

LAB REPORTER

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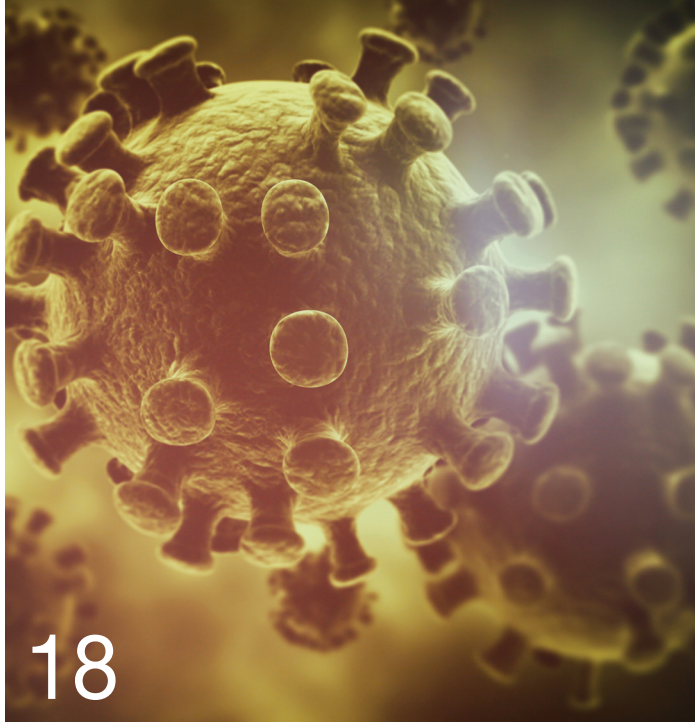
THE CONNECTION BETWEEN **BIRTH YEAR AND FLU RISK**

In This Issue: A New Source for Hydranal and Chromasolv,
Using Stem Cells to Fight Lung Disease, Cloaking Devices
for Faster Computing, Prevent Cell Culture Contamination

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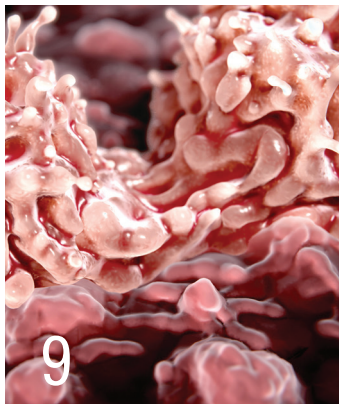
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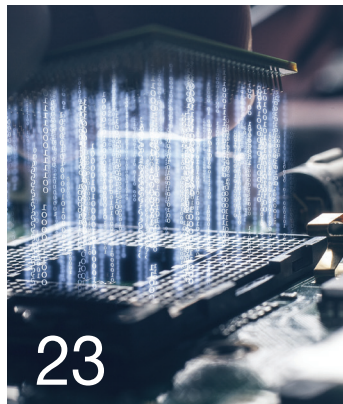
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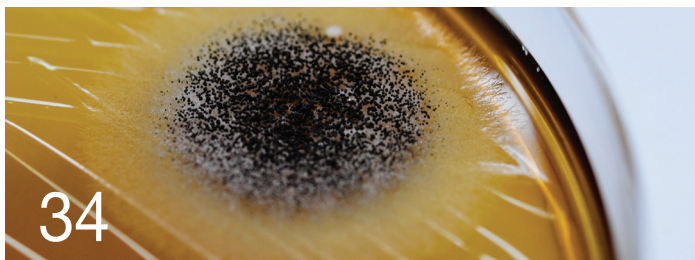
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HYDRANAL AND CHROMASOLV: Same Chemicals, New Supplier

By Mike Howie

When Johann Daniel Riedel created a series of pharmaceuticals in 1814, he didn't realize that his work would provide the foundation for Honeywell Research Chemicals, much less the chemicals industry as a whole. Since then, Honeywell has innovatively manufactured high-quality solvents and analytical reagents and earned ISO 9001 and ISO 14001 certifications for their reliability and environmental considerations. And now, Honeywell has expanded its portfolio to include premium research chemicals acquired from Sigma-Aldrich.

Same Results

The new offering includes Chromasolv High-Purity Solvents, Hydranal Reagents for Karl Fischer Titrations, TraceSELECT Inorganics for measuring trace and low-metal content, and the Fluka line of inorganic chemicals and reagents. Although these chemicals were formerly sold as Sigma-Aldrich products, Honeywell was, and will continue to be, their manufacturer. Users can have confidence in the world-class quality and lot-to-lot consistency that have always been associated with these brands.

These chemicals now join Honeywell's Riedel-de Haën line of high-purity solvents as well as its Burdick & Jackson line of solvents and DNA and RNA reagents. Together, these three chemical product

lines offer analytical and chemistry labs a broad range of solvents and essential reagents, all of which deliver the quality and consistency the industry expects from high-quality, premium chemicals.

The quality and reliability of Honeywell Research Chemicals stems from over 200 years of experience in the development and production of solvents and reagents. Honeywell produces the majority of its chemicals in advanced manufacturing facilities in Seelze, Germany and Muskegon, Michigan, USA, ensuring that every lot of every product meets exacting quality standards.

More Choice

The acquired business is now part of Honeywell Fine Chemicals, which has supplied high-quality research chemicals and specialty organic and inorganic compounds to the chemical and pharmaceutical industries for more than 100 years. The core leadership of the acquired business will be maintained, as will its approximately 200 current employees most of whom are located in Seelze, Germany. The expanded business unit will develop and manufacture high-purity research chemicals and other materials used in new drug discovery, medical diagnostic testing and other laboratory applications.

Fisher Scientific is proud to work with Honeywell to offer these products as part of its industry-leading selection of chemicals. Turn to page 5 to browse Honeywell Research Chemicals, or visit fishersci.com/HoneywellChemicals to learn more. If you have specific questions or need help placing an order, visit fishersci.com/ChemicalSpecialist to connect with a Fisher Scientific Chemical Specialist.

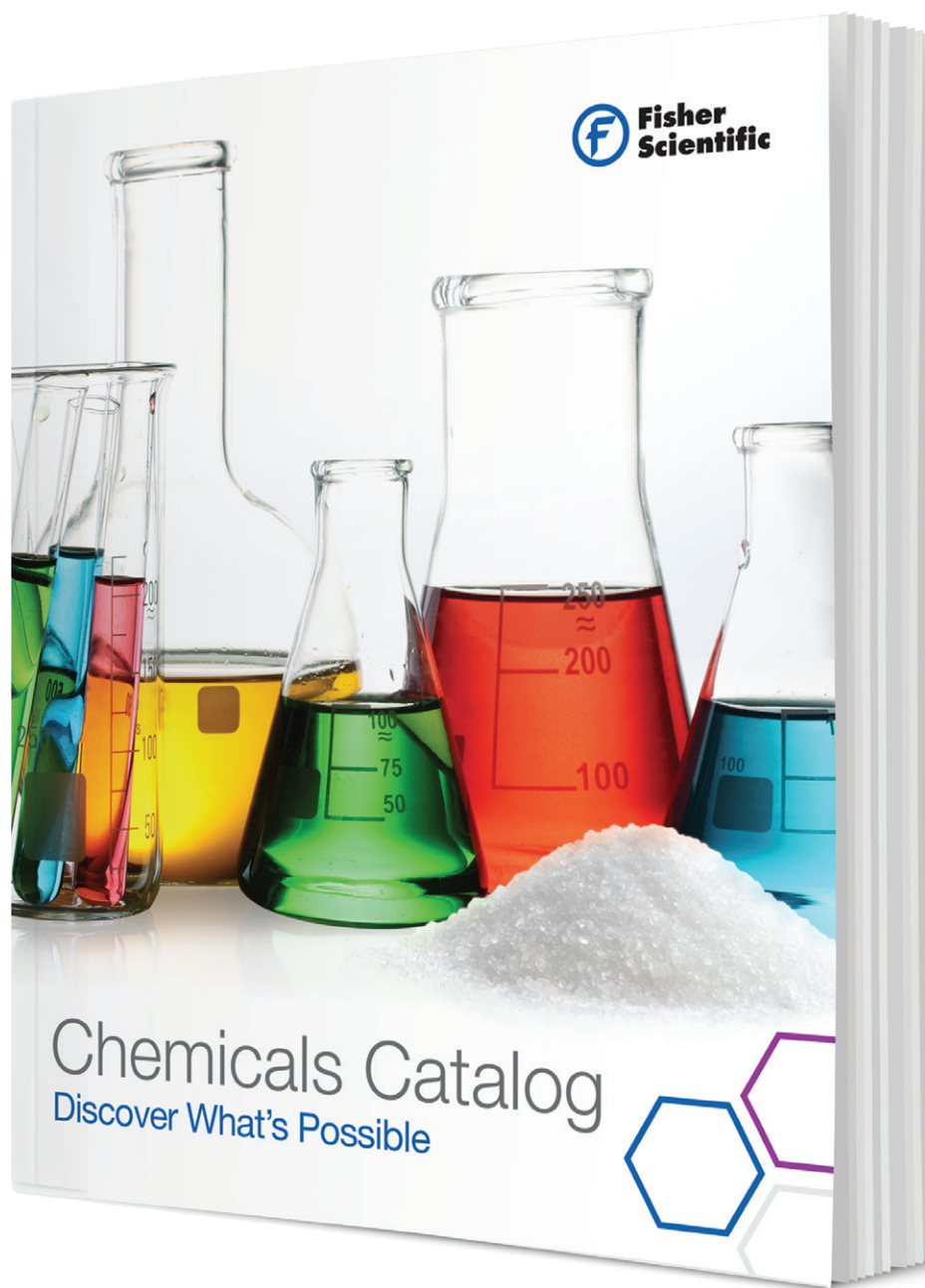
Honeywell Research Chemicals Product Lines

- Riedel-de Haën High-Purity Solvents for dedicated applications
 - Chromasolv Solvents
 - TraceSELECT Solvents
 - Spectroscopy Solvents
 - ACS and Pharmacopeia Grade
- Fluka Inorganic Chemicals and Reagents for analytical applications
 - Hydranal Reagents
 - TraceSELECT Inorganics
 - Analytical Inorganics
 - Standard Solutions
- Burdick & Jackson High-Purity Solvents and DNA/RNA Reagents
 - B&J Brand Multipurpose Solvents
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 - Anhydrous Solvents
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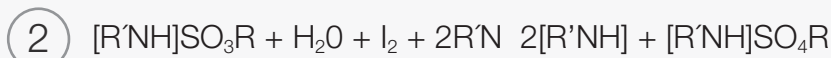
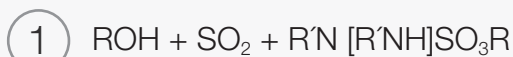
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QUICK AND ACCURATE MOISTURE DETERMINATION

Karl Fischer Reagents

German chemist Karl Fischer is credited with creating his namesake assay in 1935. Karl Fischer (KF) titrations can quickly and accurately determine the amount of water or moisture in a sample, based on a reaction that consumes water and iodine in a 1:1 stoichiometric ratio. The amount of iodine consumed in the reaction can be measured; that same amount is therefore equal to the amount of water in the sample.

The reaction occurs quantitatively and selectively with water, it is both accurate and precise (with very small standard deviations) and can be performed in one to three minutes.



