

LAB REPORTER

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COMBATTING CLIMATE CHANGE AND ALLERGIES

Also in This Issue: *E. coli* Helps Instead of Hurts, Allergies Stimulate Brain Activity, Getting Energy from Brewery Wastewater, Making Heart Tissue from Stem Cells, OSHA Lowers Limits for Beryllium

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New Strand of *E. coli* **HELPS** INSTEAD OF HURTS

By Mike Howie

For most of us, *E. coli* is most closely associated with the consequences of eating food or drinking water that wasn't exactly clean. However, most varieties of the bacteria live harmlessly in the intestines of healthy humans and animals. And now researchers from the Novo Nordisk Foundation Center for Biosustainability at the Technical University of Denmark (DTU) have found another use for it: producing a moisturizer for lotions and an ingredient for a range of other products.

Serine is one of the 20 amino acids that form proteins in the human body, and it's used for much more than just producing cosmetics. In the body, serine is important in maintaining health, preventing disease and developing the brain and its functions, and it's necessary for specific central nervous system functions. Elsewhere, serine is used in detergents and tube feeding formula, it's a building block for a number of important chemicals, and it's one of the 30 most promising biological substances that can be used to replace chemicals from the oil industry. In the chemicals industry alone serine can be converted into plastics, dietary supplements and a variety of other products.

A Cheaper Solution

With so many uses for serine, finding a way to sustainably produce large quantities of it at a low cost is a big deal. The current production process uses microbes, which must first be grown in large quantities, to convert methanol and glycine (the latter of which is relatively expensive) into serine. But that's neither quick nor easy. Other amino acids are produced through bacterial fermentation using *E. coli* — a common laboratory workhorse — but serine is toxic to *E. coli*. That's where the researchers at DTU come in: They've created a strain of *E. coli* that can not only survive in large concentrations of serine but also produces record amounts of the substance.

Their first challenge was acclimating *E. coli* cells to living with serine. The researchers used Adaptive Laboratory Evolution (ALE) to do this: They selected cells that were best suited to tolerate serine and slowly introduced them to higher and higher concentrations of it. That may sound simple, but the cells had to be constantly monitored and transferred from one medium to the next at specific times during their growth — a task that would be nearly impossible to perform by hand. To get

it right, the team used specialized ALE robots that are unique to their facilities in Denmark and the United States. The resulting serine-tolerant cells were then genetically optimized to produce serine, and were found to produce 250 to 300 grams of the substance per kilogram of glucose added — the largest productivity for serine ever achieved. They've also seen promising results when using residues from sugar production, like molasses, and other less expensive sugars. In short, they can make a lot of serine with little expense.

Once implemented on a large scale, this new production method will make serine and products containing serine more affordable, and the team is already working on that. The researchers plan to establish a company that will further develop their work, produce large quantities of serine, and commercialize their results.





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HPLC

CHEMICAL SOLVENTS

THE OPTIONS

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- Explosives, PCBs and VOCs
- Petrochemicals, lubricants and hydrocarbons
- Vitamins and plant extracts
- Sugars, nutritional substances and additives
- Drug impurities, antihistamines, drugs of abuse and NSAIDs
- Fungicides, herbicides and pesticides

Chemical Solvents are a high-volume and critical component of successful HPLC assays, and HPLC-grade chemicals will deliver the best results. The American Chemical Society (ACS) sets standards for various grades of chemicals, and most HPLC-grade chemicals have these characteristics in common:

- Meet ACS specifications
- Submicron filtered
- Purified to contain low contaminants and low residues
- Application-specific and function tested
- Consistent from lot to lot
- Low backgrounds; free of extraneous peaks
- Low UV absorbance in critical ranges
- Fluorescence tested for trace impurities
- Function tested for assay, water and minimal residue after evaporation

The Options

Use **standard and affordable HPLC-grade solvents** for routine, high-volume and well-characterized applications (QC for pharmaceutical, food and beverage testing). More specific applications may require UHPLC or LC-MS grade chemicals to meet performance requirements.

Advantages to using the most appropriate grade of solvents for your application (that can offset the additional cost of a higher-purity product):

- Reduces rework
- Offers greater reproducibility in your results
- Facilitates methods transfer
- Improves the sensitivity of instruments
- Reduces erroneous peaks and maximizes peak resolution
- Can extend column life
- Reduces downtime



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Description	Mfr. No.	Cat. No.	Quantity	Price
Buffer Sodium Hypophosphite, pH 2.4, HPLC Mobile Phase for Analysis of Beverage Additives	1468-1	14681	4L	\$124.62
Methanol, HPLC Grade, for Anethole Blank	R4828000-4C	R48280004C	4L	\$84.62
Sulfuric Acid, 0.0100 Normal, HPLC Grade	R8196121-20F	R819612120F	20L	\$41.66
Water, HPLC Grade, ACS Reagent Grade, for UV Spec and LC	9153-32	915332	1L	\$90.25
Water, HPLC Grade, ACS Reagent Grade, for UV Spec and LC	9153-1	91531	4L	\$54.91
Acetone, HPLC Grade	RSOA0011-1C	RSOA00111C	1L	\$124.99
Acetone, HPLC Grade	RSOA0011-4C	RSOA00114C	4L	\$124.99

TARGETING DISEASES WITH MONOCLONAL ANTIBODIES

By Rita Waimer

The use of targeted medical therapies has grown in popularity ever since the mid-1980s, when Orthoclone OKT3 — the first therapeutic monoclonal antibody — was approved and used to prevent the rejection of transplanted kidneys. Nearly thirty years later, 47 monoclonal antibodies are being used in the United States and Europe. Treated diseases range from paroxysmal nocturnal hemoglobinuria to a variety of cancers, multiple sclerosis and even asthma, with an increasing number of therapeutics being approved and used in other countries and markets. By 2020, it's estimated that there will be around 70 approved targeted monoclonal antibody therapies available, with sales worldwide nearing \$125 billion.

Making Recovery Less Painful

Monoclonal antibodies continue to be popular in part simply because the global pharmaceutical market is growing to meet the demands of an aging population and increased standards of living in emerging markets. Moreover, our understanding of disease at the molecular level is rapidly advancing, with genomics and proteomics continually providing new targets for modulating disease. Once the target genes are identified, researchers can quickly create a clinical proof of concept for activating, inhibiting or blocking them with monoclonal antibodies. Since the antibodies are highly specific and usually well-tolerated in humans, there's less risk of unexpected safety issues occurring during human trials than with other therapeutic products — an advantage that often leads monoclonal antibodies to be the first on the market.

Once monoclonal antibodies are used to treat patients their true benefits, along with those of targeted medical therapy in general, become more apparent. Antibodies, by nature, can be developed to target and attack specific types of cells while leaving other cells untouched. In cancer treatment, for example, the target may be a factor, such as a protein or chromosome abnormality that supports the growth and survival of cancer cells. Because they have an affinity for the target when introduced to the body, monoclonal antibody-based medicines can help to reduce the negative side effects that accompany other treatments, such as hair loss or nausea from chemotherapy.

New Methods for Quick Analysis

Back in the lab, researchers are constantly looking for new and better ways of producing and analyzing monoclonal antibodies. Many of these, such as Rituxan, Herceptin, Remicade and Avastin, are biological products made using mammalian cells. They're heterogeneous because of post-translational modifications, and further modifications like oxidation can be introduced during the manufacturing process. These and any other modifications must be identified for the antibody to be approved and manufactured at scale, so a comprehensive characterization of purity, aggregates and variants is essential.

The variant analysis is commonly tested using HPLC or LC-MS. These are rugged, fast analyses and provide detailed information about the monoclonal antibody. The monoclonal antibody can be tested both intact or digested into

fragments for more detailed information about variant. The technique of cutting the monoclonal antibody into fragments allows for easier LC-MS analysis of the variant modifications. Digestion of the monoclonal antibody to produce these fragments can be done using DTT reduction, Papain digestion or IdeS protease digestion. Then the sample is separated using HPLC or LC-MS. A novel supermacro porous reversed-phase column, Thermo Scientific MAbPac RP, has been created for high-resolution separation of these fragments or the intact monoclonal antibody. This new method makes analyzing monoclonal antibodies, fragments and oxidation variants faster and easier than before.

Monoclonal antibody-based treatments have already found their place in the medical world, and advancements like these, which make it easier to develop and deploy new therapeutics, will surely help to expand their effectiveness and popularity.

