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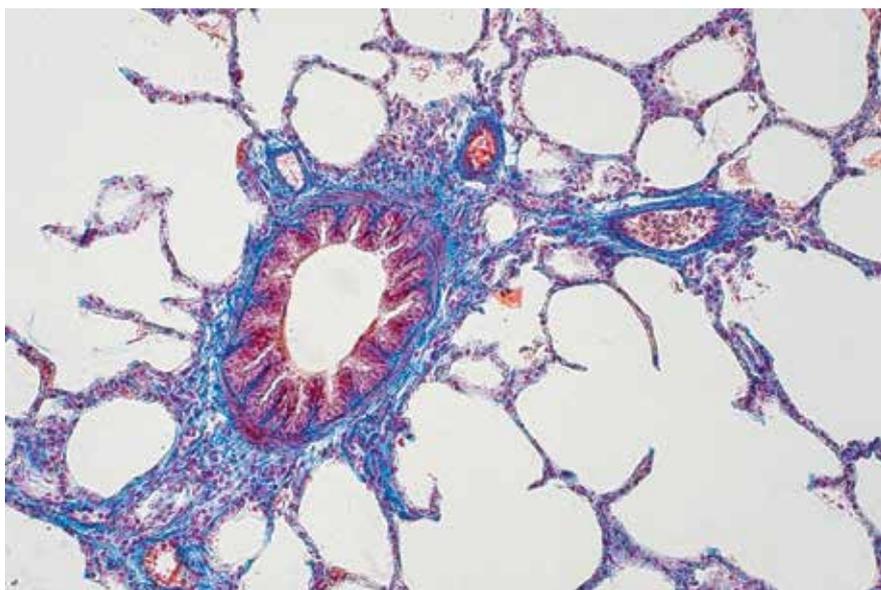
## First comprehensive lung cell map leads to new findings and implications for asthma

A team of researchers has created the first comprehensive cellular map of the lung for both healthy people and patients with asthma. The maps of “The Human Cell Atlas” reveal differences between normal and asthmatic airways and indicate how cells in the lung communicate with each other. In addition, the researchers discovered a new cell state that produces mucus in asthmatic patients. Understanding the cells and their signals may eventually lead to new drug targets for asthma treatment.

The research was conducted by the Wellcome Sanger Institute, University Medical Center Groningen, Open Targets, GSK and other collaborators. A team of 35 authors published their findings in *Nature Medicine*.

### Analyzing more than 36,000 cells

To study the cell types within the normal lungs and upper airways, the researchers used single cell technology to examine samples from 17 healthy people. They analyzed more than 36,000 individual cells from the nasal area and three different areas of the lung. The results enabled them to determine the genes that were active in each cell and identify the specific cell types. Next, the researchers detected the cell types and activities in lung samples from six asthmatic patients and compared them to cells from the normal lungs.



A microscopic view of the human lung (stock photo).

### A new mucus-producing cell state

“Clear differences” were found between cells in the normal and asthmatic lungs. Also, while overproduction of mucus is a recognized symptom of asthma, not all of the cells responsible for the condition have been known. The researchers found a new mucus-producing cell state—a “muco-ciliated state”—in the lungs of the asthmatic patients, which had not been observed to date.

“We have generated a detailed anatomical map of the respiratory airways, producing the first draft human lung cell atlas from both normal and asthmatic people. This has given us a better definition of the cell types in asthmatic lungs, and allowed us to discover

an entirely new cell state in asthmatic patients that produces mucus,” said the article’s first author, Felipe Vieira Braga, PhD, of the Wellcome Sanger Institute and Open Targets.

### Differences in cell types and communication

The findings showed that “cells in different areas of the lung have very different cellular activities.” The researchers also found major differences in the presence of various cells within normal versus asthmatic lungs and the ways cells communicate with each other. In normal lungs, a broad range of cell types are responsible for communication. However, the asthmatic lungs had many more inflammatory type 2 helper T ( $T_H2$ ) cells, which sent the vast majority of cellular signals.

“We already knew that inflammatory  $T_H2$  cells played a role in asthma, but only now do we see how great that influence is,” explained Martijn Nawijn, PhD, a senior author from University Medical Center Groningen. “In normal people, all kinds of cells communicate with each other in order to keep the airways functioning well. But in asthma patients, almost all of those interactions are lost. Instead of a network of interactions, in asthma the inflammatory cells seem to completely dominate the communication in the airways.”

## Implications for future asthma treatment

Multiple media sources indicated that, “knowing the types of cells in asthmatic lungs and how they communicate could help researchers seek new drug targets that could prevent the cells from responding to the inflammatory signals and help restore normal lung function.”

Senior author, Sarah Teichmann, PhD, of the Wellcome Sanger Institute, University of Cambridge and Open Targets, and co-chair of the Human Cell Atlas Organizing Committee, summarized by stating, “As part of the Human Cell Atlas initiative, we have created the first comprehensive cellular map of the lungs. Our large-scale, open access data reveals the activity of different cells, their communication pathways and locations. The lung cell atlas will provide a great resource for further lung research and we hope that it will enable the identification of potential new therapeutic targets for asthma relief.”

## Organizations

Open Targets is a pre-competitive partnership between pharmaceutical companies and not-for-profit research institutes. The partners are GSK, Biogen, Takeda, Celgene, Sanofi, the Wellcome Sanger Institute and the EMBL’s

European Bioinformatics Institute (EMBL-EBI).

The University Medical Center Groningen (UMCG) is an academic hospital in the Netherlands that hosts the medical faculty of the University of Groningen.

The Wellcome Sanger Institute is a genome and biodata institute.

Wellcome is a politically and financially independent foundation.

## References

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