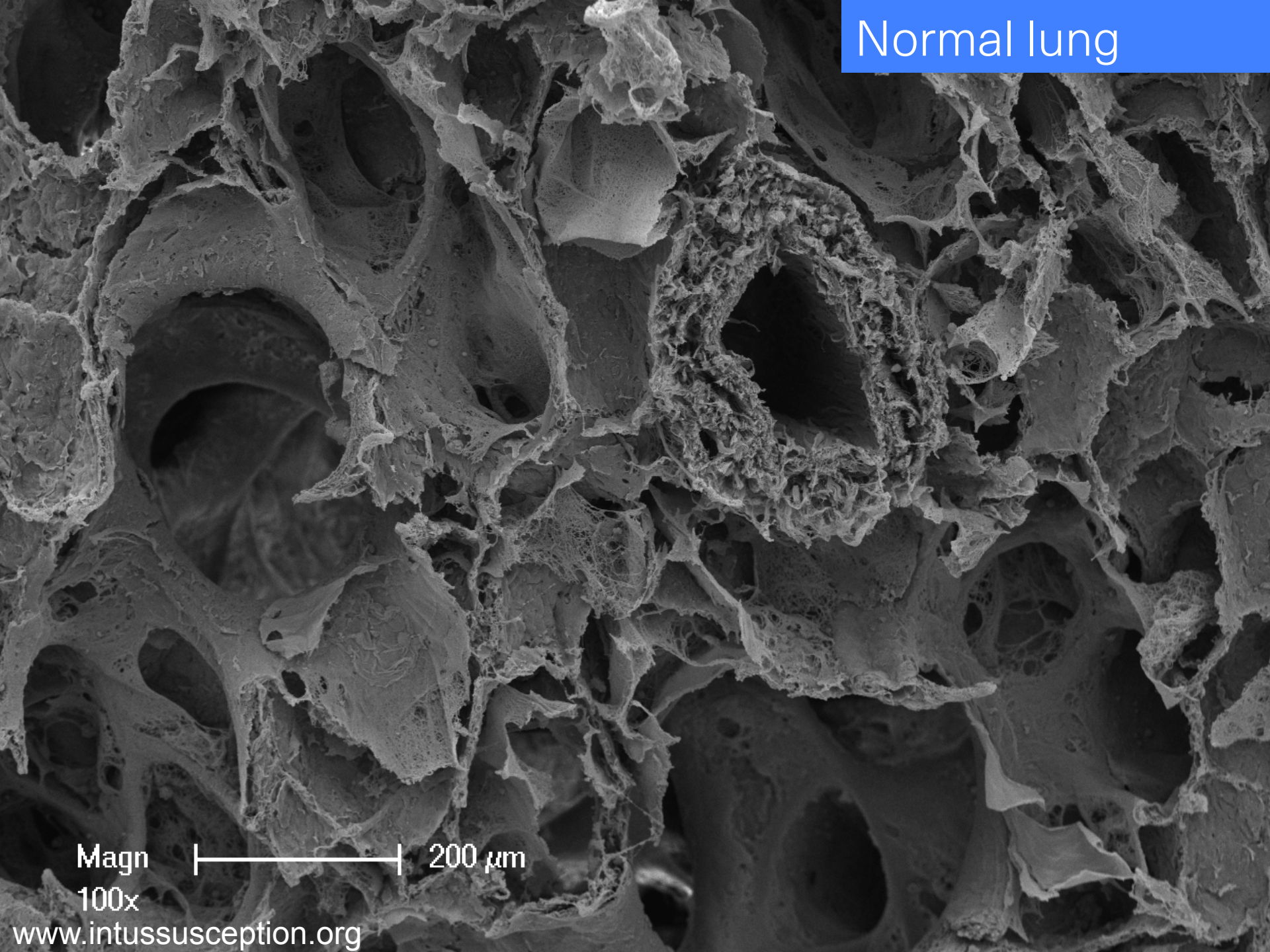
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Ackermann M, Verleden SE, Kuehnel M, et al. Pulmonary Vascular Endothelialitis, Thrombosis, and Angiogenesis in Covid-19. *N Engl J Med*. 2020;383(2):120-128.