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Analysis	Description	Columns and Buffers
mAb Capture and Titer Analysis	mAb titer determination (concentration) & screening; mAb capture for analysis workflows	Thermo Scientific MAbPac Protein A
Aggregate Analysis	Routine screening for mAb aggregates and fragments	MAbPac SEC-1 MAbPac HIC-10
Charge Variant Analysis	Routine charge variant profiling/screening, including lysine truncation, deamidation & acylation	MAbPac SCX-10, MAbPac SCX-10RS CX-1 pH Gradient Buffer Kit
Methionine & Tryptophan Oxidation	Targeted analysis of methionine and tryptophan oxidation	MAbPac HIC-20
Antibody Drug Conjugates (ADCs) Analysis	ADC Drug-to-Antibody Ratio (DAR) DAR analysis	MAbPac HIC-Butyl, MAbPac HIC-20, MAbPac RP
Intact mAb & Fragments Analysis	Light chain (LC) and heavy chain (HC) analysis; Fab and Fc analysis; scFc and F(ab') ₂ analysis	MAbPac RP
Sequence & Structural Analysis	Primary sequence analysis; peptide mapping; peptide & glycopeptide structural & linkage analysis	Thermo Scientific Acclaim RSLC 120 C18 Thermo Scientific Accucore 150-C18
Glycan Profiling	Profiling of released glycans	Thermo Scientific GlycanPac AXH-1 GlycanPac AXR-1 Accucore 150-Amide-HILIC

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- Free up valuable laboratory resources



Description	Mfr. No.	Cat. No.	Price
Basic Controller			
Microlab 610 Basic Single-Syringe Dispenser	ML610-DIS	14-816-239	\$5,086.22
Microlab 615 Basic Dual-Syringe Diluter	ML615-DIL	14-816-240	\$5,922.62
Microlab 615 Basic Dual-Syringe Dispenser	ML615-DIS	14-816-241	\$6,172.47
Microlab 615 Basic Continuous Dispenser	ML615-CNT	14-816-242	\$5,434.00
Advanced Controller			
Microlab 625 Advanced Dual Syringe Diluter with Disposable Tip Hand Probe (DTHP)	ML625-DTHP	14-818-142	\$6,039.59
Microlab 620 Advanced Single-Syringe Dispenser	ML620-DIS	14-816-243	\$5,504.86
Microlab 625 Advanced Dual-Syringe Diluter	ML625-DIL	14-816-244	\$6,531.65
Microlab 625 Advanced Dual-Syringe Dispenser	ML625-DIS	14-816-245	\$6,717.59
Microlab 625 Advanced Continuous Dispenser	ML625-CNT	14-816-246	\$6,097.10

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Coulometric CG Catholyte Solution for Cells with a Diaphragm	RK130000110	110mL	\$55.00
Coulometric AG Oven Anolyte Solution or Titration with an Oven	RK140000500	500mL	\$100.00
Composit T5 General Use for One-Component Volumetric Titrations	RK2000001C	1L	\$108.00
Composit T2 One Component for Volumetric Titrations with Lower Moisture Content	RK2100001C	1L	\$100.00
Composit K5 One Component for Volumetric Titrations of Aldehydes and Ketones	RK220000-1C	1L	\$118.00
Methanol Accelerate Medium for One-Component Volumetric Titrations	RK3000001C	1L	\$43.00
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Description	Application	Mfr. No.	Cat. No.	Quantity	Price
2,2,4-Trimethylpentane, ≥99%	HPLC	34862-4X4L	6000864	4 x 4L	\$1,001.09
2-Propanol, 99.9%	HPLC	34863-4X4L	6000129	4 x 4L	\$522.21
Acetone, ≥99.8%	HPLC	34850-4X4L	6000205	4 x 4L	\$539.72
Acetonitrile, ≥99.9%	HPLC	34998-4X4L	6000235	4 x 4L	\$1,457.45
Acetonitrile, ≥99.9%	HPLC (Gradient)	34851-4X4L	6000247	4 x 4L	\$1,184.50
Chloroform, ≥99.8%, amylene stabilized	HPLC	34854-4X4L	6001739	4 x 4L	\$715.85
Cyclohexane, ≥99.7%	HPLC	34855-4X4L	6000476	4 x 4L	\$817.82
Dichloromethane, ≥99.8%, amylene stabilized	HPLC	34856-4X4L	6000496	4 x 4L	\$555.17
Diethyl Ether, ≥99.9%, inhibitor-free	HPLC	309966-4x4L	6000519	4 x 4L	\$675.68
Dimethyl sulfoxide, ≥99.7%	HPLC	34869-4X4L	6002581	4 x 4L	\$1,710.17
Ethyl acetate, ≥99.7%	HPLC	34858-4X4L	6000575	4 x 4L	\$626.24
Heptane, ≥99%	HPLC	34873-4X4L	6001021	4 x 4L	\$963.05
Hexane, ≥97% (GC)	HPLC	34859-4X4L	6001051	4 x 4L	\$764.26
Methanol, ≥99.9%	HPLC	34860-4X4L	6000943	4 x 4L	\$485.65
Methanol, ≥99.9%	HPLC (Gradient)	34885-4X4L	6000959	4 x 4L	\$498.01
Tetrahydrofuran, inhibitor-free, ≥99.9%	HPLC	34865-4X4L	6001674	4 x 4L	\$1,071.20
Toluene, 99.9%	HPLC	34866-4X4L	6001711	4 x 4L	\$490.80
2-Propanol	LC-MS	34965-4X4L	6000136	4 x 4L	\$625.96
Acetonitrile	LC-MS	34967-4X4L	6000251	4 x 4L	\$1,357.70
Methanol	LC-MS	34966-4X4L	6000955	4 x 4L	\$493.75
Water	LC-MS	39253-4X4L	6002698	4 x 4L	\$320.36
2,2,4-Trimethylpentane	Pesticide	34499-4x4L	6000109	4 x 4L	\$948.60
Acetone	Pesticide	34480-4X4L	6000212	4 x 4L	\$478.04
Cyclohexane	Pesticide	34496-4X4L	6000481	4 x 4L	\$810.11
Ethyl acetate	Pesticide	31063-4X4L	6000582	4 x 4L	\$506.38
Heptane	Pesticide	34495-4X4L	6000632	4 x 4L	\$932.05
Hexane	Pesticide	34484-4X4L	6001057	4 x 4L	\$699.29
Petroleum ether	Pesticide	34491-4X4L	6001180	4 x 4L	\$587.58

Environmentally Safe



MP Biomedicals Liquid Scintillation Cocktails

MP Biomedicals provides a complete line of environmentally safe* liquid scintillation cocktails formulated for specific applications and maximum performance. Whether you require a general-purpose or a large-volume cocktail, MP offers a non-hazardous, non-toxic, ready-to-use formulation to meet your needs.

- Biodegradable, safe-to-handle
- Non-toxic, non-hazardous
- One-step, ready-to-use

*MP Biomedicals liquid scintillation cocktails are environmentally safe in accordance with EPA regulations (Resources Conservation and Recovery Act, Title 40, CFR 260-263).

CytoScint ES

CytoScint has the highest tritium performance and one-step filter counting and can be used for TLC scrapings and other solubilized samples without pretreatment. It's also excellent for small-volume aqueous samples and requires no chemiluminescence waiting period.

Description	Cat. No.	Quantity	Price
	88245301	1 gal.	\$276.57
CytoScint ES	88245304	4 x 1 gal.	\$547.89
	ICN88245305	5 gal.	\$649.69

UniverSol ES

This LSC provides maximum "gelling" efficiency. As a traditional "dual-phase" cocktail, UniverSol ES is formulated to work over a wide variety of requirements, and when diluted with water it allows concentrated solutions that normally precipitate to be counted as clear homogenous solutions.

Description	Cat. No.	Quantity	Price
	88248001	1 gal.	\$258.10
UniverSol ES	88248004	4 x 1 gal.	\$549.24
	ICN88248005	5 gal.	\$811.02

EcoLume

EcoLume provides maximum efficiency for large-volume aqueous and organic samples including deionized water, PBS, HCl and urine. It will not gel or phrase with the addition of sample to maximum load capacity (40%).

Description	Cat. No.	Quantity	Price
	88247001	1 gal.	\$276.75
EcoLume	88247004	4 x 1 gal.	\$739.16
	ICN88247005	5 gal.	\$649.16



BetaMax ES

This formulation provides maximum efficiency for counting beta particles in non-aqueous samples, samples dried on solid supports and organic samples extracted from aqueous mixtures.

Description	Cat. No.	Quantity	Price
	88002001	1 gal.	\$214.80
BetaMax ES	MP188002004	4 x 1 gal.	\$545.25
	MP188002005	5 gal.	\$615.90

EcoLite (+)

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Description	Cat. No.	Quantity	Price
	88247501	1 gal.	\$277.36
EcoLite(+)	88247504	4 x 1 gal.	\$733.34
	ICN88247505	5 gal.	\$930.41

ALLERGIES STIMULATE BRAIN ACTIVITY

By Kevin Ritchart

A new study published in the journal *Frontiers in Cellular Neuroscience* has found that there may be more to the physiology of allergies than typical physical reactions. Allergens can actually have an impact on your brain.

Researchers studied the brains of mice and found that those exposed to a grass pollen allergen produced more neurons than the control group. The study examined the hippocampus, which is the part of the brain responsible for forming new memories and where neurons continue to form throughout life.

Thanks for the Memories

When an allergic reaction occurred, the number of new neurons in the hippocampus increased, which begs the question: what, if any, impact can the consequences of allergies have on memory?

To learn more about the potential impact on memory, researchers are taking a closer look at the immune cells of the brain, known as microglia. Researchers found that the same allergic reaction that triggers the body's immune system has the opposite

effect on the microglia in the brain. Rather than being stimulated to act, the resident immune cells in the brain were actually deactivated during an allergic reaction.

“It was highly unexpected to see the deactivation of microglia in the hippocampus,”

said **Barbara Klein**, one of the authors of the study. “Partly because other studies have shown the reverse effect on microglia following bacterial infection.

“We know that the response of the immune system in the body is different in case of an allergic reaction versus a bacterial infection. What this tells us is that the effect on the brain depends on the type of immune reaction in the body.”

A recent World Health Organization report estimated that between 10 and 30 percent of the population suffers from allergic rhinitis, more commonly known as hay fever. So continuing to learn more about the physiology of the immune response to allergens ultimately will benefit a large

segment of people around the world.

Making a Connection

Allergic reactions also are responsible for an increase in neurogenesis, or the growth and development of nervous tissue. Thus the question for researchers now becomes whether people who are prone to allergies experience different brain progression than those who are not susceptible.

Further research also aims to solidify the link between advancing age and a reduction in the number and type of neurons produced during an immune response. The type of immune response resulting from the introduction of an allergen is thought to have diverse effects on not just the brain but the central nervous system as a whole.

