

# A HEALTHY ENVIRONMENT

In Life Sciences and  
Pharmaceuticals,  
It's the Key to Success

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With 1,000 miles of airways, 60,000 miles of blood vessels, and 100 trillion cells<sup>1</sup>, the human body is often referred to as the world's most complex machine. So it's no surprise that industries such as pharmaceuticals and life sciences, devoted to keeping that machine in good working order, require a complex and highly exacting set of operating environments.

Manufacturers in these fields turn to environmental control partners such as Air Innovations for help in maintaining the tight tolerances demanded in their specialized and closely regulated businesses.



## SMALL FLUCTUATIONS, BIG WORRIES

As you'd expect, most pharmaceutical and life sciences manufacturing takes place in large cleanrooms, also known as ballrooms, where maintaining air quality and sterile conditions is a must. But the real art of environmental control often takes place not throughout the room but deep inside the individual machines governing each phase of the manufacturing process.

The same holds true in semiconductors and other industries famous for extremely tight environmental requirements. Yet while semiconductor manufacturers obsess over *keeping contaminants off ever-tinier nano-sized microchips*, what keeps pharmaceutical companies up at night are minute fluctuations in moisture or temperature. Variations far too slight to be detected by human senses could be more than enough to destroy life-saving medicines or cause intricate diagnostic systems to misread vital data.

## FINDING THE PERFECT FIT

Serving these industries requires close collaboration and partnership, a deep understanding of specific needs, and the commitment to strategize, plan, design, and build environmental systems as precise as the processes they support.

Because of the varied and highly specialized requirements in the *life sciences and pharmaceutical industries*, off-the-shelf solutions don't work. The systems we design must be not just precise and reliable but also as invisible as possible, so as not to interfere with operations of existing equipment and workers. Sometimes the solution, like those famous Russian dolls, is a machine within a machine—a compact, self-contained environmental control unit fully enclosed within the manufacturer's equipment. In other cases, the unit may be located nearby or even below the floor level, with controlled air delivered through precision ductwork.

1. <http://www.nationalgeographic.com/science/health-and-human-body/human-body/>; <https://www.livescience.com/37009-human-body.html>



## CHALLENGE:

# Maintain precise humidity levels

Of all the potential impediments in pharmaceutical manufacturing, none may be more concerning than excess moisture. Consider the processes that go into creating the millions of over-the-counter and prescription tablets and capsules populating shelves at U.S. pharmacies. Virtually every phase can present moisture hazards.

During the milling process, excess moisture can cause powder to stick to the delicate grinding blades, making it harder to transmit precise amounts of medicine to the manufacturing phase. During compounding, moisture absorbed by hygroscopic powders can corrupt the proper reactions of different ingredients, potentially lessening their effectiveness or shelf life. And when powders are compressed into tablets and coated, moisture can lead to clumping or an uneven finish—potentially destroying entire batches of expensive medication. The dangers don't end when the manufacturing is complete. Imprecise humidity control during storage and packaging can degrade products.

## SPECIALIZED NEED

A pharmaceutical packaging company asked for help maintaining steady conditions for its fluid bed dryers—machines that use hot air or gas to suspend particles and dry them faster. In this case, the company needed absolute humidity control to ensure even coating of capsules, pills, and caplets.

## CUSTOMIZED SOLUTION

While relative humidity (the moisture in a given environment relative to a saturated environment) and dew point (the temperature at which air condenses into water) are both important considerations, dew point rules when exacting moisture controls are required. In this case, to maintain a precise dew point of 50°F, we created a custom unit capable of adding or removing humidity as needed. In other cases, where extreme dryness is required, we've built systems capable of delivering minus 60°C—meaning you would have to get to colder than minus 60 degrees to get water to condense out of the air.

## CHALLENGE:

# Create multiple environments in one

Think of how diagnostic processes have changed. In the old days, a lab technician would place a drop of blood on a slide, mix in a reagent, and wait to see how your blood reacted. That painstaking, labor-intensive process of measuring for one condition at a time has been replaced by modern diagnostic machines about the size of a large commercial photocopier. These systems might use a single blood sample to test for a hundred conditions. With this efficiency comes the need for precise and flexible controls to maintain the integrity of multiple powdered and fluid reagents. There's no room for error, since moisture or temperature problems at any stage of the process could lead to false diagnoses, with potentially serious consequences for patients' health.

## SPECIALIZED NEED

One company came to us needing to maintain absolute cold, dry conditions to protect various onboard reagents in FDA-approved machines delivered to customers around the world. Our solution needed absolute consistency, 24 hours a day, across a wide range of external temperature and humidity conditions. And to fit inside the diagnostic machine, our unit could be no larger than a small microwave oven.

## CUSTOMIZED SOLUTION

We developed a compact system containing two separate and independent cooling coils and process fans capable of maintaining subzero temperatures. Software and sensors built into the system monitor and automatically switch from one cooling coil to the next to enable the coils to be periodically defrosted with no service interruptions.



## AN ANSWER FOR EACH PROBLEM

Different processes along the health spectrum require different machines and different approaches. A design engineering company came to us for help in creating a medical environmental control system capable of maintaining less than 3 percent relative humidity and 75°F for biotherapy reagents. The reagents were sensitive to heat and humidity, both of which were introduced during the automated packaging process. To neutralize those effects, we created a system using a desiccant dryer and prefiltered air to maintain a stable environment, with ductwork to eliminate hot exhaust. In other cases, we may even be called upon to create explosion-proof systems to ensure that volatile solvents used in, say, coating pharmaceutical tablets never ignite.

Whatever the need, our emphasis is on precise planning, testing, and coordination. That's because none of our solutions, whether for life sciences and pharmaceuticals, semiconductors, aerospace, or any other industry, exist in a vacuum. Like an expert dance partner, the systems we create must work in perfect step with the machines they support—anticipating every move and never letting their partner down.

That takes plenty of practice and a commitment get it right each time. Technology is driving a revolution in healthcare, leading to better, less invasive treatments, longer life-spans, and a higher quality of life for millions of people. Maintaining pristine environments to support that revolution is no easy task, but being part of that spectacular revolution is a reward in itself.

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At Air Innovations, all of our equipment is custom designed for particular applications. Unlike other companies that build commercial off-the-shelf-type equipment, we create a solution that's tailored to your unique challenges. If you have an idea you would like to find an environmental control solution for, a challenging environmental control issue that's yet to be addressed, or a project coming up that requires specialty environmental control, we would like to talk to you before you write your specification or release an RFQ—we are climate control experts, after all.

So whether it's an environmental control application for aerospace, the military, a research lab, the pharmaceutical industry, or a medical device—or an out-of-the-box concept you'd like to explore—simply fill out our contact form at [airinnovations.com/contact-us](http://airinnovations.com/contact-us) or give us a call. We're looking forward to talking to you!

For more information about our life sciences and pharmaceutical projects or to learn more, visit us at: **[airinnovations.com](http://airinnovations.com)**

Or call:  
**800-825-3268 or 315-452-7400**