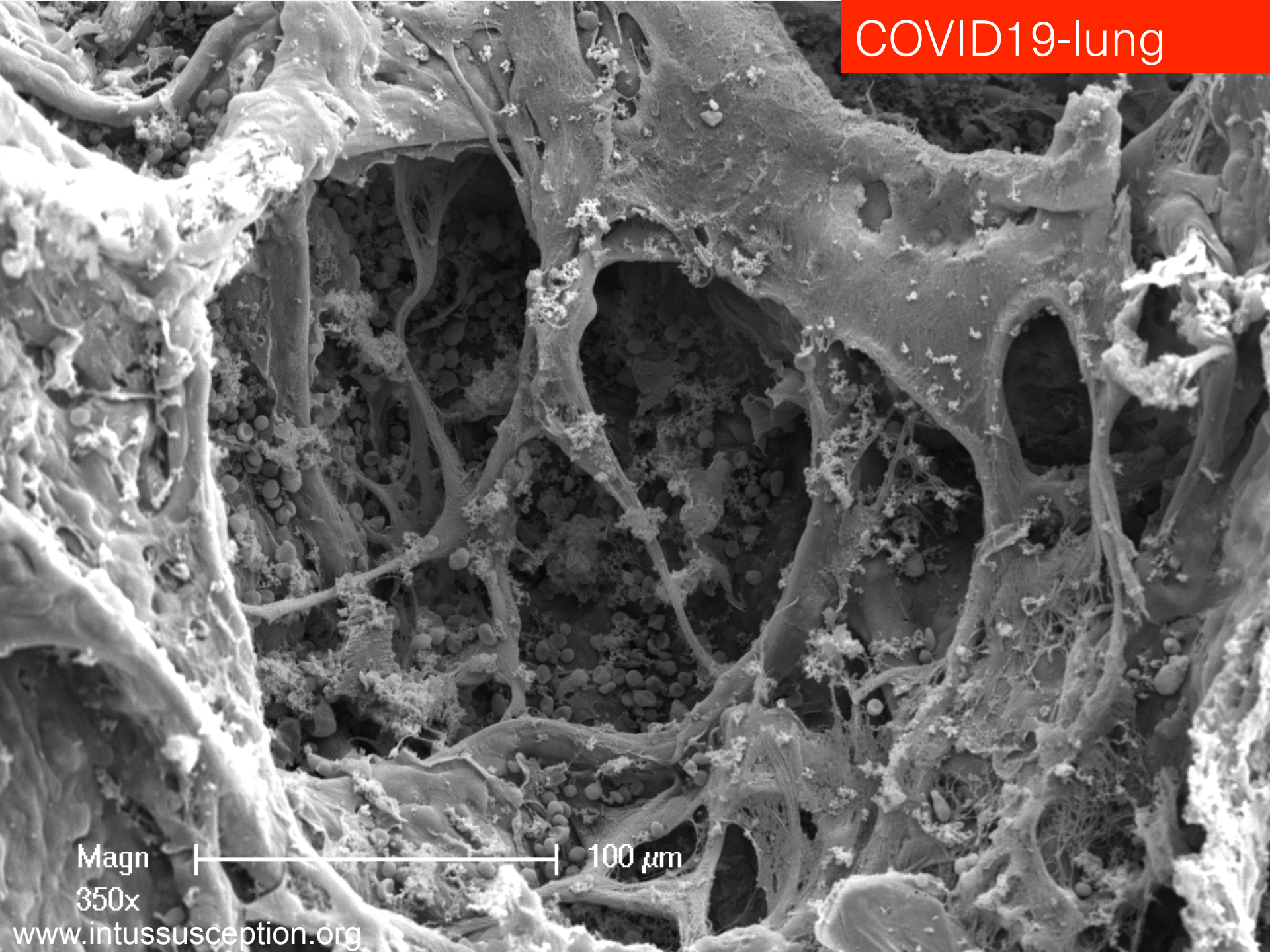
Normal lung



Magn |-----| 200 μ m

100x

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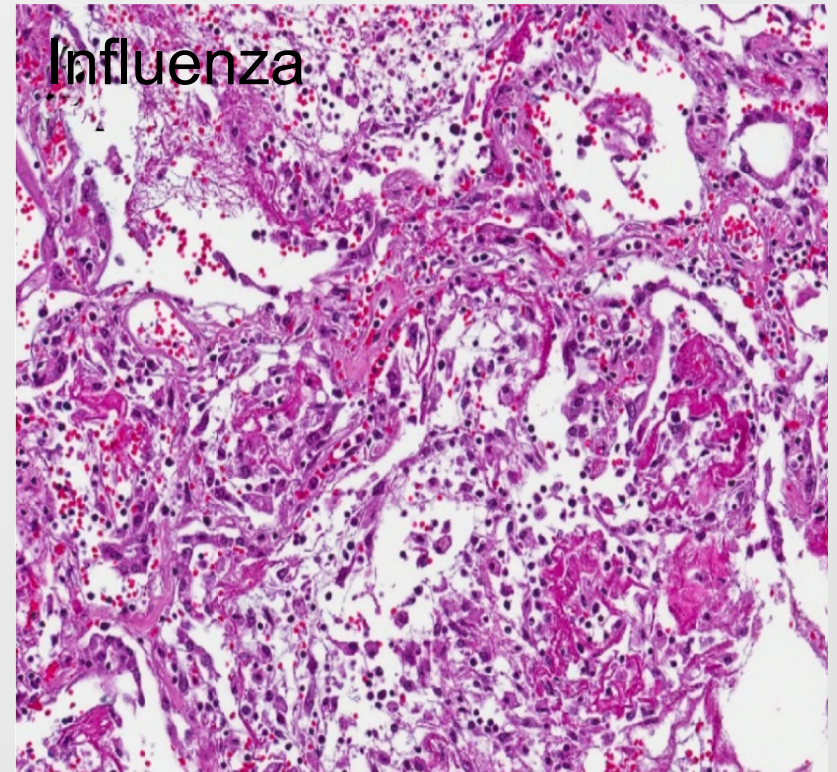
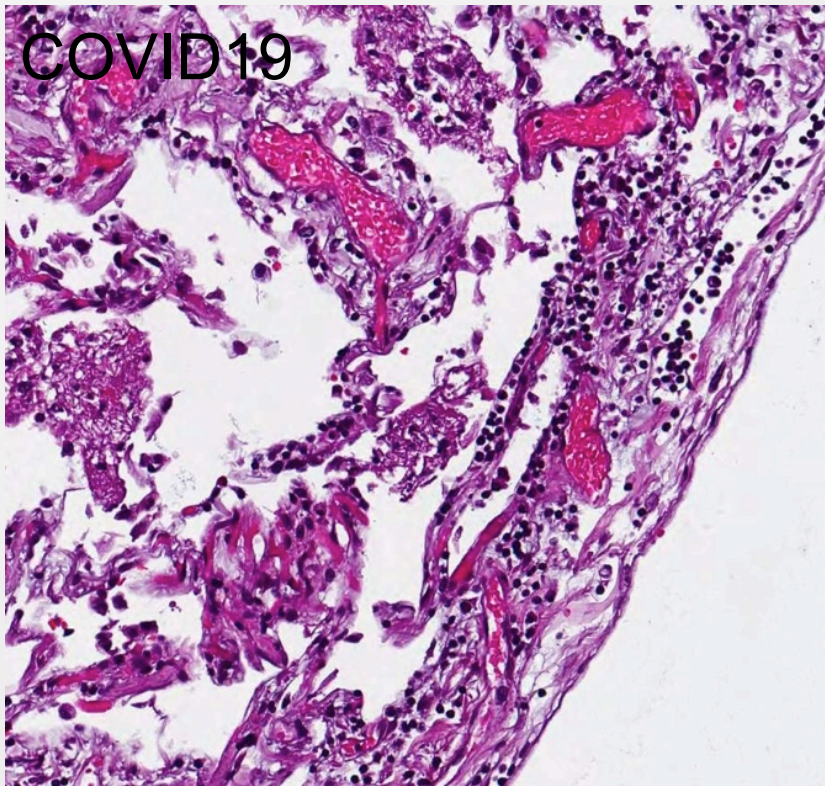