In the future, researchers would like to conduct additional studies to gauge neuron production in the brain throughout the course of a more persistent immune response and further understand the connection between peripheral immune activation and the function of the central nervous system.

SECURING GENOMIC SAMPLES AGAINST CONTAMINATION

There are a number of challenges in genomics research, but the last thing you want to struggle with is keeping your samples free from contamination, especially contamination that comes from your sample containers and pipette tips. That's why the Thermo Scientific team works to produce high-quality containers and tips that guard against contamination.

Contaminant-Free Containers

The new Thermo Scientific Sterilin 30mL Universal Sample Containers are certified to be free of RNase, DNase, human DNA and pyrogens, helping to ensure that your container will not be a source of contaminating DNA. They're ideally suited for managing large-volume samples common in genomic and molecular applications.

To make handling easy, Sterilin Containers are free-standing, can be centrifuged up to 9,500 x g, and are individually lot numbered to support traceability. Plus, the Thermo Scientific team routinely tests its containers for compliance at ambient temperatures by submitting them to rigorous leak tests — BS EN 14254 and 95kPA — to ensure that every valuable sample is safely and securely maintained.

Robotic Tips for Automation

Automated liquid handling in genomics applications has become significantly more popular over the past decade thanks to high-throughput sample processing. Integrating automation with other molecular lab applications reduces cost per sample and offers plug-and-play implementation. This shift from manual to automated work has increased the need for automated liquid



handlers and robotic tips — the latter of which represent a physically small but highly important piece in the automated genomics workflow.

Purifying your genomic DNA is the first step in any genomics application, and choosing the right pipette tip for your liquid handling workstation based on sample type will help you get off to a smooth start. The Thermo Scientific brand offers standard and specialized tips that support purification of any sample type.

Thermo Scientific robotic tips are designed to help you transfer defined quantities of reagents to reaction wells quickly, accurately and reliably. The full line of tips features over 300 products designed to fit over 50 liquid handling workstations, making them a convenient choice for your lab. Moreover, Thermo Scientific tips are tested and validated on the actual workstations intended for their use. And similar to the brand's containers, its tips undergo a rigorous 15-point quality control process to help ensure that every tip will deliver the reliability and consistency the industry demands.

With Thermo Scientific tips, you can choose the exact options you need, including:

- Sterile or nonsterile
- Filtered or unfiltered
- Conductive (liquid-sensing) or clear
- Regular or wide bore
- Regular or extended length
- Regular or low retention

With over 30 years of experience in manufacturing consumables, the Thermo Scientific team is ready to help secure your genomics work against contamination.



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Unique, complete protection for your samples

ART barrier pipette tips provide 100% security against aerosol and liquid contamination.

They shouldn't be confused with traditional filter tips.

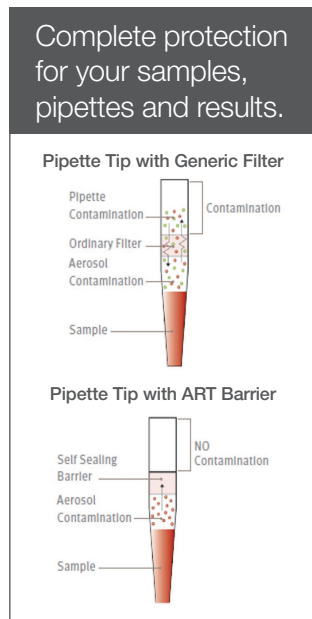
Self-sealing Thermo Scientific ART barrier tips are the only tips that seal completely to prevent contamination of your pipettes and associated samples, by blocking:

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- Liquids
- Radioactive isotopes
- Biological materials

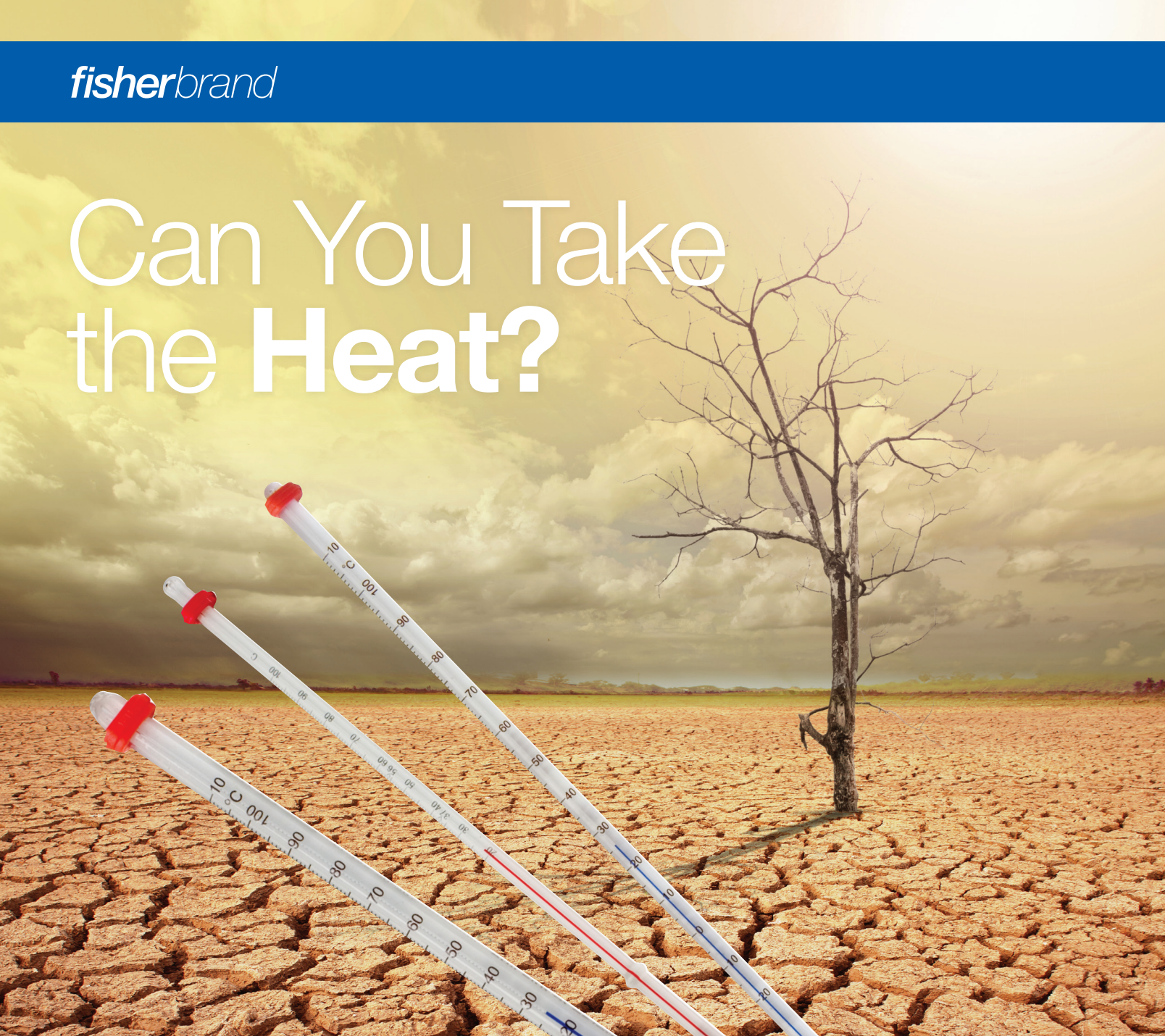


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Fisherbrand Reusable Glass Media Bottles with Caps are ideal for a variety of general laboratory applications. They feature a convenient wide opening, enhanced graduations and a clear (natural), drip-free, replaceable polypropylene pour ring.

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- Autoclavable (to 140°C)
- Permanent white enamel marking spot
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- Linerless blue polypropylene caps



Description	Cat. No.	Quantity	Price
100mL (3.3 oz.)	FB800100	10/Case	\$93.83
250mL (8.45 oz.)	FB800250	10/Case	\$104.30
500mL (17 oz.)	FB800500	10/Case	\$117.32
1000mL (33.8 oz.)	FB8001000	10/Case	\$154.74
2000mL (67.6 oz.)	FB8002000	1/Case	\$39.95
5000mL (169.1 oz.)	FB8005000	1/Case	\$132.11
10000mL (338.1 oz.)	FB80010000	1/Case	\$229.85

Visit fishersci.com or fishersci.ca for more information.

COMBATTING CLIMATE CHANGE AND ALLERGIES

By Christina Phillis

Sponsored by the Thermo Scientific brand

If you've noticed your allergies lasting longer than normal lately, you can't place all the blame on your neighbor's cat. Higher-than-normal temperatures caused by climate change are elongating allergy season and lowering air quality, worsening allergies for about 25 million Americans. According to a 2010 report produced by the Asthma and Allergy Foundation of America (AAFA) and the National Wildlife Federation (NWF), pollen season lasted 11 to 27 days longer between 1995 and 2011 due to warmer temperatures in the U.S.

Also contributing to the severity of allergy season are carbon dioxide levels in the atmosphere, which have increased by about 40 percent since the 1700s. Since carbon dioxide is required for plant survival, the increased levels can cause plants to grow faster and larger. Ragweed, which is the allergen that causes hay fever in 75 percent of sufferers, grows faster, produces more pollen per plant, and exhibits higher allergenic content because of higher carbon dioxide levels. When researchers in one study increased carbon dioxide levels from current levels, production of Amb a 1, the allergenic protein in ragweed, increased by 70 percent. Larger ragweed plants that produce more pollen later into the fall also add to the longevity of allergy season. If fossil fuel emissions continue at their current level, pollen production is expected to increase by 60 to 100% by around 2085.