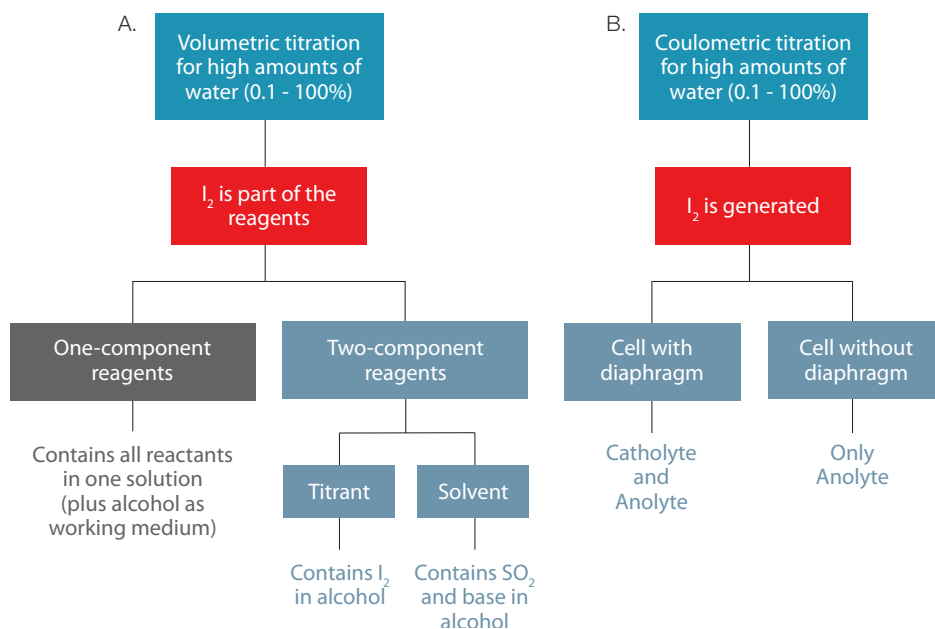
($\text{R}'\text{N}$ = base, ROH = alcohol, typically methanol)

There are two primary forms of KF titrations:

A. Volumetric assays are used for samples with higher water content (usually 1 to 100mg per sample). An iodine-containing solution serves as the titrating agent; the volume and titer of the agent is used to calculate the water content of the sample. Two types of reagents are used for the volumetric assay:

- One-component: All of the reactants (iodine, sulfur dioxide and a base) are combined in a suitable alcohol.
- Two-component: Reactants are separated to provide better stability of the titrating agent and increase the speed of the reaction.

B. Coulometry is a micro-method used for samples with lower water content (10µg to 10mg). In this method, the iodine is generated electrochemically in the titration vessel by oxidation of iodide in the reagents. A change in electrical charge is used to calculate the amount of water in the sample based on the consumption of iodide.



The choice of working medium and the pH range are two important factors that ensure an interference-free KF reaction. The working medium is the solvent or solvent mixture in which the sample is dissolved and the KF reaction occurs. Methanol is the preferred solvent for the working medium, but is often mixed with other solvents to increase the solubility of the sample or prevent interfering side reactions. Buffer solutions can be used to keep the pH of the mixture between 5 and 7, the optimal range for KF reactions.

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- Honeywell Performance Grade Solvents and Inorganics for general laboratory use

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Description	Cat. No.	Price (USD)	Description	Cat. No.	Price (USD)
GC Headspace Grade			LC/MS Optima Grade		
DMF, 6x1L	D133-1	\$648.45	Acetonitrile with 0.1% FA, 4x 4L	LS120-4	\$2,962.78
DMAC, 6x1L	D160-1	\$717.16	Acetonitrile with 0.1% TFA, 4x4L	LS121-4	\$2,027.29
DMSO, 6x1L	D139-1	\$712.81	Acetonitrile, 4x4L	A955-4	\$1,948.12
NMP, 6x1L	N140-1	\$2,291.90	Acetonitrile, 6x500mL	A955-500	\$688.24
Water, 6x1L	W10-1	\$180.60	Acetonitrile, 4x2.5L	A955-212	\$1,521.61
GC Resolv Grade			Methanol, 4x4L	A456-4	\$552.98
Acetone, 4x4L	A928-4	\$781.82	Methanol, 6x500mL	A456-500	\$319.64
Hexanes, 4x4L	H307-4	\$658.88	Methanol, 4x2.5L	A456-212	\$111.61
n-Hexane, 4x4L	H307-4	\$658.88	2-Propanol, 6x1L	A461-1	\$598.02
Methanol, 4x4L	A457-4	\$527.83	2-Propanol, 4x2.5L	A461-212	\$576.63
Methylene Chloride, 4x4L	D154-4	\$609.78	Water, 6x500mL	W6-500	\$242.35
HPLC Grade			Water, 4x2.5L	W6-212	\$528.54
Acetone, 4x4L	A949-4	\$720.25	Water, 4x4L	W6-4	\$640.28
Acetonitrile, 4x4L	A998-4	\$1,595.29	Water, with 0.1% FA, 4x4L	LS118-4	\$523.99
Alcohol, 4x4L	A995-4	\$529.92	Water, with 0.1% TFA, 4x4L	LS119-4	\$578.73
Chloroform, 4x4L	C606-4	\$398.68	Pesticide Grade		
Ethyl Acetate, 4x4L	E195-4	\$571.52	Acetone, 4x4L	A40-4	\$679.55
Heptane, 4x4L	H350-4	\$1,073.76	Acetonitrile, 4x 4L	A999-4	\$1,278.37
Hexanes, 4x4L	H302-4	\$542.21	Methanol, 4x4L	A450-4	\$469.25
Methanol, 4x4L	A452-4	\$363.87	Methylene Chloride, 4x4L	D142-4	\$715.95
Methylene Chloride, 4x4L	D143-4	\$478.49	UHPLC-MS Optima™ Grade		
2-Propanol, 4x4L	A451-4	\$470.20	Acetonitrile, 6x1L	A956-1	\$1,153.04
Tetrahydrofuran, 4x4L	T425-4	\$965.08	Methanol, 6x1L	A458-1	\$547.18
Toluene, 4x4L	T290-4	\$560.09	Water, 6x1L	W8-1	\$432.44
Water, 4x4L	W5-4	\$396.44			

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USING STEM CELLS TO FIGHT LUNG DISEASE

By Kevin Ritchart

Everything is easier in 3-D. That's the tack being taken by researchers from the Eli and Edythe Broad Center of Regenerative Medicine and Stem Cell Research at UCLA who have succeeded in creating three-dimensional lung organoids from stem cells.

These lab-grown tissues can be used to study lung diseases like idiopathic pulmonary fibrosis, which is difficult to do using conventional methods. Typically, scientists are forced to rely on two-dimensional cell cultures to study the effect of genetic mutations or drugs on lung cells. But the problem with taking a 2-D approach to the study of a disease like idiopathic pulmonary fibrosis is that flat cell cultures taken from people with the disease appear healthy rather than showing the scarring present in those who have the disease.

"Scientists have really not been able to model lung scarring in a dish," said Brigitte Gomperts, MD, associate professor of pediatric hematology/oncology and a member of the UCLA Broad Stem Cell Research Center. "While we haven't built a fully functional lung, we've been able to take lung cells and place them in the correct geometrical spacing and pattern to mimic a human lung."

How It Works

The process of getting stem cells to mimic the makeup of lung tissue begins with the coating of tiny gel beads with lung-derived stem cells and letting them assemble into the shape of air sacs found in human lungs. This approach to growing 3-D stem cells into organoids (organ buds grown *in vitro* that contain realistic organ anatomy) for the purpose of research began in 2010 and has been identified as one of the most important scientific breakthroughs of this decade, according to *The Scientist* magazine.

"The technique is very simple," said Dan Wilkinson, a graduate student in the UCLA Department of Materials Science and Engineering and one of the authors of the research paper on this subject. "We can make thousands of reproducible pieces of tissue that resemble lung and contain patient-specific cells."

By studying these patient-specific cells, scientists will be better equipped to hone in on the causes of diseases like idiopathic pulmonary fibrosis and aid in developing more effective treatment options. The primary indicator of the disease is scarring of the lungs that makes them thick and stiff. Over time, this causes patients to experience a progressively worsening

shortness of breath and a lack of oxygen getting to the brain and vital organs. Once they're diagnosed with this disease, patients typically live about three to five years.

The Next Steps

At this point, researchers don't know the cause of all cases of idiopathic pulmonary fibrosis. For some, it's been found to run in their families. For others, smoking and exposure to certain types of dust have been known to increase the risk of developing the disease.

With the development of the new lung organoids, researchers will be able to study the biological causes of diseases and identify the best course of treatment. This would involve collecting cells from the patient, turning them into stem cells, forming them into 3-D organoids and putting those organoids through a battery of tests. Because it's easy to create multiple organoids at once, researchers are able to test the effects of multiple drugs at the same time.

"This is the basis for precision medicine and personalized treatments,"

Gomperts said.

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- Volume range: 20 to 1000µL
- Unfiltered

Description	Mfr. No.	Cat. No.	Quantity	Price
Clear PP Tips, 50µL, Nonsterile	TT-50-C-HTR	14-222-848	2,304/Case	\$286.48
Clear PP Tips, 200µL, Nonsterile	TT-200-C-HTR	14-222-838	2,304/Case	\$281.99
Clear PP Tips, 1000µL, Nonsterile	TT-1000-C-HTR	14-222-833	2,304/Case	\$218.99
Conductive Black PP Tips, 20µL, Sterile	TT-20-CBK-HTR	14-222-840	2,304/Case	\$348.71
Conductive Black PP Tips, 50µL, Sterile	TT-50-CBK-HTR	14-222-845	2,304/Case	\$347.23
Conductive Black PP Tips, 200µL, Sterile	TT-200-CBK-HTR	14-222-835	2,304/Case	\$345.71
Conductive Black PP Tips, 1000µL, Sterile	TT-1000-CBK-HTR	14-222-830	1,536/Case	\$236.40

Tips for Beckman Coulter, Biomek FX, Biomek NX, Multimek, Biomek 1000 and Biomek 2000

- Format: 96-, 384-tip
- Volume range: 5 to 250µL
- Unfiltered
- Catalog numbers listed are only standard surface
- ANSI/SLAS tip rack format

Description	Mfr. No.	Cat. No.	Quantity	Price
Compatible with AP-96, MP20, MP200				
Clear PP, Regular Point, 250µL, Nonsterile	FX-250-R	14-222-094	960/Pack	\$80.19
			4,800/Case	\$342.81
Compatible with AP-384				
Clear PP, Regular Point, 30µL, Nonsterile	FX-384-R	14-222-102	3,840/Pack	\$866.45
			19,200/Case	\$3,801.47
Clear PP, Fine Point, 40µL, Nonsterile	FX-384-30FP-R	14-222-098	19,200/Case	\$4,309.63

Tips for Agilent/Velocity11, VPrep and Bravo

- Format: 96-, 384-tip
- Volume range: 5 to 250µL
- Standard or Axygen Maxymum Recovery surface
- ANSI/SLAS tip rack

Description	Mfr. No.	Cat. No.	Quantity	Price
Unfiltered, Compatible Head: 96LT, 8LT				
Clear PP, 250µL, Nonsterile	VT-250-R	14-222-881	960/Pack	\$71.00
			4,800/Case	\$311.01
Unfiltered, Compatible Head: 384ST, 96ST, 16ST				
Clear PP, 5µL, Nonsterile	VT-384-5UL-R	14-222-892	19,200/Case	\$3,145.64
Clear PP, 10µL, Nonsterile	VT-384-10UL-R	14-222-886	19,200/Case	\$3,149.71
Clear PP, 30µL, Nonsterile	VT-384-31UL-R	14-222-889	3,840/Pack	\$708.96
			19,200/Case	\$3,102.62
Clear PP, 70µL, Nonsterile	VT-384-70UL-R	14-222-895	19,200/Case	\$3,209.84
Filtered, Sterile, Compatible Head: 384ST, 96ST, 16ST				
Clear PP, 15µL, Sterile	VTF-384-15UL-R-S	14-222-903	19,200/Case	\$4,219.90
Clear PP, 30µL, Sterile	VT-384-31UL-R-S	14-222-890	19,200/Case	\$3,369.94
Clear PP, 50µL, Sterile	VTF-384-50UL-R-S	14-222-904	19,200/Case	\$4,210.68

Tips for PerkinElmer, MultiPROBE, Janus

- Format: 96-, 384-tip
- Volume range: 20 to 1000µL
- ANSI/SLAS tip rack

Description	Mfr. No.	Cat. No.	Quantity	Price
Compatible Head: Variospan 1, 4, 8				
Filtered, 25µL, Sterile	RRF-25-C-R-S	14-222-444	4,800/Case	\$917.48
Compatible Head: Variospan 1, 4, 8, P235				
Filtered, 175µL, Sterile	RRF-175-C-R-S	14-222-442	4,800/Case	\$917.48
Compatible Head: MDT-96 P50				
Unfiltered, 20µL, Nonsterile	PK-20-R	14-222-365	4,800/Case	\$422.08
Unfiltered, 50µL, Nonsterile	PK-50-R	14-222-371	960/Pack	\$98.30
			4,800/Case	\$416.21
Compatible Head: MDT-96 P235				
Filtered, 180µL, Sterile	PKF-180-R-S	14-222-374	960/Pack	\$170.54
			4,800/Case	\$775.20
Unfiltered, 200µL, Nonsterile	PK-200-R	14-222-361	960/Pack	\$98.20
			4,800/Case	\$419.70
Compatible Head: MDT-384 P30				
Unfiltered, 30µL, Nonsterile	PK-384-R	14-222-367	3,840/Pack	\$811.16
			19,200/Case	\$3,739.80

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CHOOSING THE RIGHT FILTRATION PRODUCTS

Using the correct laboratory filter for processing liquids is an important decision, but it does not have to be difficult or complicated. Filter membranes are available in a variety of materials, pore sizes and other specifications, but you can narrow the selection by asking just a few questions.