Magn

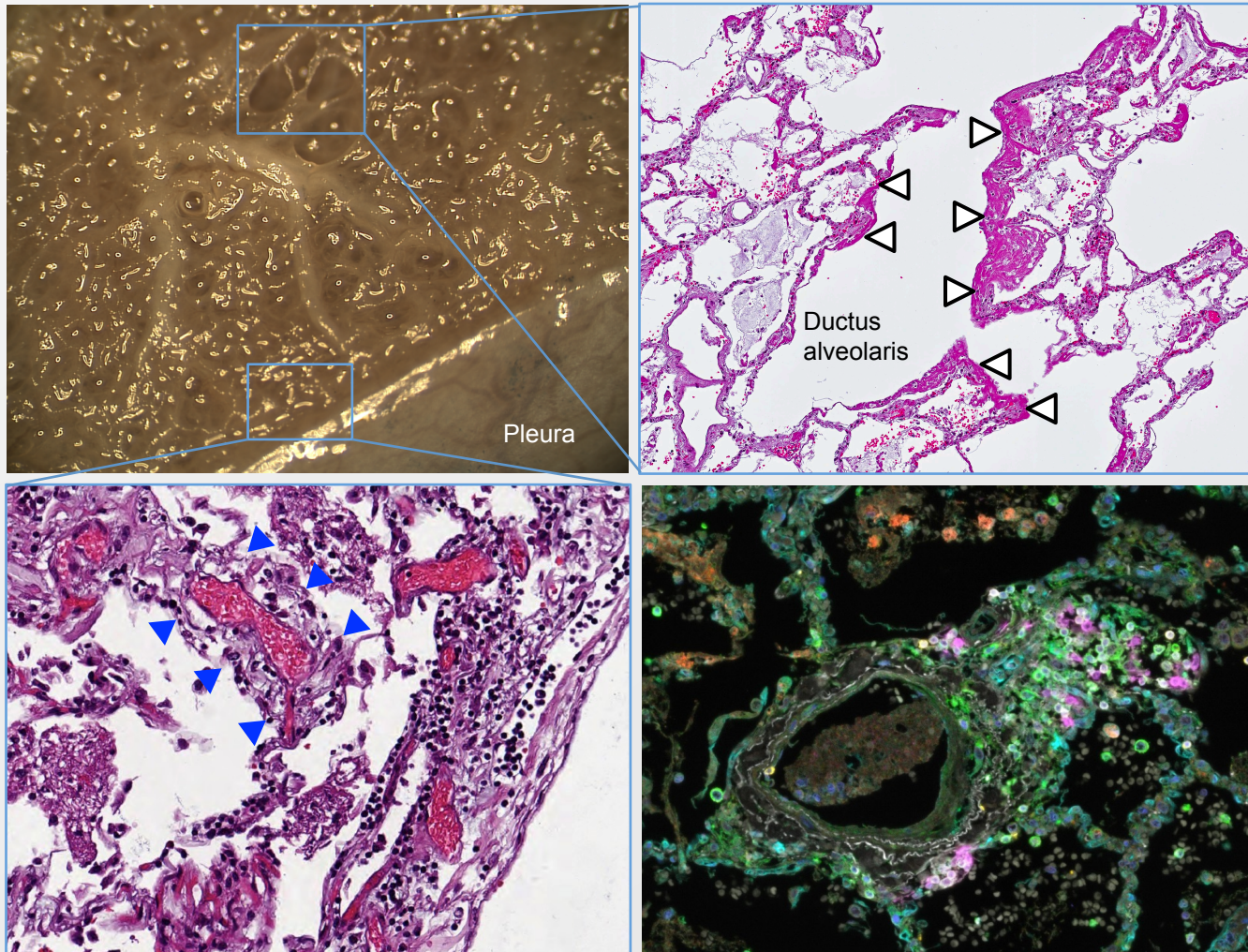
350x

100 μ m

ARDS in Covid19 & Influenza

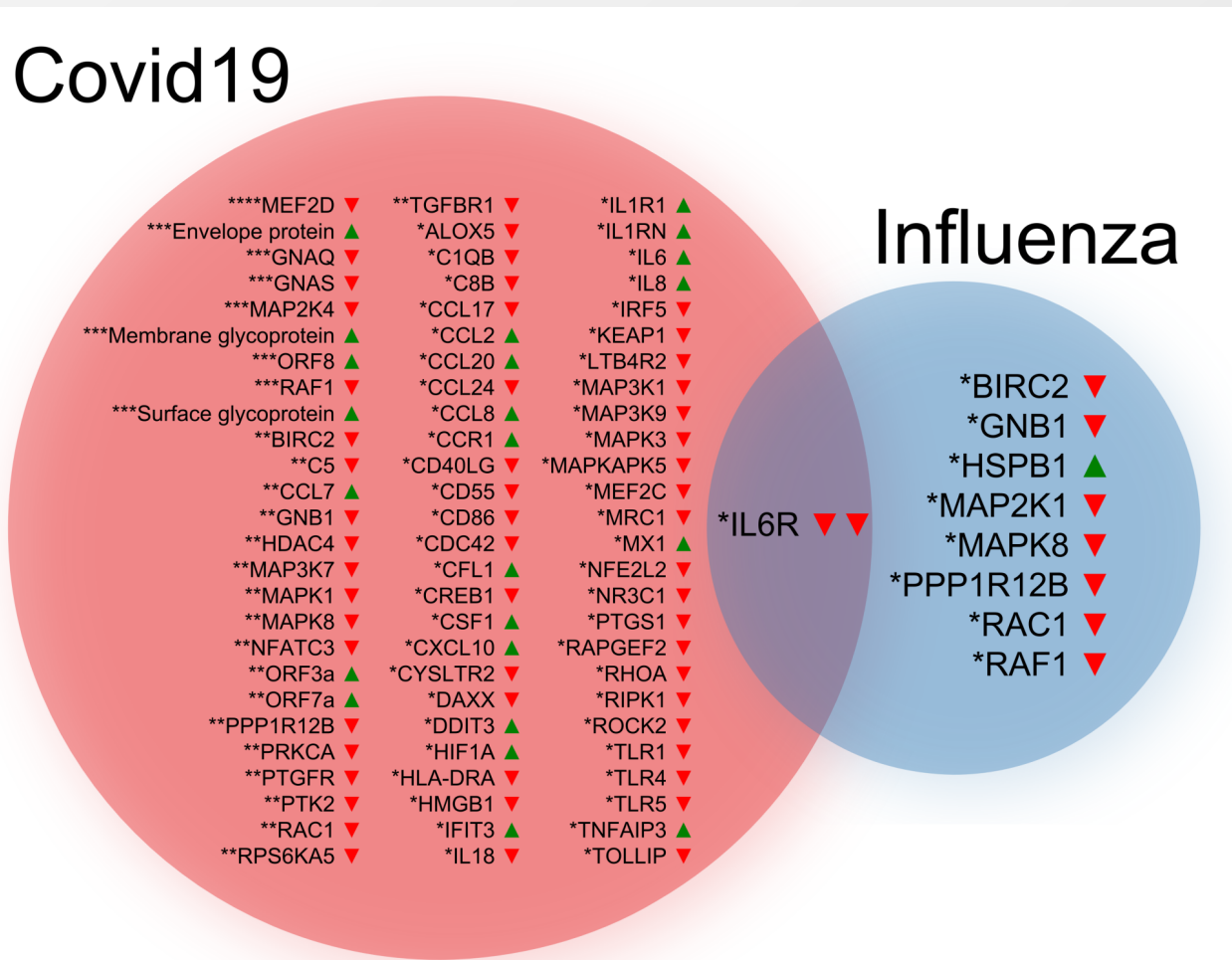


Perivascular T-cell-inflammation