Where and when plants can grow is also in flux as the growing season gets longer. Spring arrives an average of 10 to 14 days earlier than it did 20 years ago, and many plants, unable to tolerate the hotter conditions, are spreading north to higher elevations. The habitat for oaks and hickories, two highly allergenic tree species, could significantly expand under these conditions.

Reducing Allergy Risks

The report from the AAFA and the NWF makes recommendations on what can be done to reduce allergy risks caused by climate change. Relying more on solar energy as opposed to burning fossil fuels has the dual effect of reducing global warming and improving air quality.

Placing restrictions on the planting of pollen-producing species of trees is another option, but any effects may be significantly delayed due to the long life spans of trees. The report also points out that this option would have to be weighed against the value of the plants for wildlife, among other natural benefits.

Urban design that incorporates more parks and trees, reflective coatings on structures, and "green" roofs on buildings would decrease the amount of heat generated in cities, thereby decelerating the production of pollen.

The Toll of Allergies

According to the American College of Allergy, Asthma, and Immunology, allergies affect 50 million people in the United States — fully 30 percent of adults and 40 percent of children — and that number is increasing. Allergies are the fifth leading chronic disease in the U.S. in people of all ages and the third most common chronic disease in children under 18 years old. According to a brief produced by the National Center for Health Statistics, 11.1 million people were diagnosed with allergic rhinitis in 2012. Americans with nasal swelling spent roughly \$17.5 billion on health care costs and lost more than 6 million work and school days in 2010, according to the Academy of Allergy and Asthma in Primary Care.

Finding Allergy Relief

While allergy sufferers patiently wait for improvements in air quality and climate, there is a fairly new treatment available — and it doesn't require getting shots once a week. In 2014 the FDA approved Ragwitek, an immunotherapy developed by Merck, as the first allergen extract to be administered sublingually, or under the tongue, to treat short ragweed pollen-induced allergic rhinitis, more commonly known as hay fever.



“The approval of Ragwitek offers millions of adults living with ragweed pollen allergies in the United States an alternative to allergy shots to help manage their disease,”

said Karen Midthun, MD, director of the FDA’s Center for Biologics Evaluation and Research.

Ragweed pollen season in the United States can start as early as August and last until November. Those suffering from allergies brought on by ragweed pollen display the following symptoms: sneezing, runny or itchy nose, stuffy or congested nose, or itchy and watery eyes.

“During the season, many patients with moderate to severe allergic rhinitis experience nasal and ocular allergy symptoms at their worst while taking symptom-relieving medication. These patients often have multiple sensitivities,” said David Skoner, MD, director, Division of Allergy and Immunology, Allegheny Health Network, and a clinical investigator in Merck’s sublingual allergen immunotherapy tablet program.

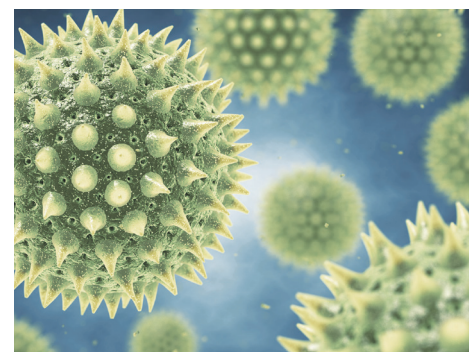
Clinical Study of Ragwitek

Five clinical studies were conducted to assess the safety and efficacy of Ragwitek in 1,700 adults. After the studies were concluded, Merck submitted a biologics license application to the Allergenic Products Advisory Committee to gain FDA approval.

To establish efficacy in these studies, rhinoconjunctivitis daily symptom scores (DSS) and daily medication scores (DMS) were self-reported and the sum of both scores was combined into the total combined score (TCS).

The FDA considers an allergen immunotherapy effective if the TCS has an average difference relative to placebo of less than or equal to -15 percent and if the upper bound of the 95 percent confidence interval is less than or equal to -10 percent.

The first study compared Ragwitek to a placebo in patients 18 through 50 years of age. Approximately 22 percent had mild asthma and required at most a low daily dose of an inhaled corticosteroid. In addition to short ragweed, 85 percent were sensitized to other allergens. The study showed there was a significant reduction in nasal and ocular symptoms and a decrease in the use of symptom-relieving allergy medication. The difference between Ragwitek and the placebo was -26 percent. The 95 percent confidence interval was



between -38.7 percent and -14.6 percent.

Patients can start taking Ragwitek as early as 12 weeks before the onset of allergy season and throughout to combat its effects. The first dose is administered under the supervision of a physician who monitors the patient for signs or symptoms of a severe systemic or severe local allergic reaction. If the first dose is administered without any issues, the patient can start taking Ragwitek at home.

Whether combatting the symptoms of allergies directly or working to stave off the escalating risks of allergies due to climate change, greater research in both areas can only help.

This issue of Lab Reporter is sponsored by **thermo**scientific

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Gilson PIPETMAN L Pipettes

The new PIPETMAN L combines the legendary robustness of the PIPETMAN Classic with a newly designed body and a state-of-the-art locking mechanism that guarantees no accidental volume changes during your pipetting cycles. Based on ergonomics, comfort and traceability research, the PIPETMAN L is designed to ensure a perfect fit and reduce tension when used for extended time periods.

- Adjustable tip ejector provides comfort for right- and left-handed users
- 2D identification code for optimum traceability of product information
- Universal tip holder — fits most brands of tips
- Lightweight and extremely low force to reduce repetitive stress injuries



Model	Volume Range	Color Code	Mfr. No.	Cat. No.	Price
Stainless-Steel Tip Ejector					
P2L	0.2 to 2µL	Orange	FA10001M	FA10001MG	\$399.36
P10L	1 to 10µL	Red	FA10002M	FA10002MG	\$393.25
P20L	2 to 20µL	Pale Yellow	FA10003M	FA10003MG	\$399.36
P100L	10 to 100µL	Salmon	FA10004M	FA10004MG	\$399.36
P200L	20 to 200µL	Yellow	FA10005M	FA10005MG	\$399.36
P1000L	100 to 1000µL	Blue	FA10006M	FA10006MG	\$399.36
Plastic Tip Ejector					
P2L	0.2 to 2µL	Orange	FA10001M	FA10001PG	\$393.25
P10L	1 to 10µL	Red	FA10002M	FA10002PG	\$393.25
P20L	2 to 20µL	Pale Yellow	FA10003M	FA10003PG	\$393.25
P100L	10 to 100µL	Salmon	FA10004M	FA10004PG	\$393.25
P200L	20 to 200µL	Yellow	FA10005M	FA10005PG	\$393.25
P1000L	100 to 1000µL	Blue	FA10006M	FA10006PG	\$393.25
Without Tip Ejector					
P5000L	0.5 to 5mL	Purple	FA10007	FA10007G	\$393.25
P10mL	1 to 10mL	Pale Blue	FA10008	FA10008G	\$393.25

PIPETMAN L is available in single-channel, multichannel and fixed-volume models. Visit fishersci.com for a full product listing.

Note: Products not available through Fisher Scientific in Canada.

One Tip, Any Pipette



Gilson EXPERT Universal Pipette Tips

Designed to fit leading pipette brands, EXPERT Tips allow you to stock one brand of tip with practical packaging options so you can save time, money and bench space.



EXPERT Tips Offer:

- Clear packaging for easy identification
- Color-coded packaging corresponds to pipette volume
- Graduated for quick volume checks
- Economical packaging at an economical price

Packaging Options

- Racked tipacks: available in filter, sterilized and autoclavable racks
- Reload system
- Bulk tips
- Mega pack — ideal for multi-channel pipetting

Description	Cat. No.	Quantity	Price
EF10ST-LR Sterilized Filter Tips, Low Retention	F1731032G	960/Pack	\$74.95
EFL10ST-LR Sterilized Filter Tips, Low Retention	F1732032G	768/Pack	\$74.95
EF20ST-LR Sterilized Filter Tips, Low Retention	F1733032G	768/Pack	\$74.95
EF100ST-LR Sterilized Filter Tips, Low Retention	F1734032G	768/Pack	\$74.95
EF200ST-LR Sterilized Filter Tips, Low Retention	F1735032G	768/Pack	\$74.95
EF200ST XL Tri-Fit Sterilized Filter Tips, Low Retention	F1735042G	384/Pack	\$37.47
EF300ST-LR XL Sterilized Filter Tips, Low Retention	F1736032G	384/Pack	\$37.47
EF1000ST-LR XL Sterilized Filter Tips	F1737032G	384/Pack	\$37.47
E10 Tipack	F1731002G	960/Pack	\$38.21
EL10 Tipack	F1732002G	768/Pack	\$38.00
E200 Tipack	F1733002G	768/Pack	\$38.26
E300 Tipack	F1736002G	768/Pack	\$38.26
E1000 XL Tipack	F1735002G	384/Pack	\$19.68
E10ST Sterilized Tipack	F1731012G	960/Pack	\$43.48
EL10ST Sterilized Tipack	F1732012G	768/Pack	\$43.53
E200ST Sterilized Tipack	F1733012G	768/Pack	\$43.53
E300ST Sterilized Tipack	F1736012G	768/Pack	\$43.53
E1000ST XL Sterilized Tipack	F1735012G	384/Pack	\$21.77
EL10 EcoPack	F1734512G	1,000/Pack	\$18.52
E200 EcoPack	F1739312G	1,000/Pack	\$18.52
E10 Gel Loading Flat Tips (0.17mm OD)	F1731182G	200/Pack	\$62.20
E10 Gel Loading Round Tips (0.37mm OD)	F1731282G	200/Pack	\$26.30
E200 Gel Loading Flat Tips (0.37mm OD)	F1733182G	200/Pack	\$62.20
E200ST Sterilized Gel Loading Flat Tips (0.37mm OD)	F1733382G	200/Pack	\$62.20
E200 Gel Loading Round Tips (0.57mm OD)	F1733282G	200/Pack	\$26.30
E200ST Sterilized Gel Loading Round Tips (0.57mm OD)	F1733482G	200/Pack	\$26.30

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Qorpak Straight Sided Round Jars are now available in borosilicate glass, bringing thermal stability, resistance to chemical corrosion and durability to all your critical applications.