Why are you filtering?

There are many reasons why a filtration step may be part of your laboratory protocol. Most often, filtration is performed to remove something from the liquid, a function that is dependent on the membrane pore size.

- To remove Mycoplasma from a solution, use a 0.1µm pore filter
- Routine laboratory sterilization of media, buffers, biological fluids and gases requires a 0.2 or 0.22µm pore filter membrane
- Clarification or pre-filtration of solutions and solvents can be accomplished with a 0.45µm pore size

- Glass fiber filters can be used for water testing or as pre-filters (to improve subsequent filter performance)

What are you filtering?

The chemical or biological characteristics of the liquid will also affect the choice of filters.

- Some membranes contain wetting agents or other non-toxic substances that can interfere with results
- The membrane material may bind proteins, nucleotides or other macromolecules that can clog the filter, remove important constituents or otherwise compromise the sample
- Not all filter membranes are compatible with all chemicals, so confirm that the filter that you choose will work with your solvent or solution
- The temperature and length of exposure to the chemical may also affect the membrane's integrity

How are you filtering?

The filter choice will also depend on the volume of liquid to be filtered and the method or device that is being used. Filter membranes are available in a variety of formats:

- Flat or disc filters
- Syringe filters
- Filter/storage devices
- Vacuum filters
- Bottle-top filters
- Centrifuge or microfuge tube filters

If the membrane is part of a filtration device, confirm that the housing material is also compatible with the liquid being filtered.

Membrane Material	Physical Characteristics	Chemical Compatibility	Biological Compatibility	Applications
Cellulose Nitrate	<ul style="list-style-type: none"> • Strong and flexible • Hydrophilic • Autoclavable • Limited pore size range 	<ul style="list-style-type: none"> • Low extractables • Limited resistance to organic solvents 	High protein binding	<ul style="list-style-type: none"> • Protein or RNA transfer • Sample preparation • Microbiological and sterility studies • Food, beverage and water testing
Nylon (Polyamide)	<ul style="list-style-type: none"> • Hydrophilic • Autoclavable 	<ul style="list-style-type: none"> • Very low extractables • Moderately stable with esters and alcohols • Resistant to organic solvents • Suitable for high pH samples 	Binds proteins	<ul style="list-style-type: none"> • Media sterilization • Solvent filtration and degassing • Aqueous filtration • Organic solvent filtration
PES	<ul style="list-style-type: none"> • Hydrophilic • Autoclavable 	Low extractables; broad range solvent compatibility	Low protein binding	<ul style="list-style-type: none"> • Media sterilization • Solvent filtration and degassing • General lab filtration • Aqueous and compatible organic solvents
Polypropylene	<ul style="list-style-type: none"> • Strong and flexible • Hydrophobic • Autoclavable 	<ul style="list-style-type: none"> • Low extractables • Resistant to a wide range of organic solvents. 		<ul style="list-style-type: none"> • Media sterilization • Solvent filtration (HPLC) • Vacuum degassing (acetonitrile) • Biological solution filtration
PTFE (laminated to PP or PE)	<ul style="list-style-type: none"> • Easy to handle • Hydrophobic • Wide range of pore sizes 	<ul style="list-style-type: none"> • Low extractables • Resistant to organic solvents • Resistant to strong acids and bases 		<ul style="list-style-type: none"> • Solvent and gas filtration • Sterile air venting • Organic solvent filtration • Non-aqueous sample filtration
PVDF	Hydrophilic	Resistant to a broad range of organic solvents	Low protein binding	
Cellulose Acetate	<ul style="list-style-type: none"> • Hydrophilic • Autoclavable (when wet) 	<ul style="list-style-type: none"> • Limited solvent resistance • Resistant to alcohol and oil • Compatible (short-term) with MEK 	Very low protein binding	Cold sterilization of proteinaceous solutions
Glass Microfiber	Hydrophilic	<ul style="list-style-type: none"> • Compatible with organic solvents • Compatible with strong acids and bases (not HF) 		<ul style="list-style-type: none"> • Air or water monitoring • Filter or pre-filter

This table provides an abbreviated outline of common specifications and applications for various filter membrane materials. Your Fisher Scientific Sales Representative can offer assistance or consult with the manufacturer's technical support about specific filtration products.

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- Three-ply cap liner (foam core sandwiched between polyethylene)
- Strong resistance to chemicals and moisture

White Polypropylene Pulp/Vinyl Lined Caps

- Vinyl-coated liner
- Liner made from high-density paper

Black Phenolic PolyCone Lined Caps

- Liner molds around sealing areas
- Tight seal virtually eliminates leaking, evaporation, contamination, binding and backing off

Safety-Coated Bottles

- Plastisol coating enhances grip and reduces risk of breakage
- Coating contains substance if bottle breaks
- White caps lined with polypropylene PE foam/PTFE

THE CONNECTION BETWEEN BIRTH YEAR AND FLU RISK

By Kevin Ritchart

A study led by researchers from both the University of Arizona and UCLA has found a link between the year of a person's birth and their potential susceptibility to various strains of animal-origin influenza.

Until recently, scientists believed that previous exposure to a flu virus provided little or no protection against new flu viruses that have the ability to spread from animals to humans. But the results of a recent study, which was published in the November 11 issue of *Science*, could be the key to developing public health measures that could minimize the risk of major flu outbreaks in the years to come.

“Even a comparatively weak, mild pandemic flu event like the 2009 H1N1 (swine flu) outbreak is a trillion-dollar affair,” said Michael Worobey, head of the University of Arizona Department of Ecology and Evolutionary Biology and one of two senior authors of the study. “A major pandemic like the one we saw in 1918 has the potential to kill large numbers of people and shut down the world's economy.”

The combined research team studied influenza A (also known as bird flu) viruses. The avian viruses known as H5N1 and H7N9 have already caused hundreds of cases of severe illness or death in humans, and both strains are of great concern

globally because of the potential for mutation. These mutations could allow the viruses to not only jump from birds to humans, but also possess the ability to spread from one human host to another at a rapid rate.

After combing through data from every severe illness or death caused by both strains of the bird flu virus, researchers found that the human influenza virus a person was exposed to as a child was linked to the strain of avian-origin flu strain they would be protected from in the future. This so-called immunological imprinting appears to scientists to apply only to a person's first exposure to the human flu virus and may not be reversible.

What Flavor is Your Flu?

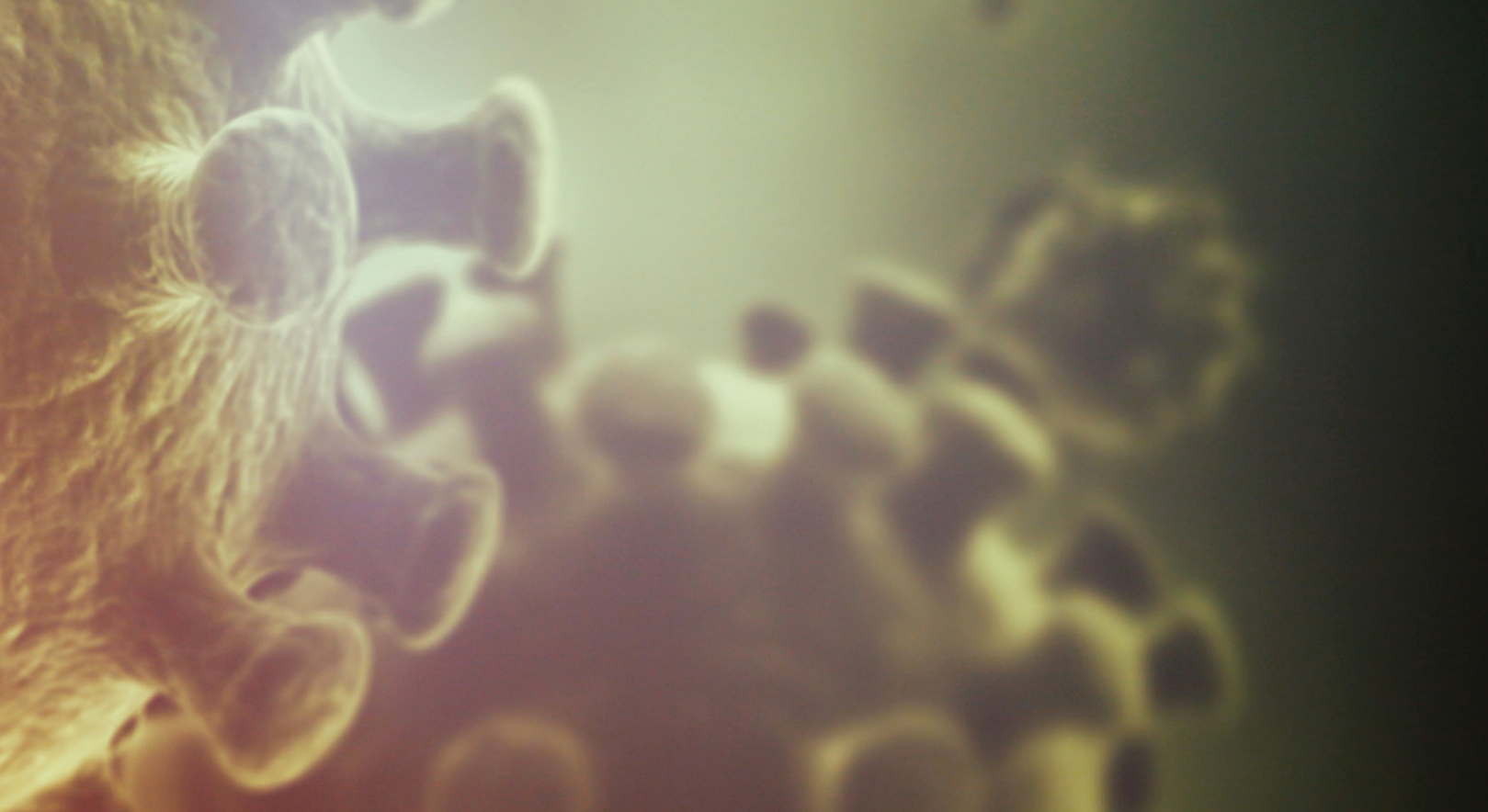
When a person is exposed to the flu virus for the first time, their immune system produces antibodies that target hemagglutinin, a receptor protein that sticks out from the surface of the virus. The makeup of the hemagglutinins in each strain of the influenza virus is different, but in each of the 18 known influenza A viruses, the hemagglutinin subtypes can be split into two main groups. The Arizona and UCLA researchers used the analogy of lollipop flavors to illustrate the differences between the subtypes.

“In this analogy, let's say you were first exposed to a human ‘orange lollipop’ flu as a kid,” Worobey said. “If later in life you encounter another subtype of flu virus, one from a bird and one that your immune system has never seen before but whose proteins also are of a similar ‘orange’ flavor, your chances of dying are quite low because of cross-protection. But if you were first infected with a virus from the ‘blue lollipop’ group as kid, that won't protect you against this novel, ‘orange’ strain.”

The results of this study answered a question that had been eluding epidemiologists for a long time: Why are certain age groups more susceptible than others to suffer serious or even fatal complications from an infection with novel influenza strains?

“All sorts of possibilities have been put forth,” Worobey said, “and here my colleagues from UCLA and I present a strong result showing that whatever other minor factors are at play, there is one really major one, and that is — surprise, surprise — we're not a completely blank slate when it comes to how susceptible we are to these emerging flu viruses. Even if we've never been exposed to H5 or H7 viruses, we have some protection against one or the other.”

Of the 18 subtypes of influenza A



hemagglutinin that come from non-human hosts (primarily birds), only three — H1, H2 and H3 — have circulated in humans in the past 100 years. Until now, there has not been a reliable way to predict which of the 18 subtypes might be responsible for causing the next flu pandemic by jumping from animals to humans. There also has been no way to definitively identify which age groups would be most at risk.