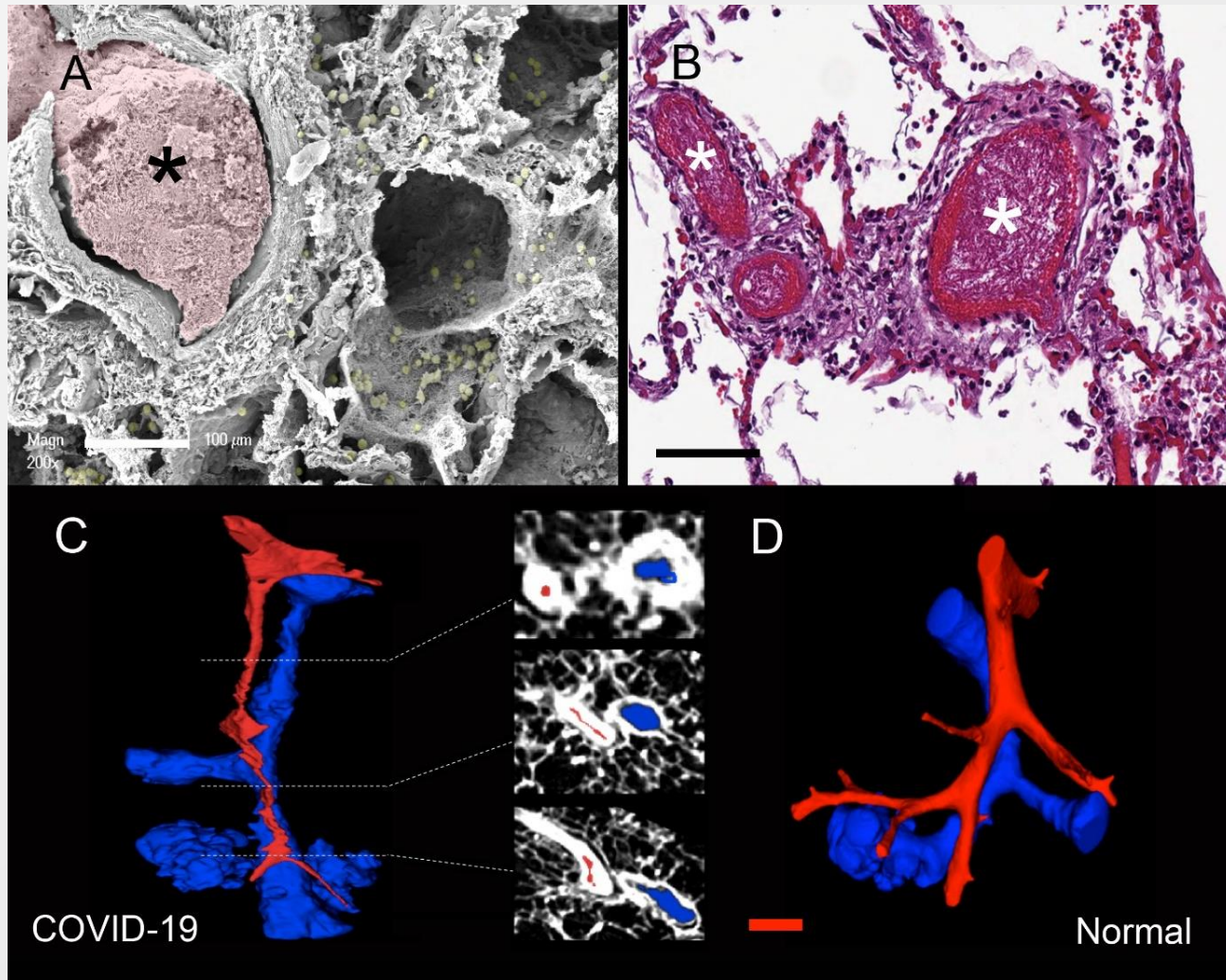
Ackermann M, Verleden SE, Kuehnel M, et al. Pulmonary Vascular Endothelialitis, Thrombosis, and Angiogenesis in Covid-19. *N Engl J Med*. 2020;383(2):120-128.