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- Identified by the Qorpak logo on the bottom of the jar



Description	Mfr. No.	Cat. No.	Quantity	Price
240mL (8 oz.), No Caps	268240	02-913-103	12/Case	\$50.00
240mL (8 oz.), Attached Caps (Green Thermoset F217 with PTFE Liner)	271012	02-913-104	12/Case	\$98.00

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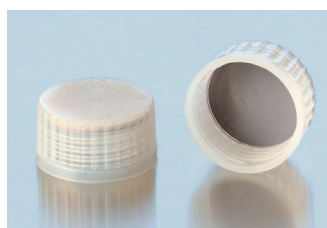
WHEATON

WHEATON DURAN GL 45 Screw Caps and Closures

Simplify your daily tasks with WHEATON's complete line of autoclavable DURAN Screw Caps for GL 45 containers, and pair them with DURAN 3.3 borosilicate glass lab and media bottles for optimal performance.



Description	Cat. No.	Quantity	Price
GL 45 Screw Cap with PTFE Venting Membrane, Temperature Resistance: -40° to +140°C, Blue, Sterile Storage of Liquids	09-841-268	5/Pack	\$52.90



GL 45 Premium Cap, PTFE/Silicone Membrane, Temperature Resistance: -196° to +260°C, Clear, High Purity and High Performance	09-841-062	5/Pack	\$124.40
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GL 45 PBT Open-Top (Aperture) Cap, Temperature Resistance: -45° to +180°C, Red, Open Topped for Septa or Connectors	09-841-256	10/Pack	\$67.12
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GL 45 PBT Cap, PTFE/Silicone Seal, Temperature Resistance: -45° to +180°C, Red, High Temperature and Airtight	09-841-271	10/Pack	\$106.13
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GL 45 Cap with 2 Hose Connectors, Temperature Resistance: -45° to +180°C, Blue, For Tubing Diameters 6-9mm	05-719-310	2/Pack	\$98.33
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Duran Connection System GL 45 Screw Cap with 2 or 3 Ports (GL14 thread), Temperature Resistance: -45° to +180°C			
GL 45 Screw Cap with 2 GL 14 Ports	09-841-110	2/Pack	\$120.43
GL 45 Screw Cap with 3 GL 14 Ports	09-841-111	2/Pack	\$129.33
GL 14 Screw Cap Hose Connection	09-841-112	2/Pack	\$16.38
GL 14 Screw Cap	09-841-113	2/Pack	\$9.53
GL 14 Port Insert, 1.6mm	09-841-116	1/Pack	\$29.04
GL 14 Port Insert, 3.0mm	09-841-117	1/Pack	\$32.38
GL 14 Port Insert, 3.2mm	09-841-118	1/Pack	\$29.04
GL 14 Port Insert, 6.0mm	09-841-119	1/Pack	\$29.04
GL 14 Membrane Filter (for pressure equalization), 0.2µm	09-841-115	2/Pack	\$33.88

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WHEATON

WHEATON Liquid Scintillation Vials

WHEATON Scintillation Vials are compatible with all scintillation counters that accommodate 20mL vials. Choose from glass, HDPE or PET vials, available with a variety of cap and liner materials. Screw caps are attached to vials to maintain cleanliness. See promotion details below.



Glass Liquid Scintillation Vials

- Made from WHEATON 180 low potassium borosilicate glass
- Background counts are consistent and low
- Ultraviolet transmission is high

Description	Mfr. No.	Cat. No.	Quantity	Price
White PE Cap with Foamed PE Liner	986540	03-341-25D	500/Case	\$306.60
White PE Cap with Metal Foil Liner	986541	03-341-25E	500/Case	\$309.96
Clear PP Cap with Foamed PE Liner	986560	03-341-25K	500/Case	\$316.16
Clear PP Cap with Metal Foil Liner	986561	03-341-25L	500/Case	\$321.83
White Urea Cap with PE Disc Liner	986548	03-341-25H	500/Case	\$368.76
White Urea Cap with Polyseal Cone Liner	986546	03-341-25J	500/Case	\$390.71
Clear Urea Cap with PE Disc Liner	986568	03-341-25P	500/Case	\$367.08



HDPE Liquid Scintillation Vials

- High-density polyethylene with lightweight walls for increased counting efficiency
- Manufactured to precise tolerances to avoid jamming

Description	Mfr. No.	Cat. No.	Quantity	Price
White PP Cap with Foamed PE Liner	986700	03-341-72	500/Case	\$221.83
White Urea Cap with Metal Foil Liner	986702	03-341-72B	500/Case	\$265.82
White PE Cap with No Liner	986704	03-341-72C	500/Case	\$250.54
White Urea Cap with Foamed PE Liner	986706	03-341-72D	500/Case	\$361.82



PET Liquid Scintillation Vials

- Low permeability to solvents
- Minimal background counts
- Clarity of glass with the safety of plastic
- Vials can be safely incinerated — no harmful gas is generated

Description	Mfr. No.	Cat. No.	Quantity	Price
White PP Cap with Foamed PE Liner	986730	03-341-73	500/Case	\$266.24
White PP Cap with Metal Foil Liner	986731	03-341-73A	500/Case	\$264.58
White PE Cap with No Liner	986734	03-341-73C	500/Case	\$271.34
White Urea Cap with Polyseal Cone Liner	986736	03-341-73D	500/Case	\$398.74

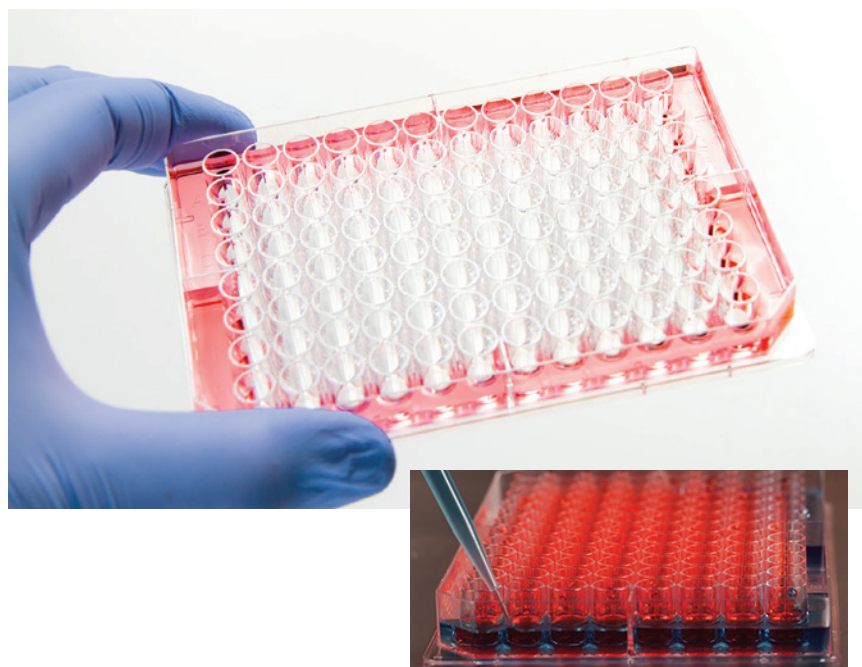
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Description	Cat. No.	Quantity	Price
96-Well, Clear, 400µL, Treated, Sterile, With Lid	14-387-220	Case of 50*	\$101.50
	14-387-221	Case of 160†	\$305.50
96-Well, Clear, 400µL, Treated, Sterile, Without Lid	14-387-222	Case of 50*	\$94.76
	14-387-223	Case of 160†	\$255.25
96-Well, Clear, 400µL, Untreated, Sterile, With Lid	14-387-224	Case of 50*	\$86.62
	14-387-225	Case of 160†	\$249.23
96-Well, Clear, 400µL, Untreated, Sterile, Without Lid	14-387-226	Case of 50*	\$66.52
	14-387-227	Case of 160†	\$227.11
96-Well, Clear, 400µL, Untreated, Nonsterile, With Lid	14-387-228	Case of 160†	\$211.00
96-Well, Clear, 400µL, Untreated, Nonsterile, Without Lid	14-387-229	Case of 160†	\$219.08

*Products packaged as 50/Case are individually wrapped

†Products packaged as 160/Case are in packs of 10

BREWERY WASTEWATER: A NEW SOURCE OF ENERGY

By Moira Bell

If you thought breweries were trendy now, just wait until they start making renewable energy. That is exactly what Avery Brewing and engineers from the University of Colorado (CU) at Boulder will be doing in a long-term pilot. CU Boulder engineers figured out a way to create the carbon-based materials needed to make energy storage cells using a biological organism cultivated in brewery wastewater. This is an innovative new bio-manufacturing process that could have the double benefit of reducing wastewater treatment costs for breweries and providing a more cost-effective way for creating renewable, naturally derived fuel cell technologies.

An Untapped Resource

The idea of converting biological materials or biomass into carbon-based battery electrodes is not a new concept. Some energy industry sectors are already converting timber into energy storage. The problem is obtaining naturally occurring biomass that is easy to convert. It's usually in short supply, and even if it's available, biomass like wastewater is expensive and difficult to optimize because it's been over processed and filtered.