Increasing Protection

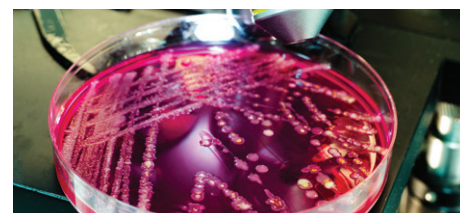
This new study has revealed that immunological cross protection appears to exist within every major strain of influenza A. One branch in the evolutionary tree of the influenza A virus contains human H1 and H2 as well as avian H5, while the other includes human H3 and avian H7.

In the lollipop analogy, those born before the late 1960s had exposure to “blue lollipop” influenza (H1 or H2) during their childhood. Researchers found that these older groups rarely succumb to avian H5N1 — which contains a shared “blue” hemagglutinin — but often die from the “orange” H7N9. People who were born after the late 1960s and were exposed to

“orange lollipop” influenza (H3) as children have shown the opposite effect: They are protected from H7N9 but are susceptible to severe disease and death when exposed to H5 viruses that don’t match their childhood exposure.

Based on recent findings, the next step for researchers will be to further identify the root causes for immunological imprinting and find ways to modify vaccines to account for the varying needs of patients of all ages.

“In a way it’s a good-news, bad-news story,” he said. “It’s good news in the sense that we can now see the factor that really explains a big part of the story: Your first infection sets you up for either success or failure in a huge way, even against ‘novel’ flu strains. The bad news is the very same imprinting that provides such great protection may be difficult to alter with vaccines: A good universal vaccine should provide protection where you lack it most, but the epidemiological data suggest we may be locked into strong protection against just half of the family tree of flu strains.”



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- Fast volume setting and menu navigation
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- Safe-Cone Filters to reduce contamination risk
- Microwell plate tracker guide
- Optional password protection



Description	Mfr. No.	Cat. No.	Price
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Single Channel, 5 to 120µL, Yellow	LH745041	14-557-822	\$1,029.54
Single Channel, 10 to 300µL, Orange	LH745061	14-557-823	\$1,029.54
Single Channel, 50 to 1000µL, Blue	LH745081	14-557-824	\$1,029.54
Single Channel, 0.1 to 5mL, Green	LH745101	14-557-825	\$1,029.54
Single Channel, 0.5 to 10mL, Red	LH745111	14-557-826	\$1,029.54
8-Channel, 0.2 to 10µL, Gray	LH745321	14-557-827	\$1,693.00
8-Channel, 5 to 120µL, Yellow	LH745341	14-557-828	\$1,693.00
8-Channel, 10 to 300µL, Orange	LH745361	14-557-829	\$1,693.00
8-Channel, 50 to 1200µL, Purple	LH745391	14-557-830	\$1,693.00
12-Channel, 0.2 to 10µL, Gray	LH745421	14-557-831	\$2,100.03
12-Channel, 5 to 120µL, Yellow	LH745441	14-557-832	\$2,100.03
12-Channel, 10 to 300µL, Orange	LH745461	14-557-833	\$2,100.03
12-Channel, 50 to 1200µL, Purple	LH745491	14-557-834	\$2,100.03

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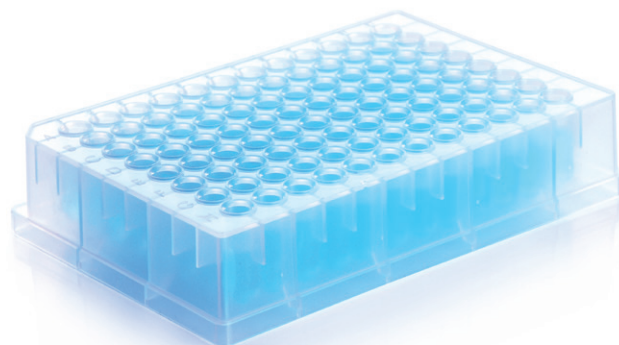


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- No leaching of additives or low molecular weight components
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02-911-700	20	\$414.86
02-911-701	40	\$805.57
02-911-702	120	\$2,295.84
96-Well Plate, Conical, 1mL		
02-912-401	20	\$321.28
02-912-402	40	\$623.29
02-912-403	120	\$1,776.40
96-Well Plate, Conical, 2mL		
02-912-404	20	\$450.66
02-912-405	40	\$743.14
02-912-406	120	\$2,117.95
384-Well Plate, Conical, 120µL		
02-911-703	20	\$383.74
02-911-704	40	\$745.13
02-911-705	120	\$2,011.87

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Volume Range: 0.2 to 2mL	13-689-020	\$433.51	13-689-013	\$453.91
Volume Range: 0.5 to 5mL	13-689-021	\$433.51	13-689-014	\$453.91
Volume Range: 1 to 10mL	13-689-022	\$433.51	13-689-015	\$453.91
Volume Range: 2.5 to 25mL	13-689-023	\$606.91	13-689-016	\$627.31
Volume Range: 5 to 50mL	13-689-024	\$622.20	13-689-017	\$642.60
Volume Range: 10 to 100mL	13-689-025	\$969.00	13-689-018	\$989.40
Digital Easy Calibration				
Volume Range: 0.1 to 1mL*	13-689-006	\$494.71	13-689-000	\$525.31
Volume Range: 0.2 to 2mL	13-689-007	\$494.71	13-689-001	\$525.31
Volume Range: 0.5 to 5mL	13-689-008	\$494.71	13-689-002	\$525.31
Volume Range: 1 to 10mL	13-689-009	\$494.71	13-689-003	\$525.31
Volume Range: 2.5 to 25mL	13-689-010	\$668.11	13-689-004	\$698.71
Volume Range: 5 to 50mL	13-689-011	\$678.31	13-689-005	\$708.91

* New size

Each Dispensette S includes a discharge tube, valve mounting/calibration tool, bottle thread adapters (PP), telescoping filling tube, recirculation tube (optional), performance certificate, operating manual and one-year warranty.

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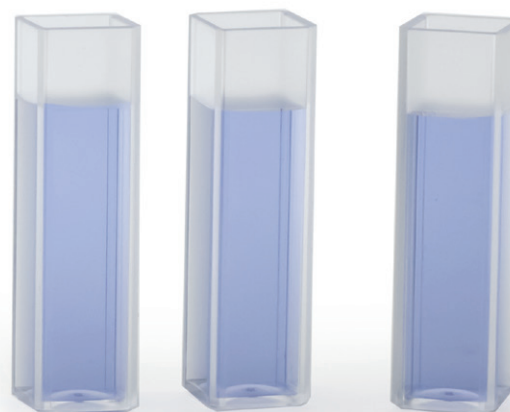
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New BRAND disposable macro fluorimetry cuvettes are designed with four optically clear sides for fluorescence applications. Choose high-quality polystyrene to measure wavelengths from 340nm to 800nm, or a proprietary polymer (ultra-low autofluorescence) for light in the visible or UV wavelengths (230 to 800nm).

- 10mm light path — fit all standard fluorimeters
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- Grouped by manufacturing mold cavity to ensure lowest variation among packs



Description	Mfr. No.	Cat. No.	Quantity	Price
Volume Range: 0.2 to 2mL	759030	14-381-600	100/Pack	\$ 31.65
	759035	14-381-601	500/Pack	\$133.35
Volume Range: 1 to 10mL	759125	14-381-602	100/Pack	\$141.65
	759128	14-381-603	500/Pack	\$633.35

Prices are U.S. list prices — pricing in Canada may vary

CLOAKING DEVICES

and the Hunt for Faster Computing

By Rita Waimer

For many, the idea of a cloaking device belongs entirely to science fiction or a distant, distant future. But take a look at University of Utah professor Rajesh Menon's microscopic work and you will see, or at least be told, a different story.

In November 2016, Menon, along with doctoral student Bing Shen and senior optical engineer Randy Polson, published a paper in *Nature Communications* detailing how they developed a cloaking device that hides microscopic photonic integrated devices from one another inside photonic computer chips.

The Power of Light

Photonic computer chips are an alternative to silicon-based chips that use light photons instead of electrons to transfer and process data. Where silicon chips have billions of transistors, photonic chips have billions of photonic devices, each with a specified function. They're faster than silicon chips, yet they could potentially consume 10 to 100 times less energy and therefore produce far less heat. Photonic chips are already being used in high-end military equipment, and their reduced power consumption could be hugely beneficial to data centers, which accounted for 1.8 percent of all electricity usage in the U.S. in 2014 — a statistic that's expected to grow to 4 percent by 2020.

The primary struggle with photonic chips is that the devices need to be spaced apart for the chip to work properly. If they're too close together, leaking light will spread from one device to another and cause interference. The spacing requirement is fine for simple chips, but becomes an issue when trying to add more power or functionality to a chip, which requires the addition of more devices. If the only way to prevent interference is to add space between devices, the chip eventually and necessarily becomes larger, limiting where it can be used. The cloak Menon's team developed is meant to eliminate this spacing requirement, allowing photonic devices to be packed more densely together than ever before and, in turn, making photonic chips more capable than ever before.

Invisibility for the Future

Menon and his team placed nanopatterned silicon-based barriers between the devices, successfully preventing them from "seeing" one another. Any light that leaks out of one device is redirected back to it, fooling the device into thinking there's nothing on the other side of the barrier. They're not the first group to tackle the density challenge — other researchers have demonstrated all-dielectric cloaks employing conformal

mapping before, but those typically had a footprint of hundreds of micrometers. Menon's cloak, on the other hand, was designed with an inverse-design algorithm and has a footprint of just a few micrometers. Moreover, it's applicable to various integrated photonic components.

It's an exciting development for silicon photonics, which are gaining more and more interest from influential companies like Facebook and Google. Beyond use in military equipment and data centers, the chips are already being tapped for use in emerging technologies like self-driving cars, where they could be used to create a lidar system with no moving parts, as well as life sciences research, where the technology could be used in biochemical sensors.

It's no surprise that photonic chips are currently used in such high-end applications — that's how most technologies get started, after all — but once they become more mature and affordable they'll inevitably be used in consumer devices. Particularly, they'll bring longer battery life to smartphones, smartwatches and other small devices that have limited space for batteries — something users have been wanting for years.

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SOLUTIONS FOR SUCCESSFUL CELL CULTURE

Accuracy in cell culture research hinges on creating and maintaining the right environment for your samples. Here are a few tips to ensure that your research yields reliable results.

Preventing Contamination in Your Biological Safety Cabinet

Biological Safety Cabinets (BSCs) serve two main purposes: preventing contamination to protect your samples, and to protect yourself and your surroundings from your samples. Thermo Scientific BSCs employ filters and uniform airflows to create an invisible barrier between the outside and inside of the cabinet to protect the user and samples from contaminants such as microorganisms and nucleases.

Go with the flow

When using a BSC, ensure that your samples only encounter contaminant-free air. In addition to using filters, you can minimize interference with the BSC: by placing everything you need inside the BSC before you start, and avoid fast arm movements as this could cause turbulence which alters the airflow.

Cleaning solutions for BSCs

While bleach is a highly effective germicide, it is corrosive to the steel surfaces of the BSC. Limit your use of bleach to emergencies, such as an infectious spill. For routine disinfection, 70 percent ethanol is effective and safe for steel. Allow the ethanol to air dry for best efficacy.

UV Sterilization

UV light can kill most microorganisms in about 30 minutes and it can reach areas of the BSC that are difficult to reach, taking some manual labor out of the disinfection process. Make sure to use a BSC with a safety interlock preventing operation of the UV light unless the window is closed.

How Clean is your CO₂ Incubator?

Location, location, location

Position your CO₂ incubator away from areas of high traffic, but out of neglected corners that may be sources of contamination. Also, make sure it's sheltered from ventilation and other airstreams that could deliver airborne contaminants.