Molecular differences in inflammation



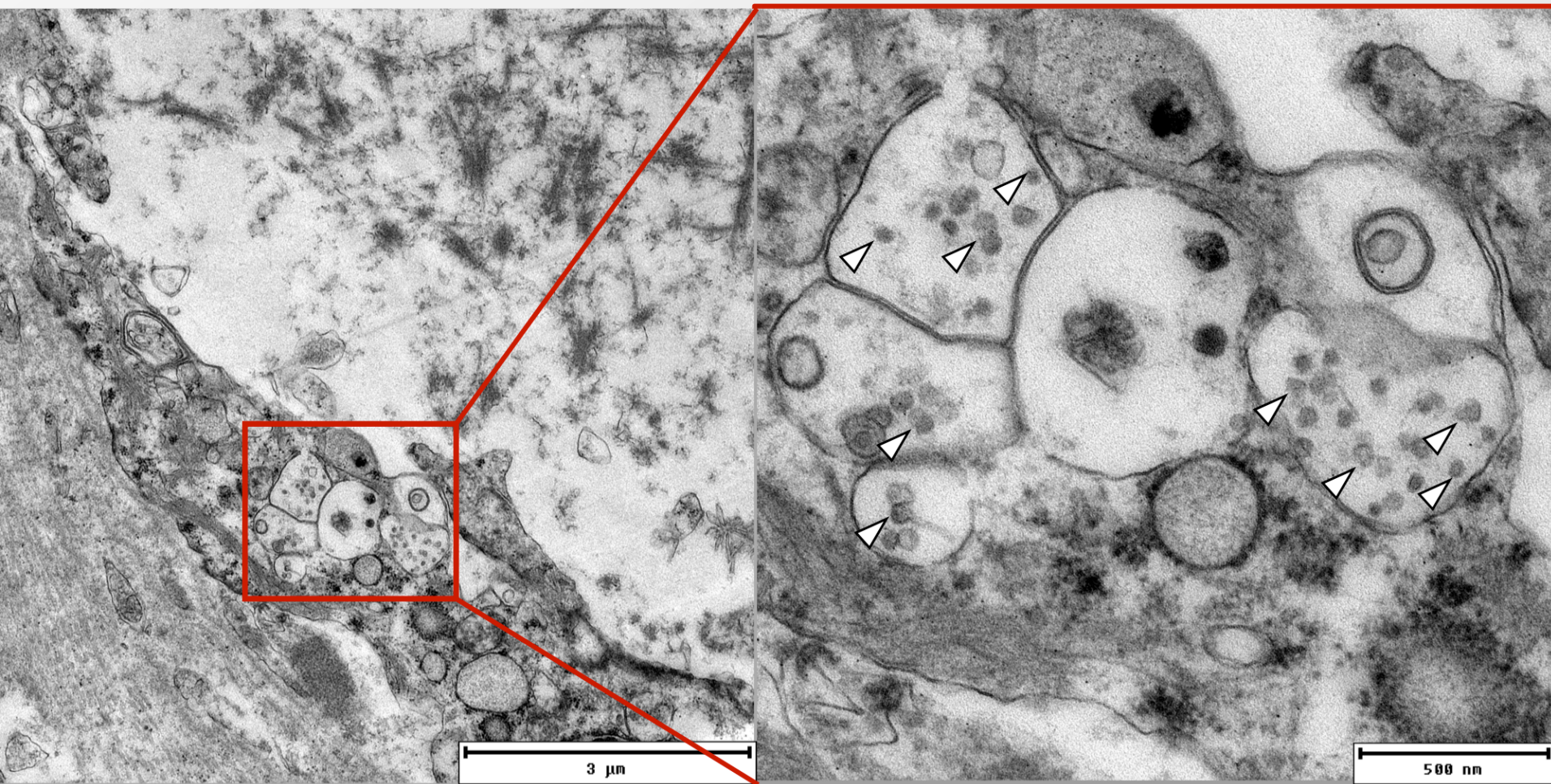
Ackermann M, Verleden SE, Kuehnel M, et al. Pulmonary Vascular Endothelialitis, Thrombosis, and Angiogenesis in Covid-19. *N Engl J Med*. 2020;383(2):120-128.