But the sugar-rich wastewater produced by a brewery is the perfect environment to cultivate the fast-growing fungus *Neurospora crassa* while controlling its chemical and physical processes from the beginning. The naturally derived lithium-

ion battery electrodes that result are the most efficiently created to date. And it doesn't hurt that during the process, the wastewater is cleaned.

"The novelty of our process is changing the manufacturing process from top-down to bottom-up," said Zhiyong Jason Ren, associate professor, CU Boulder. "We're bio-designing the materials right from the start."

On a larger scale, breweries have the potential to significantly reduce their municipal wastewater costs while manufacturers would get a cost-effective incubating medium for advanced battery technology components.

"Breweries use about seven barrels of water for every barrel of beer produced," said Tyler Huggins, a graduate student in CU Boulder's Department of Civil, Environmental and Architectural Engineering and lead author of the new study. "And they can't just dump it into the sewer because it requires extra filtration."

To understand the larger impact, consider that California craft brewers alone use 558 million gallons of water to process beer and 93 million gallons of water to make beer each year, according to a report by the Public Policy Institute of California.

Reaping the Benefits

Huggins and study co-author Justin Whiteley are hoping to commercialize the technology with the creation of their

Boulder-based company, Emergy. They've also filed a patent for the process. Their partnership with Avery Brewing will allow them to try out the new process and determine its scalability.

"We see large potential for scaling because there's nothing required in this process that isn't already available," said Huggins.

Brewing Innovation

Avery Brewing and the engineers at CU Boulder are not the only ones trying to turn waste into something productive. New Belgium Brewing Co. has learned how to power its 292kW combined heat and power engine using a byproduct of its wastewater cleaning process. The wastewater goes through a series of aerobic and anaerobic basins, and the methane gas produced during this process is harvested and piped to the brewery to power the engine.

For breweries looking for a premade solution, Cambrian Innovation sells the EcoVolt system, which uses a proprietary bioelectric technology to treat brewing wastewater while generating biogas energy.

Just as there seems to be an endless number of breweries and new flavors of beer cropping up lately, the opportunities to create energy from brewery wastewater continue to rise.



Supporting Genomics Innovation

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Purchase a Heracell VIOS 160i CO₂ incubator and receive an additional 15% discount on our general purpose centrifuge tissue culture packages.

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Thermo Scientific Heracell VIOS 160i CO₂ Incubators

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- Complete contamination control including ISO Class 5 HEPA-filtered air, on-demand high-temperature sterilization, and optional easy-to-maintain copper

Thermo Scientific General Purpose Centrifuges

Fits in. Stands out.

- Designed for solid performance and consistent results
- Rotor innovations include push-button Auto-Lock rotor exchange for application flexibility and lightweight Fiberlite carbon fiber rotors with superior performance and ergonomics

¹ Restrictions apply. Please see thermofisher.com/spinitwarranty for complete warranty offer and coverage details.

For more information on this and other promotions, visit fishersci.com/promotions

ARE YOU USING THE BEST BALANCE TO WEIGH YOUR SAMPLES?

OHAUS Explorer Semi-Micro Balances

Semi-micro balances — those with a readability of 0.01mg — are frequently regarded as overkill or recommended only for extremely sensitive weighing applications. But are they, in fact, the right instrument for the job?

While the readability of a balance does not ensure its accuracy, a balance with a smaller readability will typically offer greater accuracy than one with a larger readability. For example, a balance capable of reading to 0.1mg will provide a more precise reading than a balance that only measures to 1mg.

So let's say that you wish to accurately measure the samples that weigh 0.05g (50mg) — which balance would you choose?

A balance with 1mg readability? Or one that reads to 0.1mg?

The correct answer first requires you to define your maximum uncertainty tolerance, or how much of a difference between the measurement and the absolute truth will be acceptable. Do you require a maximum uncertainty of one percent of the sample weight? Or perhaps 0.1 percent?

Many users, including the United States Pharmacopeia (USP), choose balances based on the minimum weight convention; this provides a relative uncertainty that is less than the published value. Adopting a minimum weight requirement can help to ensure that your samples are being weighed according to your acceptable criteria for accuracy. You can ensure a maximum measurement uncertainty by choosing a minimum weight for your sample size and any heavier samples (within the range for the balance).

To determine the minimum weight, divide the standard deviation of the balance's repeatability (Rstd) by the desired accuracy. In some cases, a buffer factor is applied (USP uses 2 x Rstd, just to be safe).

For a sample weighing approximately 50mg, one might assume that a balance readability of 0.1mg is sufficient, but is this correct? In this example, a maximum uncertainty tolerance of 0.1 percent with an Rstd of 0.1mg $[(2 \times 0.1\text{mg}) / 0.001]$ suggests a minimum weight of 200mg. So a balance with 0.1mg readability would not meet the stated accuracy requirements — the balance would need to deliver readability of 0.01mg.

That readability level requires a semi-micro balance such as the Explorer 5 Series from OHAUS. In fact, OHAUS Explorer semi-micro balances are guaranteed to weigh samples as small as 20mg (and, with proper qualification, down to 10mg) while maintaining compliance with USP41 minimum weight standards.

The OHAUS Explorer semi-micro balances also incorporate anti-static devices to help ensure maximum weighing accuracy — because static buildup can cause substantial error when weighing small samples. In addition, the Explorer Series is available with automatic draft shield doors, a large color touchscreen display, an intuitive user interface, and other features that support GMP/GLP as well as regulatory compliance and traceability.



Content Provided by:



Intelligent Evaporation



Heidolph Hei-VAP Series Rotary Evaporators



Hei-VAP Value[†]

- With hand lift only
- Large dial controls
- No digital display

Hei-VAP Value Digital[†]

- With in hand lift only
- Large dial controls
- Digital display and controls

Hei-VAP Advantage[†]

- With hand lift or motor lift
- 3.5" LCD tethered display control panel to adjust rotation speed, heating bath and vapor temperature

Hei-VAP Precision

- With hand lift or motor lift
- 4.3" LCD tethered display control panel to adjust rotation speed, heating bath and vapor temperature
- Built-in vacuum controller — (Requires Vacuum Valve)

[†] Vacuum controller not included, recommend Heidolph Manual Vacuum Controller (Cat. No. 13-889-343)

Description	Mfr. No.	Cat. No.	Price
Hei-VAP Value — The Collegiate			
Model G1B	036000090	13-876-306	\$6,006.24
Model G3B	036000110	13-876-308	\$6,764.44
Model G5B	036000130	13-876-310	\$7,393.89
Digital Model G1B	036000033	05-404-501	\$6,519.20
Digital Model G3B	036000053	05-404-503	\$7,077.37
Digital Model G5B	036000073	05-404-505	\$7,706.09
Hei-VAP Advantage			
Model HL/G3B	036000270	13-878-414	\$7,947.03
Model HL/G5B	036000310	13-878-418	\$8,080.05
Model ML/G1B	036000450	13-878-432	\$6,930.93
Model ML/G3B	036000470	13-878-434	\$8,133.40
Model ML/G5B	036000510	13-878-438	\$8,702.64
Hei-VAP Precision			
Model ML/G3B	036001270	13-878-514	\$11,714.75
Model ML/G5B	036001310	13-878-518	\$11,809.62
Model HL/G3B	036001070	13-876-150	\$9,787.63
Model HL/G5B	036001110	13-878-498	\$11,566.42
Model ML/G1B	036001250	13-878-530	\$9,428.00

Note: HL = Hand Lift, ML = Motor Lift, G1 = Diagonal Coil, G3 = Vertical Coil, G5 = Dry Ice, B = Coated

Visit fishersci.com/heidolph to learn more.

Strong Enough to Crush, Gentle Enough to Mix

Fisher Scientific Bead Mill Homogenizers



Use for a variety of applications that require grinding, lysing, and homogenization of biological samples to prepare them for molecular extraction.

Bead Mill 4 Homogenizer

- Small footprint requires minimal bench space
- Broad performance range:
1 - 5m/s
- Process up to four samples per cycle



Bead Mill 24 Homogenizer

- Processing range is ideal for all tissue types
- Highest Power:
0.8 - 6m/s
- Simultaneously homogenize up to 24 x 2mL or 0.5mL tubes



Description	Cat. No.	Price
Bead Mill 4 Homogenizer	15-340-164	\$1,995.00
Bead Mill 24 Homogenizer	15-340-163	\$6,900.00
Fisherbrand Bead Mill Tubes*		
Tubes for Soft Tissue Homogenization, 2mL, Pack of 50	15-340-153	\$150.00
Tubes for Hard Tissue Grinding, 2mL, Pack of 50	15-340-151	\$150.00
Tubes for Hard Tissue Homogenization, 2mL, Pack of 50	15-340-154	\$150.00
Tubes for Lysing Microorganisms, 2mL, Pack of 50	15-340-152	\$150.00

*Fisherbrand Bead Mill Tubes are compatible with all other bead mills homogenizers.



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

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" Type B Enclosure	36-100-4292	\$7,119.68
AC740C 48" Type B Enclosure	36-100-4293	\$7,770.75



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 36" Type C Enclosure	36-101-8906	\$9,167.61
AC770C 48" Type C Enclosure	36-101-8908	\$9,768.31
AC780C 72" Type C Enclosure	36-101-8910	\$13,728.75

ENHANCED ANALYTICAL CHEMISTRY LEARNING WITH UV-VIS TECHNOLOGY

Thermo Scientific SPECTRONIC and GENESYS Spectrophotometers



Instructors rely on spectrophotometers that read in the visible and UV-visible ranges to teach their high school and undergraduate chemistry students about spectroscopic concepts such as:

- Beer's Law
- Reaction kinetics
- Spectrochemical series

These core instruments must not only be reliable enough for use year after year, but also combine operation simple enough for a beginner with modern, accurate features. Thermo Scientific spectrophotometers are designed with those needs in mind.