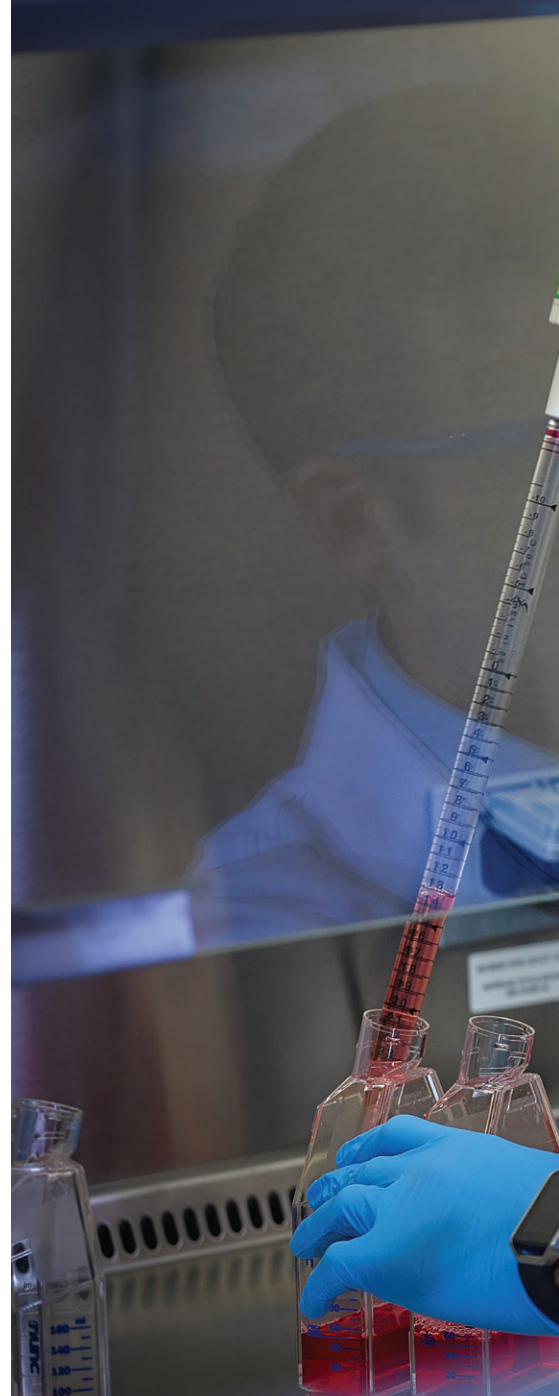
Cleaning solutions for CO₂ incubators

The best way to clean your CO₂ incubator is to use mild dish soap in water. Use clear water to rinse and then apply a 2 percent solution of a quaternary ammonium disinfectant, followed by 70 percent ethanol to remove any residues that could harm incubator components or your cells.

Right Water Purification System for Your Cell Culture Laboratory

Cell culture labs require ultrapure water that meets or exceeds ASTM Type I standards. Water must be low in ions, organics, bacteria but most importantly endotoxins, which can interfere with cell growth. Ultrapure water systems that incorporate dual wavelength UV light and ultrafiltration technologies are important features to consider when ensuring the best quality of water for successful cell cultures.

While ultrapure Type I water is required for more critical applications in the lab, the lack of ions makes it aggressive and it attacks the stainless-steel components of lab equipment such as CO₂ incubators and water baths. ASTM Type II or III water is recommended for these applications. If Type I water is the only source of lab water, it is suggested to add ions and raise the pH to 7-9 with a small amount of a sterile, weak solution of sodium bicarbonate.



Choosing the Right Surface for Your Cell Cultures

Understanding both how surfaces work and the environments they create for your cells is a key component to successful cell culture. When you're setting up your culture, you'll need to answer these key questions:

- Will the culture require a hydrophobic or hydrophilic surface?
- Will it benefit from additional coating?
- What harvesting method will you employ?
- Do you want to encourage spheroid formation in your cell cultures?



Your answers will guide you to choosing the right cultureware surface. Consider these basics on five surface types when making your selection:

Surface energy treatment delivers electronic energy into a cloud of gas, creating energetic oxidation. Depending on which energy treatment is applied — corona or plasma — your cultureware surface will be ideal for different types of cells.

Extracellular Matrix Coating (ECM) uses passive absorption, ideal for cells such as neurons that will not adhere to an energy-treated coating. The ECM coating helps with the binding of tricky cells by

replicating the basal lamina substrates on culture surfaces.

Polymer graft uses covalent binding to keep the polymers attached to the polystyrene surface, allowing greater control over the adherence and release of cells.

Untreated polystyrene is a good choice if you need to create a non-adherent environment at a low cost.

Ultra low binding surface coating encourages a spheroid formation by blocking the adsorption of extracellular matrix (ECM) proteins that mediate cell adhesion. With such properties, the cells are unable to attach

to the culture dish, and instead, attach to one another via cell-cell adhesion. As further cells attach, a spheroid is grown.

Choosing the right environment to surround your samples may ensure that you get reliable results in the lab.

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PLANNING IS THE KEY TO EFFECTIVE LAB DESIGN

Good planning is vital to the success of a new lab or expansion of an existing lab.

Creating a science laboratory requires close and constant collaboration between the planning engineers and the scientists. This starts with a broad concept from the initial workshops and continues for the length of the project.

There are four common issues in lab construction that can make the difference between success and failure. Pay close attention to electrical requirements, HVAC demands, local building code compliance, and ordering products with long lead times.

What to consider when building or remodeling a lab:

- What about HVAC? HVAC is a very important infrastructure issue for laboratories. The volume of air changes varies from office environments, experiments may have specific temperature requirements and lab equipment may produce large amounts of heat. Hood and enclosure air flows will affect air circulation, as will requirements for negative pressure, low humidity or clean/sterile conditions. Space will also be needed for ductwork and vents for safety storage cabinets.

- Ensure adequate electrical supply. In addition to an adequate number of power receptacles, high-capacity lines may be needed along with back-up power sources for utility interruptions. Frozen samples may be at risk

- Choose the right casework. A wide variety of wood, steel, and stainless options are available to replace existing pieces with standard sizes and finishes. Or will custom casework be needed? Can configurable or flexible systems work for you?

- Keep safety in mind. Employee exposure to chemicals and other hazards is also a concern. Additionally, the installation of full-body showers (and drains), eye wash stations and storage for safety products should be considered. Think about safe chemical storage and plan for storing hazardous, explosive or flammable substances.

- Pick the right hoods and enclosures. Lab enclosures include fume hoods, biological safety cabinets (BSCs) and ductless hoods. They also include special-use hoods like those for radioactive substances, perchloric acid or explosion-prone materials.

- Select large equipment early in the process. The placement of fixed and portable equipment can affect the layout and the structural needs of the facility (foundation requirements, framing). In addition to hoods and enclosures, key products in this category include refrigerators and freezers, incubators, autoclaves, centrifuges, water purification systems, glassware washers, etc.



Contain Contaminants, Save Energy

Labconco Protector Premier Fume Hoods



Designed for general chemistry use, Protector Premier Fume Hoods keep harmful fumes away from the operator. Containment-enhancing features allow these hoods to operate at lower velocities, saving energy.

- Easy-to-clean, corrosion-resistant, one-piece molded fiberglass liner
- Eco-Foil Air Foil with aerodynamic Clean-Sweep openings reduces energy consumption by 7 to 10%
- Meets SEFA-1 standard of a low-velocity, high-performance hood
- Safe operation as low as 60fpm
- Large 37.5 in. high unobstructed sightline for comfortable viewing while standing
- Cord-Keeper Slots on left and right sides of air foil allow sash to close completely
- Two pre-plumbed service fixtures for gas, air, water or vacuum connections
- Requires remote blower, ductwork, work surface and supporting base (sold separately)

Description	Mfr. No.	Cat. No.	Price
4' Premier Hood with 2 Fixtures, 1 Duplex	100400002	10-369-117	\$8,598.75
5' Premier Hood with 2 Fixtures, 1 Duplex	100500002	10-369-126	\$9,439.50
6' Premier Hood with 2 Fixtures, 1 Duplex	100600002	10-369-135	\$10,317.00
8' Premier Hood with 2 Fixtures, 2 Duplexes	100800002	10-369-144	\$13,545.00

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- Five-year limited warranty; lifetime warranty on the pneumatic lift

Additional features:

Fisherbrand Executive Mesh Office Chair

- Tilting and locking functions
- Optional headrest

Fisherbrand Modern Mesh Office Chair

- Adjustable lumbar support
- Optional synchro tilt adjustment



Description	Cat. No.	Price
Executive Mesh Office Chair		
Executive Chair with 2-Way Adjustable Arms, with Headrest	14-400-440	\$340.00
Executive Chair with 2-Way Adjustable Arms, without Headrest	14-400-441	\$316.00
Executive Chair with 3-D Adjustable Arms, with Headrest	14-400-442	\$344.00
Executive Chair with 3-D Adjustable Arms, with Headrest	14-400-442	\$344.00
Modern Mesh Office Chair		
Modern Chair with 2-Way Adjustable Arms, Standard Lift Control	14-400-444	\$249.00
Modern Chair with 3-D Adjustable Arms, Standard Lift Control	14-400-445	\$252.00
Modern Chair with 2-Way Adjustable Arms, Synchro Tilt Control	14-400-446	\$277.00
Modern Chair with 3-D Adjustable Arms, Synchro Tilt Control	14-400-447	\$280.00

Stay Connected to Your Critical Environments

TRACEABLE™

TraceableLive WiFi Hygrometer/Thermometer

With TraceableLIVE, you can stay connected to your lab with your smartphone, tablet or personal computer. Use the app or visit Traceablelive.com to view current temperatures and humidity, change the alarm parameters, view data history and view and generate reports. Multiple users can access any connected instruments via TraceableLIVE.



Features:

- Multiple-point temperature calibration, traceable to NIST‡
- Alerts: humidity alarm, connectivity interruption, low battery
- Works for individual labs or a network of facilities
- Connects to existing Wi-Fi
- Cloud-based applications; no local software required; data visibility via web, Android, iOS
- Sends mobile push, email or text notifications
- SSL-encrypted SECURE connection
- Requires TraceableLIVE subscription†

Description	Sensor	Cat. No.	Price
Datalogging Hygrometer/Thermometer	Ambient Sensor Dongle	15-079-628	
Datalogging Hygrometer/Thermometer	Remote Sensor (10' Cable)	15-079-629	

Devices	Monthly Fees	Annual Fees	Optional SMS (Text)
1-9	\$8.99 per Device	\$100 per Device	+\$2 per Device a Month
10+	\$7.20 per Device	\$80 per Device	+\$2 per Device a Month

‡Traceable Certificate

Includes multi-point calibration from an A2LA-accredited ISO/IEC 17025:2005 (1750.01) calibration laboratory. Indicates traceability of measurements (SI units) through NIST or other recognized national measurement institutes (NMI).

†TraceableLIVE Subscription available at traceablelive.com.

Explorer Series



Durably Constructed Balances

Featuring readabilities from 0.01mg to 0.1g and capacities up to 35kg, the OHAUS Explorer Series is a robust family of durably constructed balances specifically designed to offer outstanding accuracy and weighing performance. Fully featured to meet all of your weighing needs, the Explorer Series is outfitted with:

- A large color graphic touch screen and intuitive user interface, available in 14 operating languages
- Measurement traceability for easy compliance with GLP and GMP standards
- 14 specialized applications, including formulation, dynamic (animal) weighing, and pipette adjustment
- RS-232, USB, and ethernet interfaces for printer or PC connectivity and system integration



Description	Capacity	Readability	Cat. No.	Price
Model EX125D Semi-Micro Balance	52g/120g	0.015mg	01-919-370	\$5,125.50
Model EX225D Semi-Micro Balance	120g/220g	0.015mg	01-919-372	\$6,231.00
Model EX124 Analytical Balance	120g	0.0001g	01-920-232	\$4,187.77
Model EX324 Analytical Balance	320g	0.0001g	01-920-234	\$5,404.94
Model EX223 Precision Balance	2200g	0.001g	01-920-235	\$3,305.78
Model EX623 Precision Balance	620g	0.001g	01-920-237	\$3,931.71
Model EX2202 Precision Balance	2200g	0.01g	01-920-239	\$3,317.45
Model EX6202 Precision Balance	6200g	0.01g	01-920-241	\$3,937.01
Model EX6201 Precision Balance	6200g	0.1g	01-920-243	\$3,371.55
Model EX12001 High-Capacity Precision Balance	12000g	0.1g	02-112-245	\$3,826.01

No More Flooded Labs

Heidolph Radleys Super Air Condenser

How it works:

- The Findenser has a small amount of water permanently sealed between an internal glass condenser and an external, finned aluminum jacket
- The glass condenser has more internal surface area than traditional condensers for increased heat transfer capacity
- Can be used for solvent columns from 5mL to 1L
- Helps meet sustainable water reduction targets
- Available in standard (400 x 72mm) or mini (275 x 72mm) sizes



Description	Length	Cone Size	Socket Size	Solvent Volume	Mfr. No.	Cat. No.	Price
Findenser Standard	400mm	B24	B24	1L	015610000	13-889-550	\$451.63
Findenser Standard	400mm	B29	B24	1L	015610001	13-889-531	\$419.98
Findenser Standard	400mm	B19	B19	1L	015610002	13-889-532	\$419.98
Findenser Mini	275mm	B24	B24	250mL	015610003	13-889-533	\$398.07
Findenser Mini	275mm	B19	B19	250mL	015610004	13-889-534	\$394.94
Findenser Mini	275mm	B14	B14	250mL	015610005	13-889-535	\$398.07

Oil-Free, Low Maintenance

Fisher Scientific MaximaDry Pumps

No more downtime is necessary to add or change pump oil. Enjoy quiet, reliable operation without the mess of oil or the operating costs and environmental problems associated with water aspirators.