Thrombosis and microangiopathy



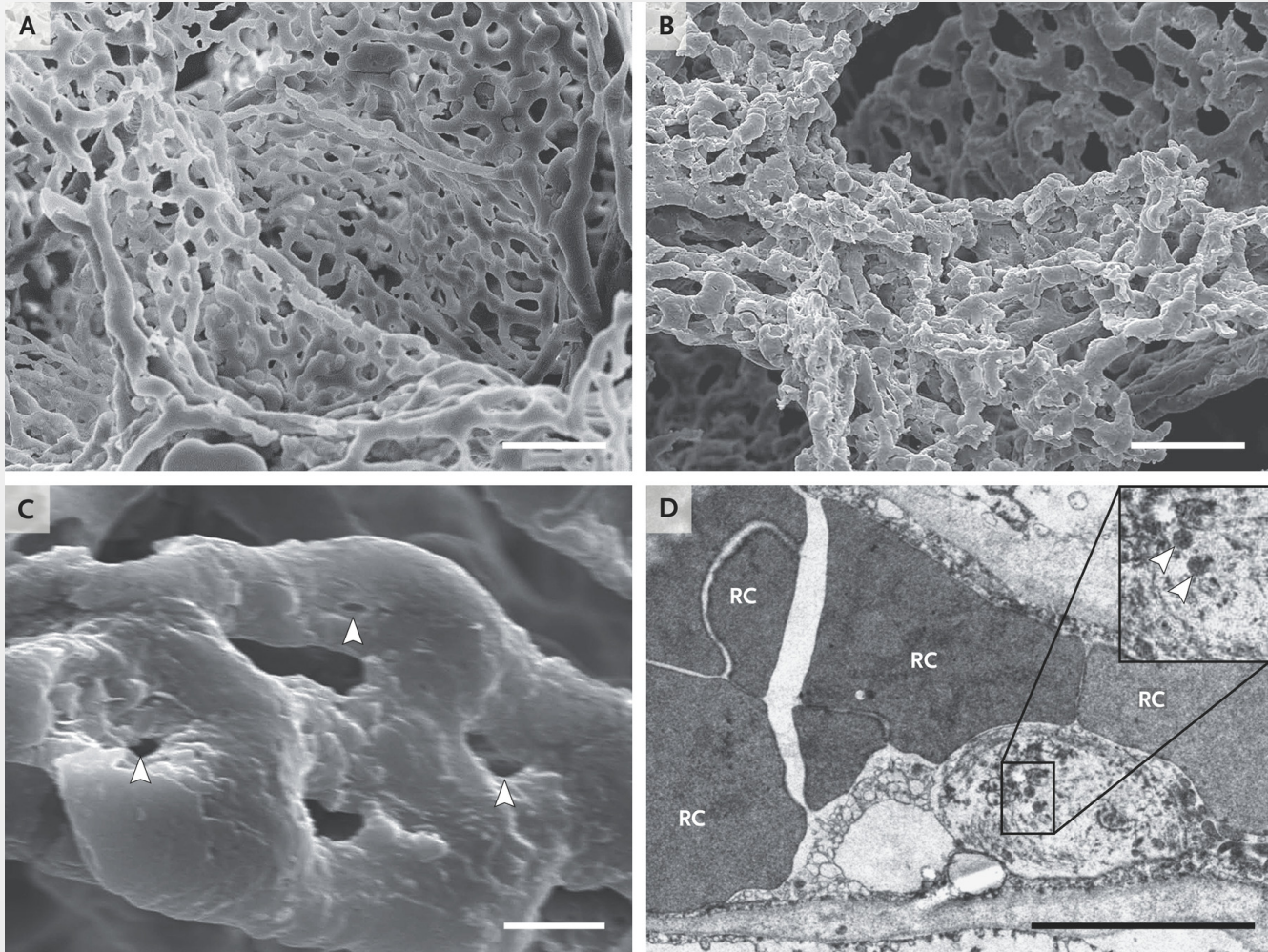
Ackermann M, Verleden SE, Kuehnel M, et al. Pulmonary Vascular Endothelialitis, Thrombosis, and Angiogenesis in Covid-19. *N Engl J Med*. 2020;383(2):120-128.

SARS-CoV-2 in endothelial cells

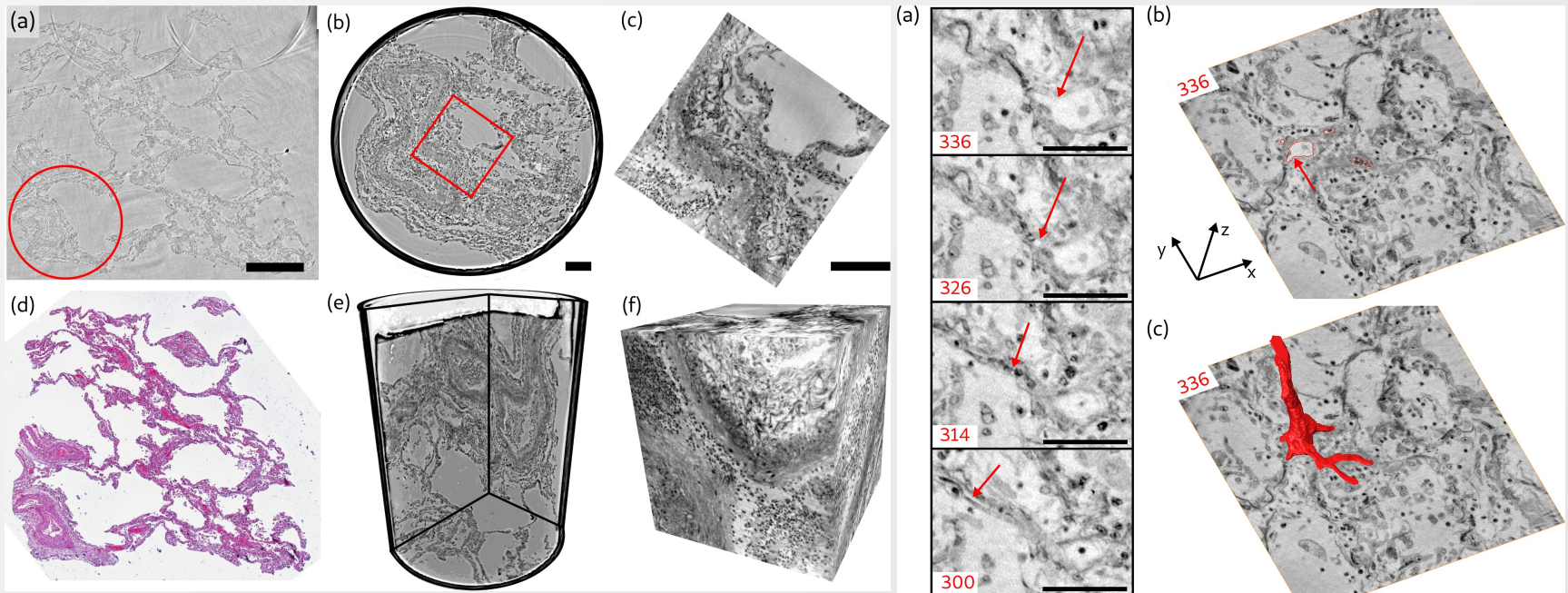


Ackermann M, Mentzer SJ, Jonigk D. Pulmonary Vascular Pathology in Covid-19. 2020 Jul 17]. *N Engl J Med*. 2020;383:10.1056/NEJMc2022068#sa4.