For 57 years, the Thermo Scientific SPECTRONIC spectrophotometers from Thermo Fisher Scientific have been the frontrunners in UV-VIS spectroscopy for education. The SPECTRONIC 20 spectrophotometer introduced generations of chemistry and biology students to hands-on quantitative analysis through spectroscopy and led the market by offering affordable and reliable measurements to a single absorbance unit. Thermo Scientific instruments continue to offer better data

quality over a larger range of concentrations, making them well suited for introductory, intermediate and advanced teaching levels.

SPECTRONIC 200E spectrophotometer, the latest addition to the SPECTRONIC line, was developed for Advanced Placement (AP) high school and introductory college courses. It offers an array detector with fast scanning and integration times and is optimized to deliver the most accurate data at all wavelengths. The SPECTRONIC 200E Spectrophotometer delivers features that have made it a favorite among teachers:

- Reliability and accuracy over a wide concentration range
- Stand-alone simplicity, total control without a computer
- Removable, washable sample compartment for easy classroom cleanup

The new Thermo Scientific GENESYS 30 visible spectrophotometer was designed for college and university students and delivers next-level accuracy and precision combined with a superior user experience. Introduced in 2016, the GENESYS 30 incorporates the



latest technologies to deliver stable, accurate results between 325 and 1100nm. Its intuitive keypad can easily be programmed and allows the user to easily choose:

- Scanning
- Live display
- OD600
- Quantitative analyses

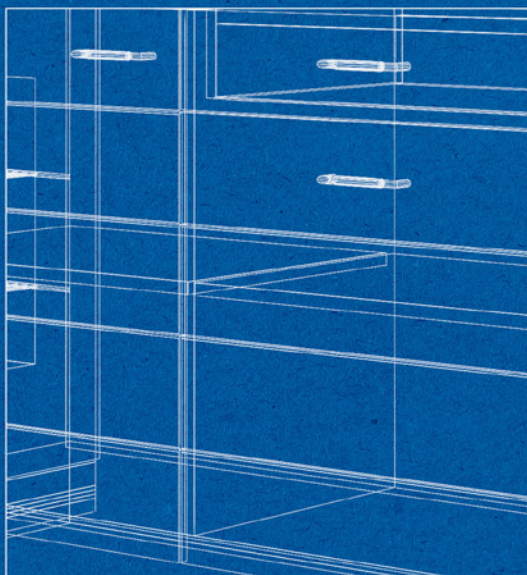
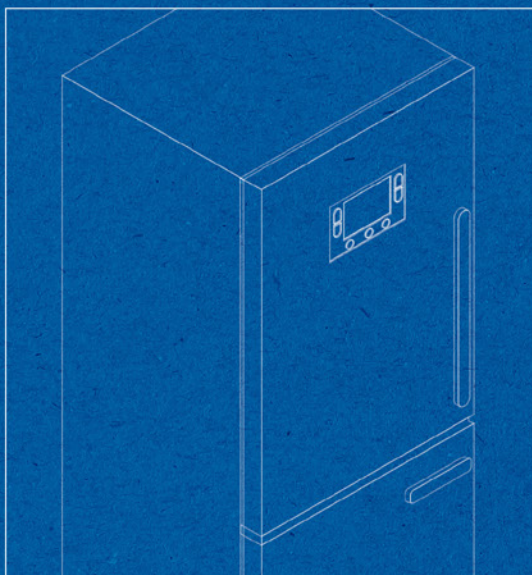
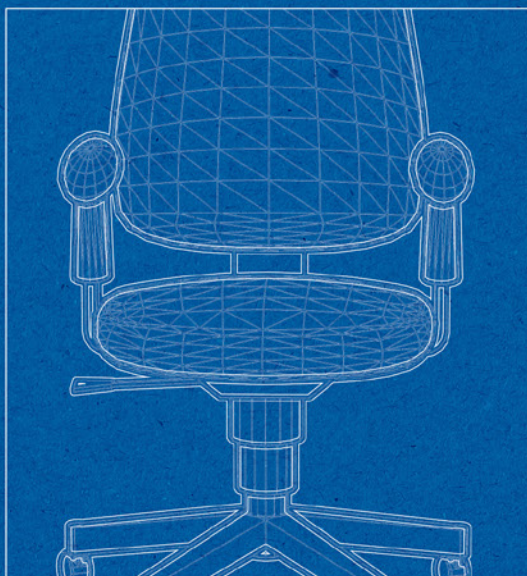
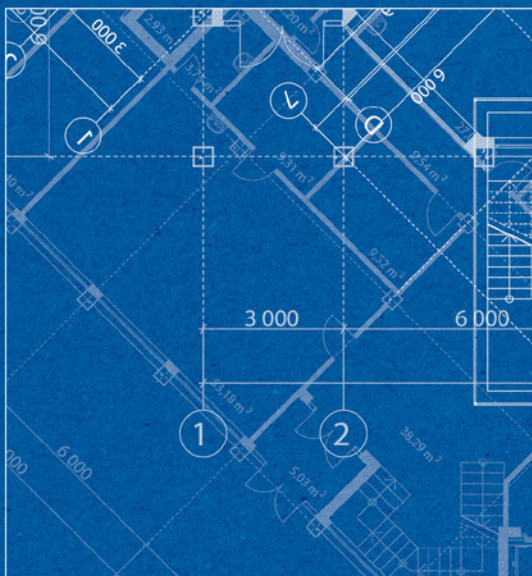
A high-resolution five-inch screen displays your results. Choose the printer accessory to create hard copies for reports or save your data to a USB stick for later analysis.

When your experiments call for measurements in the UV range, consider the popular Thermo Scientific GENESYS 10S UV-Vis spectrophotometer. As a proven performer in hundreds of teaching labs, the GENESYS 10S spectrophotometer combines a reputation for resilience with a xenon lamp that lasts and lasts. Choose it for the power and flexibility to do more sophisticated quantitative analysis, kinetics and scanning applications with advanced students while retaining a simple live display option that first-time users can master with only a minute's training.

Classroom spectroscopy solutions have never been more accurate, accessible and economical. Whatever your needs, there is a Thermo Scientific spectrophotometer that can meet them without compromising data quality or support. Empower your students to master scientific concepts with robust, easy-to-use SPECTRONIC and GENESYS spectrophotometers from the world leader in serving science.

Content Provided by:

thermoscientific



Outfitting Your Lab **Made Easy**

New Furniture and Installed Equipment Catalog

From concept to completion, the Fisher Scientific brand offers a broad portfolio with everything you need to design, build and fill your lab with quality equipment, consumables and chemicals for any application.

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SELECTING THE RIGHT INCUBATOR

When you trust your cells and cultures to an incubator, you need well-designed, properly functioning laboratory incubators to help you worry less. Your cells and cultures will grow well, contamination will occur less often, and maintenance will be simple and easy.

With so many different incubators on the market today, there are many options from which to choose. Here are some important questions to ask:

- ① Is CO₂ control required?
- ② What temperature set points or ranges are needed?
- ③ How much space (chamber size) will you need?
- ④ Do you prefer benchtop, stackable or floor units?
- ⑤ What temperature stability and uniformity is required?
- ⑥ Do you need humidity control?
- ⑦ Is gravity convection adequate or will forced air circulation be needed?
- ⑧ What other features (decontamination cycle, monitoring, access ports, internal glass door, copper interior) are wanted or needed?



CO₂ Incubators

Direct Heat or Water-Jacketed?	Consider your application to decide between direct heat vs. water-jacketed incubators. Water-jacketed technology offers faster temperature recovery and will maintain temperatures longer during a power failure, but cannot offer a high temperature decontamination cycle. Direct heat offers the option of push-button sterilization/decontamination routines.
TC or IR Sensor?	Select the CO ₂ sensor best suited for your application. Traditional IR sensors typically have a faster response time, but are more expensive and may require frequent bulb replacement. TC sensors are more robust and need very little maintenance.
Variable O ₂ Control?	If your cells need to grow under conditions that mimic their native or <i>in vivo</i> conditions, then controlling the oxygen levels can help your cells grow faster and healthier.
Contamination Control?	Leading contamination control technologies include HEPA filters (to achieve ISO 5 or Class 100 air), 100% copper interiors, and high-temperature sterilization.

Microbiological Incubators

What Temperature Range?	If a temperature at or below the ambient (30°C) is needed, choose a low-temperature or refrigerated incubator. If the temperature needed is 30°C or greater, then a standard or microbiological incubator will be adequate.
Gravity or Forced Air Flow?	Two types of convection or air flow are usually available with incubators. Gravity flow incubators have no fans or mechanism to move the air; the circulation is based on the laws of physics (hot air rises, cool air falls). An active or forced air flow will enhance the temperature uniformity throughout the chamber, but can also create a drying effect over time. Some forced air incubators have an adjustable fan so that the negative effects of either option can be moderated. Gravity convection models are also more budget-friendly.

For incubators that reach temperatures above and below ambient, several options for cooling mechanisms exist.