- **Corrosion-resistant materials** — The thick, solid PTFE resin heads will not peel or corrode when exposed to most aggressive solvents. The sturdy FPPM valve system handles occasional liquids without degrading performance.
- **Quick and easy setup** — Be up and running in minutes. Everything connects together without tools or fittings. All that is needed is 3/8-inch I.D. tubing.
- **Compact, stylish design** — For convenient access, your MaximaDry oil-free pump fits easily where you need it — on your bench or inside your fume hood.



13-880 Series

Head Configuration	Capacity	Vacuum	Pressure	Motor	Dimensions (L x W x H)	Cat. No.	Price
Single Stage	20L/min.	75 torr	15psig	1/6hp	13 x 6.5 x 8.5"	13-880-14	\$1,610.00
Single Stage	40L/min.	65 torr	15psig	1/6hp	15 x 6.5 x 8.5"	13-880-16	\$2,170.00
Two Stage	20L/min.	6 torr	15psig	1/6hp	15 x 6.5 x 8.5"	13-880-18	\$2,080.00
Two Stage	35L/min.	6 torr	15psig	1/3hp	16 x 7 x 9"	13-880-20	\$2,760.00
Two Stage	35L/min.	1.5 torr	15psig	1/3hp	16 x 7 x 9"	13-880-22	\$3,925.00

Laboratory Safety Solutions



AC600 Series Ductless Chemical Workstation

The AC600 Series ductless chemical workstation is an economical solution for protection of the operator and environment from toxic vapors, gases, fumes and particulates. Ships fully assembled and can be configured in a variety of common applications.

Standard Features:

- Microprocessor controller has audible and visible alarms for both airflow velocity and filter change
- 360° visibility
- Ideal for low volume chemical applications

Description	Cat. No.	Price
AC632A 32" Workstation	36-100-4271	\$3,577.65
AC632TA 32" Workstation, Tall Version	36-100-4272	\$3,991.30
AC648A 48" Workstation	36-100-4274	\$4,808.26
AC648TA 48" Workstation, Tall Version	36-100-4275	\$5,027.03

* Filters sold separately, application worksheet required

Endeavour Ductless Fume Hood

Endeavour ductless fume hood is designed to provide superior operator protection from potential toxic fumes, vapors and particulates. AirSafe NXT provides simple and effective user interaction with fume hood operational parameters.

Standard Features:

- Microprocessor controller has audible and visible alarms for both airflow velocity and filter change
- Bonded carbon filters — no dust
- Polypropylene construction — excellent chemical resistance

Description	Cat. No.	Price
ACPT3000 36" Ductless Fume Hood*	36-100-0059	\$7,286.25
ACPT4000 48" Ductless Fume Hood*	36-100-0063	\$8,569.25
ACPT5000 60" Ductless Fume Hood*	36-100-0067	\$9,159.47
ACPT6000 72" Ductless Fume Hood*	36-100-0069	\$10,294.37

* Filters sold separately, application worksheet required



PowderSafe Type B Enclosure

Seamless polypropylene construction provides vibration resistance crucial for accurate powder weighing, while AirSafe automatic safety controller monitors airflow and filter condition. HEPASafe technology allows filters to be safely and easily changed under negative pressure.

Standard Features:

- Horizontal HEPA filtered airflow pattern
- HEPASafe filtration system for simple and easy maintenance
- Thermally-fused design for vibration reduction and balance stability

Description	Cat. No.	Price
AC730C 32" PowderSafe Enclosure	36-100-4292	\$7,119.68
AC740C 48" PowderSafe Enclosure	36-100-4293	\$7,770.75





Horizontal Clean Bench

AirClean Systems manufactures a complete range of horizontal and vertical ISO 5/Class 100 laminar flow clean benches. Application specific plastics allow for easy cleaning and sterilization which helps prevent cross-contamination.

Standard Features:

- Seamless polypropylene construction
- ISO 5 or better air quality
- Microprocessor controlled
- Available in 4-, 5-, 6- and 8-foot versions

Description	Cat. No.	Price
AC4000 HLF Horizontal Clean Bench	36-100-4381	\$7,256.20
AC5000 HLF Horizontal Clean Bench	36-100-4382	\$8,599.63
AC6000 HLF Horizontal Clean Bench	36-100-4383	\$10,552.50
AC8000 HLF Horizontal Clean Bench	36-100-4384	\$12,955.00

Combination PCR Workstation

AirClean Systems Combination PCR Workstation combines an ISO 5/Class 100 Clean Air Environment with UV light sterilization for optimal protection from sample contamination. UVtect™ microprocessor constantly monitors workstation functions.

Standard Features:

- Class 100 clean vertical laminar flow air
- Polycarbonate and polypropylene design to reflect UV energy
- Full access folding sash
- Rolled plastic design — no joints or gaps in construction
- Digital UV light timer 0-59 minutes
- UV shelf with integral pipette holder

Description	Cat. No.	Price
AC632LFUVC 32" PCR Workstation	36-101-8894	\$3,277.50
AC648LFUVC 48" PCR Workstation	36-101-8897	\$4,370.00



PowderSafe Type C Enclosure

The PowderSafe Type C balance enclosure incorporates the airflow dynamics and HEPASafe features of the PowderSafe Type B with the user-friendly features and chemical fume containment capabilities of the ductless fume hood. Thermally fused polypropylene makes the PowderSafe Type C perfect for weighing powders or solvents.

Standard Features:

- Horizontal HEPA filtered airflow pattern
- HEPASafe filtration system for simple and easy maintenance
- Thermally-fused design for vibration reduction and balance stability

Description	Cat. No.	Price
AC760C Type C Enclosure	36-101-8906	\$9,167.61
AC770C Type C Balance Enclosure	36-101-8908	\$9,768.31
AC780C Type C Balance Enclosure	36-101-8910	\$13,728.75



Filtered Laboratory Safety Solutions

MYSTAIRE®

Mystaire manufactures fume hoods and laminar flow hoods to provide operator or process protection from toxic fumes, vapors and particulates.



MY-PCR Workstations

Mystaire's MY-PCR workstations establish an ISO5 clean work area with timed UV light. MY-PCR workstations create a "personal" clean work zone.

Standard Features:

- Combines vertical ISO5 air with UV-light sterilization
- Safety switch to eliminate UV-light exposure
- Polycarbonate construction with polypropylene base

Description	Cat. No.	Price
MY-PCR24 24" PCR Workstation	15-338-365	\$2,365.00
MY-PCR32 32" PCR Workstation	15-338-366	\$3,065.00
MY-PCR48 48" PCR Workstation	15-338-960	\$3,800.00

MY-PCR filters included in the purchase price



Isola Vue Filtered Chemical Workstation

Isola Series filtered workstations provide chemical and particulate containment. Advanced monitoring and control are key components of each Isola filtered workstation.

Standard Features:

- EverSafe III Touch Control with electronic monitoring of face velocity, filter saturation, AND temperature and humidity with audible and visible alarms
- Polycarbonate construction for 360° visibility — excellent for demonstrations
- Solid-state gas detection with three sensitivity set points

Description	Cat. No.	Price
MY-ISL36 Isola Workstation	15-338-900	\$4,500.00
MY-ISL48 Isola Workstation	15-338-901	\$5,600.00
MY-ISL72 Isola Workstation	15-338-902	\$7,200.00

Isola filters sold separately – application dependent

QUALITY SAFETY SERVICE



Microscopy Refocused

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- **View**

Comfortably view live and captured images on the large touchscreen display or project them to a screen via HDMI

- **Capture**

Quickly capture images and upload them to the SeBaShare cloud or save to a USB drive

- **Collaborate**

Our secure SeBaShare cloud allows users to easily share images with colleagues, labs, and collaborators anywhere online



Contract models

Product	Applications	Plan Acromat Objectives	Digital Color Camera	Brightfield	Phase Contrast	Cross-Polarization	Darkfield
				Cat. No.	Cat. No.	Cat. No.	Cat. No.
SeBa 2 Series	Education	4	5MP	SeBa2-BF1	SeBa2-PH1	SeBa2-PL1	SeBa2-DF1
SeBa 3 Series	Education, Clinical	5	5MP	SeBa3-BF1	SeBa3-PH1	SeBa3-PL1	SeBa3-DF1
SeBa 4 Series	Clinical, Research	5 (Plan Fluor optional)	16MP	SeBa4-BF1	SeBa4-PH1	SeBa4-PL1	SeBa4-DF1
SeBa Pro4B Series, with binocular head	Clinical, Research	5 (Plan Fluor optional)	16MP	SeBaP4B-DF1	SeBaP4B-PH1	SeBaP4B-PL1	SeBaP4B-DF1

Other Traditional Microscopes from LAXCO Inc.

Laxco also offers a complete line of traditional microscopes including **LMC Upright**, **LMI Inverted**, and **LMS Stereo Microscopes**.



THE SIMPLE WAYS TO PREVENT CELL CULTURE CONTAMINATION

By Iva Fedorka

Nothing is more frustrating, expensive and potentially catastrophic to a cell culture lab than contamination. Every lab and lab worker has experienced it to some degree at one point or another. Significant time and effort may be spent nurturing a culture that ultimately is lost to contamination. Moreover, hidden contaminants can produce inaccurate, erroneous results that may damage a lab or researcher's reputation. Cell culture contamination costs millions of dollars every year in the United States alone, and it seems to be only getting worse. While the problem will not and cannot ever be fully defeated, however, it can be fought.

Know the Contamination Sources

There are three main categories of cell culture contaminants: chemical contaminants, biological contaminants and cell-line or cross-contamination. Chemical contamination, often overlooked as a cause of cell growth problems, is caused by nonliving substances that produce unwanted effects on a culture system. These can include everything from media, sera, water and endotoxins to storage vessels, fluorescent lights and incubators. Avoiding chemical contamination can prove challenging because essential

nutrients can become toxic at high concentrations and hormones and growth factors can change the culture in ways that, while not necessarily harmful, are unwanted.

Biological contaminants can be divided into those that are easy to detect and those that are more difficult to assess. Bacteria, molds and yeast are easy to detect, while viruses, protozoa, insects, mycoplasma and the presence of other cell lines are difficult to detect. These hard-to-detect contaminants pose the most serious threat to cultures because the amount of time that the contaminant goes undetected determines the extent of the damage.





Cross-contamination with cells from another species is also a clearly-established problem, and one that has serious consequences. This problem became apparent in the late 1950s, and in 1967, isoenzyme analysis showed that HeLa cells had not only contaminated 20 commonly used human cell lines but completely replaced the original cells. A few years later, in 1976, a research center tested 246 cell lines and found that 30% of them were incorrectly designated, and in 1981, a survey of cultures revealed that over 60 cell lines were actually HeLa cells. And this problem isn't just limited to contamination from HeLa cells — DNA analysis has since revealed that cell lines have been contaminated by cells from a variety of sources.

There are a number of ways that these contaminants find their way into a culture. Some are from the use of nonsterile supplies, media and solutions. Others are airborne or can swim and crawl into a culture and begin to grow. And, of course, there will always be accidents or user errors to blame. But simply knowing the different types of contaminants and understanding how they can be introduced to a culture is the first step in fighting them.

An Ounce of Prevention

While awareness is key, a proactive approach to avoiding contamination will save you and your lab a lot of headaches.