Intussusceptive angiogenesis

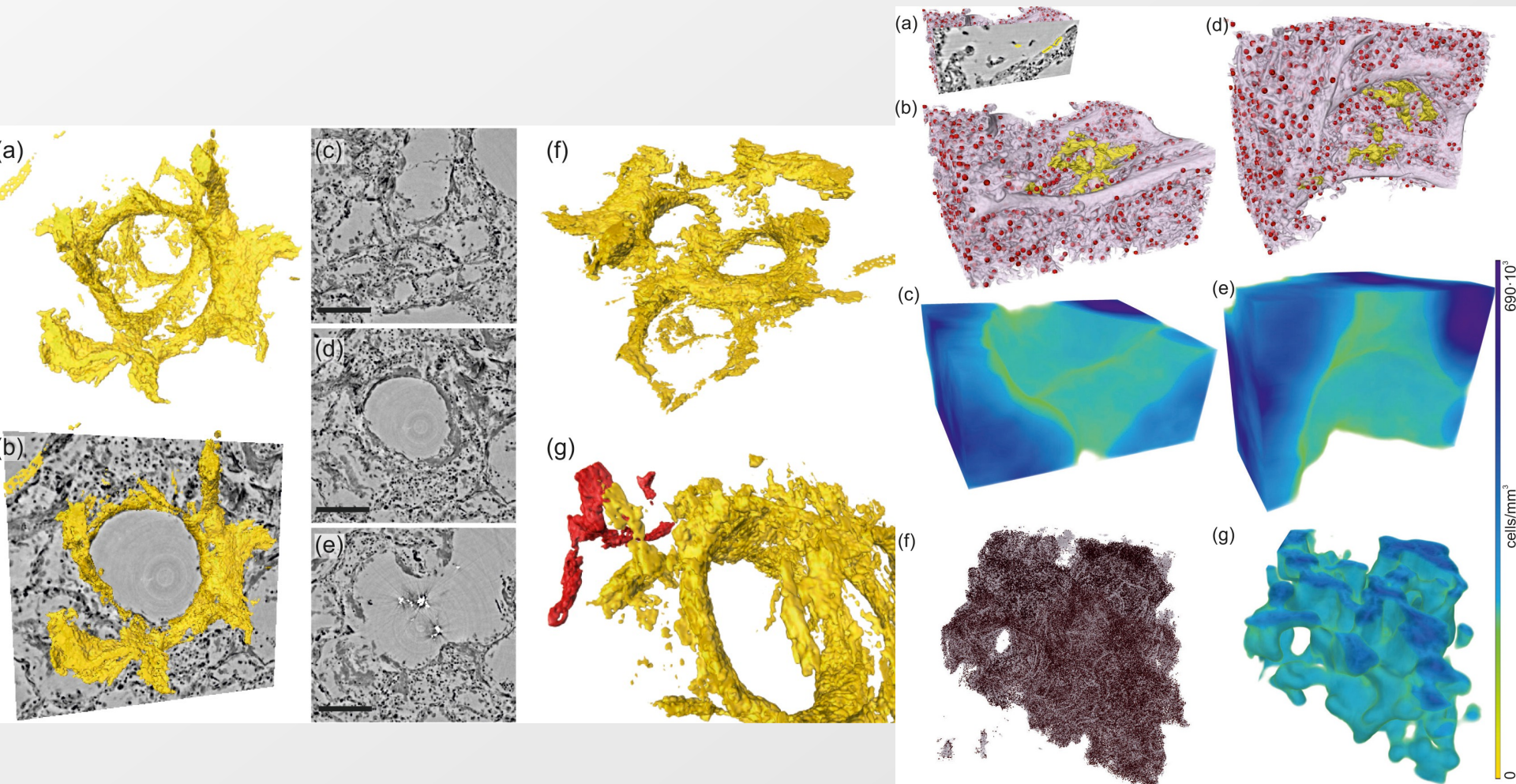


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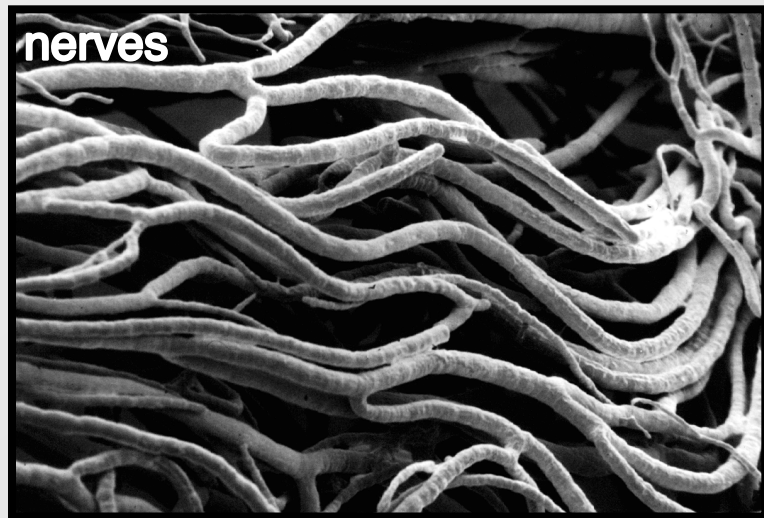
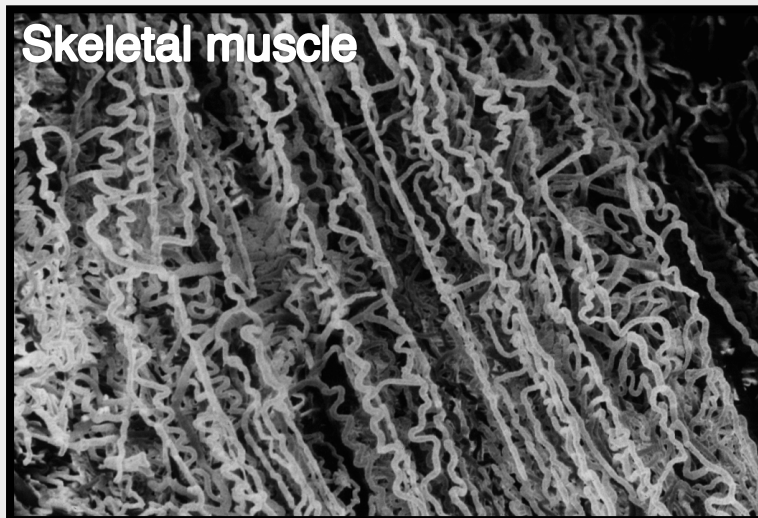
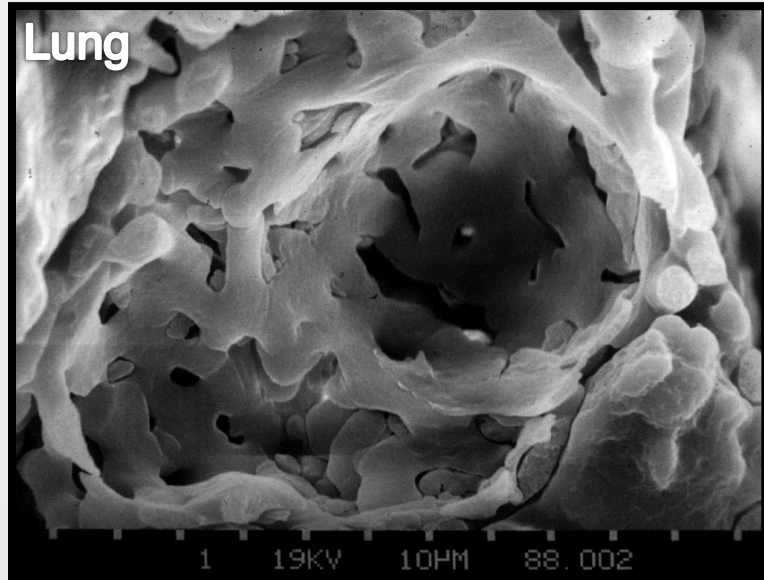
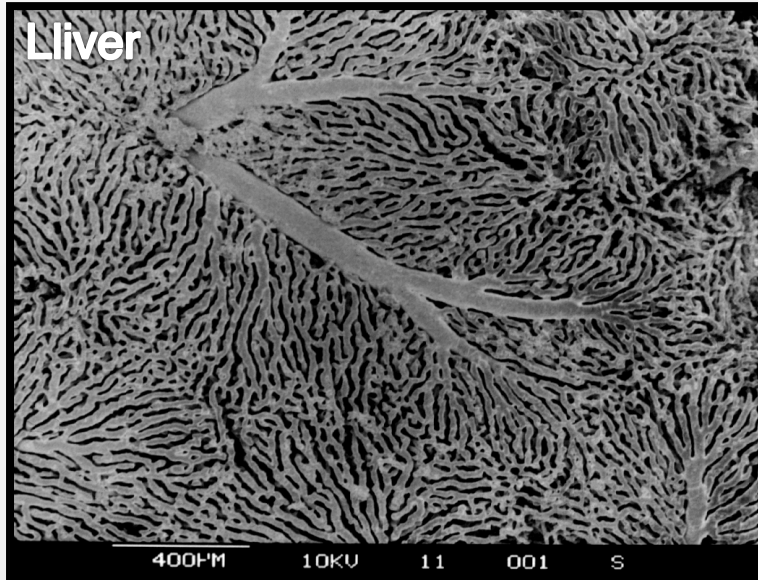
M. Eckermann, J.Frohn, M. Reichardt, M. Osterhoff, M. Sprung, F. Westermeier, A. Tzankov, C. Werlein, M. Kühnel, D. Jonigk, T. Salditt et al. 3d Virtual Patho-Histology of Lung Tissue from Covid-19 Patients based on Phase Contrast X-ray Tomography. eLife (2020).

3D virtual histopathology



M . Eckermann, J.Frohn, M. Reichardt, M. Osterhoff, M. Sprung, F. Westermeier, A. Tzankov, C. Werlein, M. Kühnel, D. Jonigk, T. Salditt et al. 3d Virtual Patho-Histology of Lung Tissue from Covid-19 Patients based on Phase Contrast X-ray Tomography. eLife (2020).

Form follows function



The Human Organ Project

The Human Organ Project:
Tracking Changes in
Covid-19 Infected Whole Organs
from Anatomy to 3D Histology



UCL: **Peter D. Lee, Claire Walsh**, Simon Walker-Samuel, Joe Jacob, Rebecca Shipley

Hannover/Mainz: **Danny D. Jonigk, Max Ackermann**, Willi Wagner (Heidelberg), Mark Kuehnel, Christopher Werlein

ESRF: **Paul Tafforeau**,

DLS: Andy Bodey, Robert Atwood,

LADAF: Alexandre Bellier, and many other contributors

What are we doing?

Utilising the €150M ESRF-EBS upgrade to achieve cellular resolution tomography in low attenuation contrast materials, enabling:

- *Human organs*: Multi-scale characterisation in health and disease, from anatomical features down to 3D histology with cellular (ca. 1 μm) resolution
 - Scanning intact organs (lung, heart, brain,...) from controls and Covid-19 victims to characterise disease progression (~30 organs, 15 to date)
- *Human lung biopsies*: Imaged >300 from Hannover Databank to advance our understanding of structure-function relationships in COVID-19 ARDS and over 20 other lung pathologies (ca. 1 μm)

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