The first and easiest method is to keep your lab clean by using a disinfectant that is effective against bacterial spores. Wipe down work surfaces often and pay attention to frequently used equipment like



incubators, laminar flow hoods, and water baths. Pay attention to areas that might be easily overlooked, such as the cooling coils on a freezer or refrigerator (which can be a major source of microbial-laden airborne particles).

Another key aspect of contamination prevention is using good aseptic technique. Laboratory workers should wear proper personal protective equipment (PPE), including gloves and lab coats at a minimum, and wash their hands when entering or leaving the lab. All sterile transfers should be performed inside a biosafety cabinet (BSC) or other appropriate enclosure that is cleaned and disinfected on at least a monthly basis. This protects workers and samples, and makes it more difficult for contaminants to enter samples. Clearly label cultures, solutions and supplies, and keep complete records of your work to help prevent accidents before they happen.

To avoid cross-contamination, obtain all your cell lines from reputable cell banks and periodically check the characteristics of your cell lines. You can also use DNA

fingerprinting, karyotype analysis and isotype analysis to confirm the presence or absence of cross-contamination in your cultures.

Routinely monitor all of your supplies, media, solutions, work areas, and existing cell cultures for contamination before using them. Keep this routine simple enough to ensure that people use it, but thorough enough to catch any hint of chemical or biological contaminants.

If a culture does become contaminated, you have several options. Autoclaving is guaranteed to eliminate the infection and keep it from spreading to other cultures. If an irreplaceable sample becomes contaminated, antibiotics or other chemicals might save it, but that takes considerable effort, is rarely successful, and can lead to more problems in the future.

Although the contamination of cell cultures cannot be eliminated completely, it can be managed. With an effective prevention program, you can reduce the likelihood of cell culture contamination and the potential for damaging your reputation, too.

ANTIBODY BUYING GUIDE

Finding the Right Antibodies

Antibodies have become valuable and ubiquitous tools in life sciences research and are used primarily to identify and locate proteins.

Different types of antibodies are used for specific applications, and proper selection is key. Here are some considerations for choosing antibodies:

Primary Antibody Selection

- What type of immunoglobulin does the antibody represent?
Mammalian antibodies are categorized by isotypes or classes, based on differences in their biological properties, functional locations and reactions to different antigens.
- Is the antibody produced in a different host species than the target?

Using antibodies from different species eliminates the need to use a secondary reagent to endogenous tissue Ig for the species.

- Does the primary antibody of interest bind specifically to the perceived expressed target antigen in the species and cell type of interest?

Example: A good Rat-anti-mouse CD31 antibody is available, but only works on mouse endothelial cells. To label rat endothelial cells, another antibody must be used.

- Is the sample or target specimen preparation compatible with the antibody?

Example: For Immunohistochemistry, some antibodies will not work on formalin-fixed paraffin embedded (FFPE) samples or may work only with non-aldehyde fixed frozen sections.

Secondary Antibody Selection

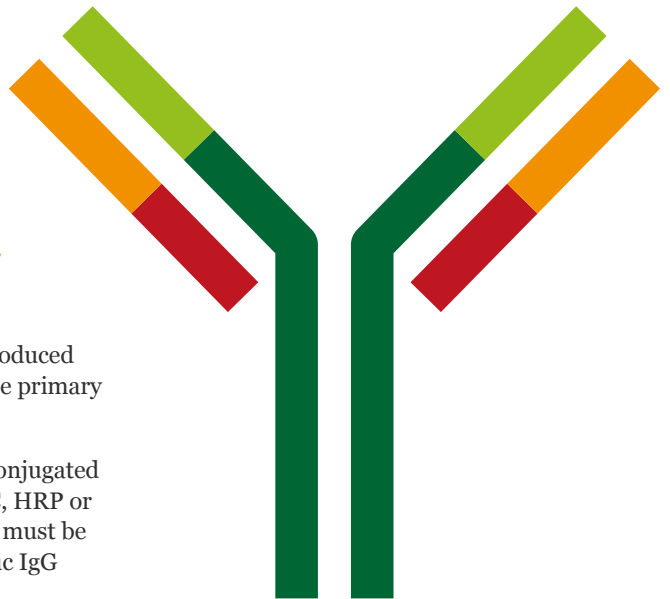
- Is the secondary antibody produced in a different species from the primary antibody?

If the secondary link is not conjugated to a visualization label (FITC, HRP or AP) then a tertiary detection must be used to eliminate non-specific IgG binding.

- Does the isotype of the secondary antibody match that of the primary antibody?

If the primary antibody is IgG, a secondary IgG antibody will work better than a species-matched IgM antibody.

Antibodies are now an integral part of major research areas, including cancer, epigenetics, immunology and neuroscience, and the underlying cell processes that they involve. They also comprise key components in many of the assays performed today in clinical and research laboratories. Use the Advanced Antibody Search to get the antibodies that you need from Fisher Scientific.



invitrogen



Primary, secondary and custom antibodies seek binding relationships

Find your match at fishersci.com/invitrogen-antibodies

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Experience Augmented Microscopy in Your Lab



Lionheart FX Automated Cell Imager

The Lionheart FX Automated Cell Imager transforms captured images into intelligent information and is optimized for live and fixed-cell imaging. Incubation to 40°C, CO₂/O₂ control, humidity chamber and Gen5 3.0 Software make cell image capture, processing, analysis and data publishing quick and effortless.

- Automated digital microscopy to 100x
- Brightfield, color brightfield, phase contrast and fluorescence imaging
- Live cell assay support with environmental controls
- Gen5 software captures and analyzes images — no extensive training required
- Compact design for quick installation and setup



Description

Fluorescence, Brightfield, Color Brightfield and Phase Contrast Imaging, Includes Imaging System Controller

Cat. No.

BTLFX

Price

\$55,900.00

A Full Spectrophotometry Workstation



Epoch 2 Microplate Spectrophotometer

- UV-Vis wavelength selection in 6- to 384-well plates, cuvettes and 2µL micro-volume samples
- Large color touchscreen with available Wi-Fi, Bluetooth and flash drive connectivity
- Full Gen5 Data Analysis Software onboard
- Advanced incubator design to 65°C with Condensation Control
- Compatible with BioStack and third-party automation



Inquire about other available configurations.

Description

Absorbance Detection (200 to 999nm), Touchscreen User Interface, Cuvette Port

Cat. No.

BTEPOCH2TC

Price

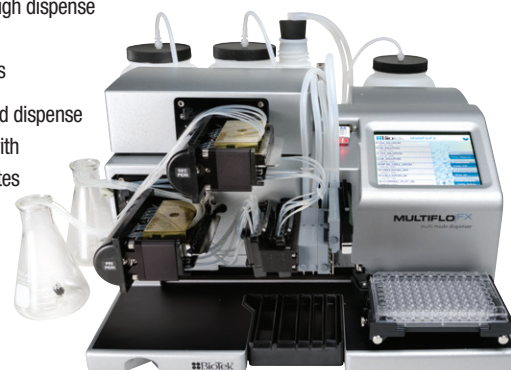
\$16,000.00

Replace Up to Four Dispensers and a Washer



MultiFlo FX Multi-Mode Dispenser

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- RAD technology for dispensing to individual wells
- Parallel Dispense Technology: peristaltic or syringe dispensing with no carryover
- Cost savings through dispense mode options and low prime volumes
- Cell-friendly angled dispense and wash tubes with adjustable flow rates



Inquire about other available configurations.

Description

Reagent Dispensing in 6- to 1536-Well Microplates, Includes Washer Module

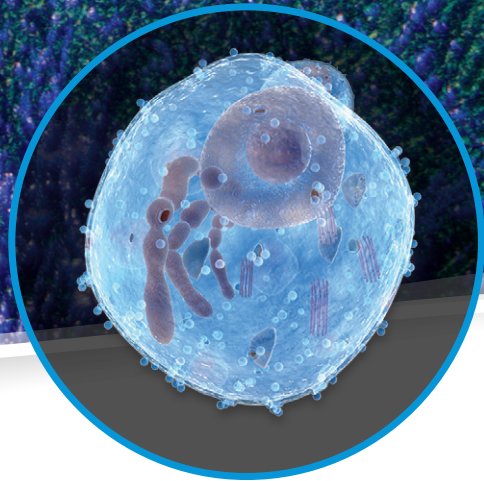
Cat. No.

BTMFXPW

Price

\$19,235.00

Unrivaled Cell Culture and Analysis



Fisher Scientific provides the highest quality Gibco™ reagents, a full line of BioTek™ instruments, and innovative Corning™ plastics for all of your cell culture needs.

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Visit fishersci.com/cellculture or fishersci.ca/cellculture for more information on our Cell Culture portfolio.

Visit fishersci.com/lifesciences or fishersci.ca/lifesciences for more information on our Life Sciences portfolio.

WORKPLACE SAFETY IN 3 EASY STEPS

By Ralph Birch

With more than 97 million chemical substances registered with the Chemical Abstract Service, the prospect of staying up to date with the composition and proper handling procedures of each can be a daunting task. Fortunately for employees of facilities that handle volatile chemicals, there are some simple strategies that can be employed to enhance and reinforce safety measures on a daily basis.

Most chemicals can be grouped into classes, which can be helpful in terms of training employees on their accepted uses along with correct handling, clean-up and disposal procedures. So if a facility typically stocks multiple flammable solvents, for example, it is more effective to train employees how to treat chemicals from the same class than to have unique handling procedures for each one individually.

To that end, here are three simple strategies for employees to keep in mind to help ensure the safest possible work environment for themselves and their coworkers:

Stick to the Plan

The Occupational Safety and Health Administration (OSHA) requires the completion of workplace hazard assessments. Once all hazards are identified, plans must be developed and implemented to prevent the hazards from harming employees. For employees who handle hazardous chemicals, following

the plan involves everything from wearing the proper personal protective equipment (PPE) to checking that equipment is functioning properly to storing chemicals properly when they are not in use.

Outlining and enforcing safety plans that are clear and easy to follow is the first step in fostering a safe working environment. If a safety plan becomes too complex, facility managers should enlist the help of employees who perform the day-to-day functions to find the best ways to simplify procedures without sacrificing safety.

Read Every Label

For people who work in a lab or other facility and perform the same tasks over and over again, it is easy to fall into a routine and become complacent. Employees should be taught to take the time to read the label on every bottle they pick up so they're aware of its contents. This will not only ensure they're using the right product for the function they're performing at that moment, but also will focus their attention on the task at hand. Getting into the good habit of reading every label will minimize the chance of exposure to a hazardous situation or unintentionally causing a harmful chemical reaction to occur.

The adoption of globally harmonized standards (GHS) for chemical labeling has changed the way chemicals are labeled, and by now, employees who work with chemicals on a daily basis should be

familiar with the pictograms and hazard statements currently in use. The only way these, or any, labeling system won't work is if people don't take the time to read them.

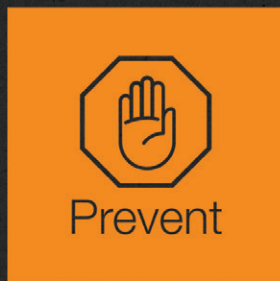
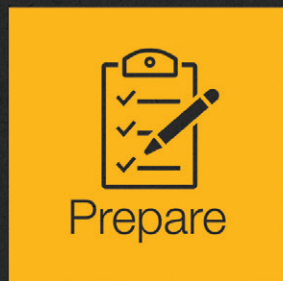
Always Be Alert

For employees who work with hazardous materials day in and day out — and have for a long time — it can be easy to become complacent when it comes to adhering to established safety regulations. Performing tasks while distracted or just going through the motions can lead to dangerous incidents for everyone in the facility.

To remind employees that hazardous materials are present in their work areas, it is vital to provide labels and signs that serve as constant reminders. But the best way to keep chemical information and safety protocols fresh in the minds of employees is through regular safety meetings. During these sessions, supervisors should review safety materials to remind employees how to perform their work functions safely and clarify exactly what to do in the event of an accident.

Teaching employees to handle and use hazardous materials safely does not have to involve cumbersome manuals or a series of one-off handouts every time a new chemical is introduced in the workplace. Training employees to follow established plans of action, diligently read labels, and focus on the task at hand will go a long way toward ensuring a safe and secure work environment.

We're Your Safety Specialists



People are your biggest investment. Keep them safe with expert specialists and everything you need to **prepare, prevent, protect and respond.**

Visit fishersci.com/safety or fishersci.ca/safety to learn more.

GLOVE BUYING GUIDE

Finding the Right Disposable Gloves

Gloves are a key component of personal safety and the most common piece of personal protective equipment (PPE). The gloves you choose should protect against hazards unique to your work and environment, such as physical hazards (like punctures or flames), chemical hazards or biohazards. Similarly, you should be sure that the design of the glove meets your needs:

Size:

Gloves that are too small or too large may compromise your ability to work effectively and safely.

Length and Cuff:

Consider whether the gloves should be long enough to cover the wrist, and choose a glove with beaded cuffs to help prevent liquids from running onto your skin or clothing.

Texture:

Choose textured gloves if the objects being handled are wet slippery.

Thickness:

Disposable gloves are typically less than 6mil thick.

Conditions:

Choose gloves with an adequate breakthrough rating to resist the chemicals, temperatures and exposure times of your applications.

No glove will protect against all hazards or be appropriate for all applications. Check your safety data sheets to see if a specific glove is recommended. Train your employees to properly use gloves and to always wash their hands after removing gloves.



Latex

- Fits like a second skin
- High level of touch sensitivity
- Very elastic and strong
- Biodegradable
- Works well in high-risk situations involving infectious materials

Vinyl

- Fits loosely; does not conform to hand
- Contains NO latex
- For short-term, low-risk tasks
- Most economical solution
- Best for non-hazardous materials

Nitrile

- Improved fit, but not as good as latex
- High level of touch sensitivity
- Contains NO latex
- Chemical resistant
- Works well in high-risk situations involving infectious materials

Chloroprene

- Also known as Neoprene
- Synthetic material
- Same advantages as nitrile
- Delivers distinct wet grip
- Greater chemical-resistance
- Higher price than latex and nitrile



Sustainable Gloves – From Start to Finish

Looking for gloves that provide dexterity, strength, protection and a way to reduce your solid waste stream?

Try **Kimberly-Clark Spring Green and Kimberly-Clark Forest Green** Nitrile Exam Gloves. Comfortable as well as sustainable, these gloves:

- Enhance Grip
- Save Space
- Reduce Waste

It All Adds Up to a sustainable solution for a greener, safer, more productive lab.



Can be recycled in the RightCycle by Kimberly-Clark Professional Program.

For more information, visit fishersci.com and search for Kimberly-Clark Nitrile Gloves.

Description	Size	Cat. No.	Quantity	Price
Spring Green Nitrile Exam Gloves <ul style="list-style-type: none"> • Powder-free • Ambidextrous • Beaded cuff • 9.5 in. Length • 4.7mil Thick • Exceeds ASTM 2.5 standard for critical defects (pinholes) • 510K approved for medical use 	XS	19-169-067	200 Pack	\$40.67
			10 Pack/Case	\$345.68
	Small	19-169-068	200 Pack	\$40.67
			10 Pack/Case	\$345.68
	Medium	19-169-069	200 Pack	\$40.67
			10 Pack/Case	\$345.68
	Large	19-169-070	200 Pack	\$40.67
			10 Pack/Case	\$345.68
	X-Large	19-169-071	180 Pack	\$40.67
			10 Pack/Case	\$345.68

Description	Size	Cat. No.	Quantity	Price
Forest Green Nitrile Exam Gloves <ul style="list-style-type: none"> • Powder-free • Ambidextrous • Beaded cuff • 3.5mil Thick • Exceeds ASTM 2.5 standard for critical defects (pinholes) 	XS	19-169-072	200 Pack	\$35.54
			10 Pack/Case	\$302.06
	Small	19-169-073	200 Pack	\$35.54
			10 Pack/Case	\$302.06
	Medium	19-169-074	200 Pack	\$35.54
			10 Pack/Case	\$302.06
	Large	19-169-075	200 Pack	\$35.54
			10 Pack/Case	\$302.06
	X-Large	19-169-076	200 Pack	\$35.54
			10 Pack/Case	\$302.06
2X-Large	19-169-077	180 Pack	\$35.54	
		10 Pack/Case	\$302.06	



Less Muscle Effort, Greater Productivity

MICROFLEX[®]

Microflex Ultraform Disposable Nitrile Gloves

Microflex Ultraform Disposable Nitrile Gloves with ERGOFORM technology are designed to reduce hand fatigue, enabling workers to exert less muscle effort and increase productivity. Ultraform also features a unique, soft formulation that forms to your hands effortlessly like a second skin. In field tests, users wearing Ultraform experienced an increase in fine motor task performance compared to a bare hand.

Ansell

ERGOFORM™
Ergonomic Design Technology



Size	Mfr. No.	Cat. No.	Qty/PK	Price
X-Small	UF524XS	19-167-301	300	\$35.05
Small	UF524S	19-167-302	300	\$35.05
Medium	UF524M	19-167-303	300	\$35.05
Large	UF524L	19-167-304	300	\$35.05
X-Large	UF524XL	19-167-305	300	\$35.05

Clean Safely

Decon
Labs, Inc.

Peroxigen ST Sterile, 6% Hydrogen Peroxide

Peroxigen ST from Decon Labs is the ONLY gamma-irradiate sterile peroxide solution available. It is a sterile, double-bagged, ready-to-use 6% Hydrogen Peroxide solution in a convenient trigger spray bottle.

- Made with Water-for-Injection (WFI)
- Lot Specific Documentation ships with each case
- Safe to use, does not leave residues and it breaks down into water and oxygen
- Low toxicity, non-flammable, and zero VOC profile helps to assist in VOC compliance
- Used for cleaning hard, non-porous surfaces in labs and production areas.

Peroxigen 6% Hydrogen Peroxide

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- Safe to use, does not leave residues and it breaks down into water and oxygen
- Low toxicity, non-flammable, and zero VOC profile helps to assist in VOC compliance
- Used for cleaning hard, non-porous surfaces in labs and production areas.



Description	Mfr. No.	Cat. No.	Quantity	Price
Peroxigen ST	9716	04-355-161	Each 12/Case	
Peroxigen, Trigger Bottle, 16 oz.	9816	04-355-160	Each 12/Case	\$37.00 \$386.04

Visit fishersci.com/Deconlabs or fishersci.ca/Deconlabs to learn more.

WONDERING WHAT TO WEAR?

Fisherbrand™



Fisherbrand Safety Apparel

- 1 Bouffant caps** offer basic protection and feature an elastic headband encapsulated in soft poly thread for a comfortable fit.
(Catalog Number 17-100-920)
- 2 Single-use beard covers** are made from 10gsm spunbonded polypropylene and are latex free.
(Catalog Number 17-100-925)
- 3 Safety glasses** provide economical lightweight protection and feature a one-piece lens that absorbs >99.9% of harmful UV light, plus adjustable spatula temples and molded-in sideshields and browguards.
(Catalog Number 19-130-2088)
- 4 Disposable facemasks** feature a nonwoven polypropylene outer layer and a thermally bonded nonwoven polypropylene inner layer for advanced protection and are available with your choice of ear loops or a tie closure.
(Catalog Number 17-100-896)
- 5 General protection lab coats** are made with a latex-free, three-layer SMS construction for high durability and protection against splash and dust and feature three roomy pockets.
(Catalog Number 17-100-841)
- 6 Polyethylene sleeve covers** feature elastic cuffs and measure 18 in. long by 6mil thick.
(Catalog Number 19-170-904)
- 7 Extended cuff nitrile exam gloves** are extra thick, providing exceptional durability and added protection, and are tested for use with exposure to chemotherapy drugs.
(Catalog Number 19-041-170B)
- 8 Shoe covers** are made from polypropylene, protect against dirt, grime and certain dry particulates, and are available with or without an anti-skid sole.
(Catalog Number 17-100-903)
- 9 Anti-static shoe covers** feature a carbon strip that helps eliminate static buildup and are made from 42gms polypropylene.
(Catalog Number 17-100-917)

Visit fishersci.com/fisherbrand to see the complete offering.

Breathe Easy



3M Disposable Comfort Respirators

N-Series Respirators from 3M are NIOSH-approved for use in particulate environments. These cup-shaped respirators are rated as N95 (percent filtration efficiency) and are approved for environments that are free of oil aerosols.

Always follow all the instructions provided with your specific respirator, and always correctly position your respirator on your face and head:

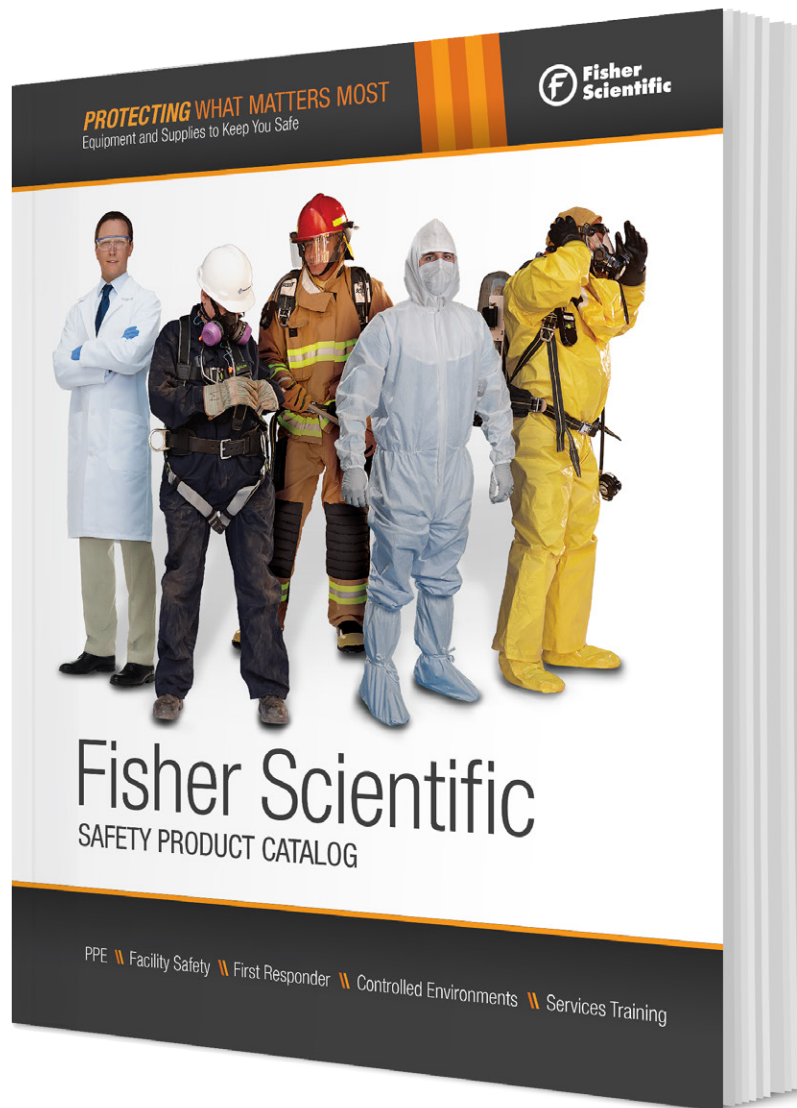
- Upper Strap: Position on the Crown of the Head
- Lower Strap: Position Below the Ears
- Nose Clip: Use Both Hands to Completely Mold to the Shape of the Nose



Description	Certifications	Mfr. No.	Cat. No.	Quantity	Price
Standard Size with Advanced Electrostatic Media†, Welded Strap Attachment, Soft Nose Foam and Adjustable Nose Clip	NIOSH TC-84A-0007	8210	18-999-473	20/Pack	\$36.72
				160/Case	\$158.53
Small Size with Advanced Electrostatic Media†, Welded Strap Attachment, Soft Nose Foam and Adjustable Nose Clip	NIOSH TC-84A-0007	8110s	19-033-524	20/Pack	\$28.90
				160/Case	\$180.57
Standard Size with Braided Headbands, Staple-Free Attachment, Advanced Electrostatic Media†, Welded Strap Attachment, Soft Nose Foam and Adjustable Nose Clip	NIOSH TC-84A-0007	8210Plus	19-130-4825	20/Pack	\$33.64
				160/Case	\$183.81
Standard Size with Advanced Electrostatic Media†, Adjustable Nose Clip and Nose Foam	NIOSH TC-84A-4271	8200	19-168-175	20/Pack	\$20.62
				160/Case	\$105.85

†Advanced Electrostatic Media: Proprietary filter media with electrostatically charged microfibers designed to ease breathing

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