Low Temperature/Refrigerated Incubators

What Cooling Type?	Cooling is accomplished by using either a compressor or a thermoelectric/Peltier device. A compressor allows the unit to reach temperatures down to 0°C or lower; a Peltier device is much more energy efficient and does not use any refrigerants, although can be more expensive to purchase.
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Environmental Chambers

Humidity Control?	If precise humidity control is required, consider purchasing an environmental chamber, which can offer a very specific controlled environment.
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Other Features and Considerations

- **Internal Doors** — Some incubators have interior glass doors that allow the contents to be seen without fully opening the incubator and affecting the temperature.
- **Ports and Outlets** — Choose a unit with an access port or internal outlet if you will need to use accessories (like stirring plates or shakers) inside the incubator.
- **Sizes and Placement** — Incubators are available in a range of capacities, from 1.4 to 40 cu. ft. Determine your current space needs and then allow for future growth or workload changes. If space is limited, incubators can be placed on a permanent or portable bench or on the floor, and stackable units are another option.

Heracell VIOS 160i and 250i CO₂ Incubators

With advanced design for sensitive cultures and complete contamination control, these incubators combine the latest technology advancements with existing reliable features.

- Choice of 5.8 cu. ft. (165L) and 9.0 cu. ft. (255L) with stainless-steel or 100% copper interiors
- Compact footprint, readily stackable
- Thermo Scientific THRIVE active airflow for fast recovery and stable conditions
- Include ISO Class 5 HEPA filtration and on-demand sterilization
- Unique covered humidity reservoir to maximize recovery
- iCAN touchscreen interface: complete data visibility with data, error and usage
- Optional O₂ control



Heratherm Microbiological and Low-Temperature Incubators

Both Heratherm Microbiological Incubators and Low-Temperature Incubators include:

- Outstanding temperature stability and uniformity
- Standard access port
- Internal glass door
- Easy-to-use, bright florescent display controller
- Stainless-steel interior and shelves
- Easy-to-clean rounded edges
- Flexible shelving system, no tools required
- Made in Germany; two-year warranty

Microbiological Incubators

- Five sizes available: From 2.1 to 26.5 cu. ft.
- Choice of gravity or dual convection (with adjustable fan)
- Ambient plus 5° to 75/105°C
- Decontamination cycle (Advanced Protocol Security model)

Low-Temperature Incubators

- Stackable benchtop (6.4 cu. ft.) or floor model (14.1 cu. ft.)
- Energy-efficient Peltier cooling technology — no refrigerants
- Wide temperature range: 5° to 70°C
- Programmable



Find out more at thermofisher.com

ThermoFisher
SCIENTIFIC

Economical Incubation Solutions

Fisher Scientific Isotemp Incubators

Isotemp CO₂ Incubators for Cell Culture

Available in Water-Jacketed and Direct-Heat Models

- Choose TC or IR CO₂ sensors
- Unique heated inner glass door minimizes condensation
- Interior coved corners for easy cleaning
- High capacity — large 6.5 cu. ft. (184L) chamber

Description	Cat. No.	Price
Isotemp CO₂ Incubators		
Water Jacketed, TC Sensor	13-225-25	\$6,613.00
Water Jacketed, IR Sensor	13-255-26	\$7,848.00
Direct Heat, TC Sensor	13-225-27	\$6,612.00
Direct Heat, IR Sensor	13-225-28	\$8,061.00



Isotemp Microbiological Incubators

High-Quality Features, Excellent Temperature Performance, Budget-Friendly Price

- Three benchtop sizes: 2.1 to 6.4 cu. ft.
- Easily stackable — no tools or kit required
- Stainless-steel exterior and interior
- Choice of gravity or forced-air convection
- Wide temperature range: Ambient +5°/+10° to 75°C
- Internal glass door
- Microprocessor controller with timer

Description	Cat. No.	Price
Isotemp Microbiological Incubators		
Gravity Air Flow, 2.1 cu. ft. (60L)	15-103-0513	\$1,925.00
Gravity Air Flow, 3.5 cu. ft. (100L)	15-103-0514	\$2,375.00
Gravity Air Flow, 6.85 cu. ft. (194L)	15-103-0515	\$2,675.00
Forced Air Flow, 2.1 cu. ft. (60L)	15-103-0516	\$2,425.00
Forced Air Flow, 3.5 cu. ft. (100L)	15-103-0517	\$3,081.00
Forced Air Flow, 6.4 cu. ft. (180L)	15-103-0518	\$3,485.00



Isotemp Low-Temperature Incubators

Wide Temperature Range, Significant Energy Savings

- Stackable benchtop (6.4 cu. ft.) or floor unit (14.1 cu. ft.)
- Temperature range: 10° to 60°C
- Easy-to-use controller with timer
- Energy-efficient Peltier cooling technology
- Internal glass door
- Stainless-steel interior
- Flexible shelving — no tools required

Description	Cat. No.	Price
Isotemp Low Temperature Incubators		
Benchtop/Stackable Model (178L)	15-103-1568	\$5,363.00
Floor Model with Lockable Casters (381L)	15-103-1569	\$7,220.00



Wireless Carbon Dioxide (CO₂) Monitoring

TRACEABLE™

TraceableLIVE WiFi CO₂ Monitor

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: parameter limits, 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
CO ₂ /Temperature/Humidity Monitor	Ambient	15-079-662	\$585.00
CO ₂ /Temperature/Humidity Monitor	External, with 3 ft. Cable	15-079-663	\$595.00

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.

Reliability Meets Comfort

fisherbrand

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by Thermo Fisher Scientific

Fisherbrand Mesh Office Chairs

With Fisherbrand Mesh Office Chairs, you get:

- Foam cushion with durable black nylon fabric cover
- Adjustable armrests (2-way or 3-D) with polyurethane pads
- Mesh back, 360° rotation
- Durable five-leg nylon reinforced fiberglass base
- Black, rolling, non-marring casters
- 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, without Headrest	14-400-443	\$318.00
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



NEW LINE OF ULTRASONIC CLEANERS HELPS CONQUER LAB CHALLENGES

Elmasonic E Plus

Laboratory equipment supplier Elma just introduced its new line of Elmasonic E Plus ultrasonic cleaners, which are ideally suited for preparing samples and cleaning instruments and related equipment in science laboratories. Registered as Class 1 medical devices, Elma E Plus ultrasonic cleaners operate at 37kHz and are available in tank capacities from 0.25 to 7.5 gal. (1L to 28.4L)

Power for Sample Preparation and Cleaning

The Elmasonic E Plus line features a unique, operator-activated pulse mode that produces intermittent bursts of 20 percent additional power to quickly remove stubborn lab instrument contaminants, degas solvents, or to mix, disperse and dissolve lab samples.

When the pulse mode is not activated, the sweep mode uniformly distributes ultrasonic cleaning power throughout the tank; this eliminates “hot spots” that can damage delicate instruments and “dead zones” of ineffective ultrasonic action.

Consistent and Safe Performance

To accommodate a variety of cleaning and sample prep challenges, Elma E Plus ultrasonic cleaners also offer a power-tracking feature that automatically maintains the power level by adjusting for load changes in the cleaning tank. Microprocessor-controlled operation assures consistent performance over time.

The control panels of the E Plus series make operation easy. Users set the unit to the recommended cleaning temperature (30° to 80°C) based on the task. The Elma E Plus units will activate an ultrasound alarm when the set temperature is reached; a warning LED indicates that the temperature has been exceeded. The timer can be set from one to 30 minutes or to remain on continuously, but will automatically turn itself off after eight hours as a safety feature.

Features and Accessories

Elmasonic E Plus ultrasonic cleaners from Elma are housed in sleek, stainless-steel cases with an intuitive, water-sealed control panel.

Models with tanks larger than 0.5 gallons have ergonomic handles; units that hold 1.5 gallons or more have a side drain. All models feature plastic lids to deaden noise and reduce evaporation; when reversed, the lids serve as drip pans for optional cleaning baskets.

Other options include: mesh-bottom cleaning baskets, fine-mesh baskets for smaller items, holders and clamps for flasks and test tubes, Hostalen acid-resistant plastic tub inserts, noise-protection boxes, and hot air dryers. Cooling coils (to control bath temperatures) and covers with inserts (to hold glass beakers) are also available.

Complete operating instructions are provided. The E Plus line carries a two-year warranty and a replacement guarantee one year from the purchase date. Elma also carries a wide range of biodegradable ultrasonic cleaning solution concentrates for industrial, laboratory, healthcare and maintenance applications.

Content Provided by:



Level Up and Save Big



Sartorius Quintix Standard Lab Balances

Save 35% on the versatile line of Quintix Standard Lab Balances, with features designed to perform a variety of everyday applications.

- isoCAL internal calibration
- Plug & Play functionality via mini USB port
- 11 integrated application programs
- Semi-micro, analytical and toploader models



Special offer valid until June 30, 2017. This offer is valid for the current catalog price in the United States. Cannot be combined with any other offers. Limit one redemption per lab.

Model	Capacity	Readability	Cat. No.	Price	Special Price
QUINTIX65-1SPM	60g	0.01mg	14-560-019PM	\$5,195.00	\$3,376.75
QUINTIX125D-1SPM	60/120g	0.01/0.1mg	14-560-020PM	\$5,415.00	\$3,519.75
QUINTIX64-1SPM	60g	0.0001mg	14-557-443PM	\$2,950.00	\$1,917.50
QUINTIX124-1SPM	120g	0.0001mg	14-557-409PM	\$3,280.00	\$2,132.00
QUINTIX224-1SPM	220g	0.0001mg	14-557-410PM	\$3,715.00	\$2,414.75
QUINTIX612-1SPM	610g	0.01mg	14-557-414PM	\$1,640.00	\$1,066.00
QUINTIX1102-1SPM	1100g	0.01mg	14-557-418PM	\$1,860.00	\$1,209.00
QUINTIX2102-1SPM	2100g	0.01mg	14-557-415PM	\$2,075.00	\$1,348.75
QUINTIX3102-1SPM	3100g	0.01mg	14-557-416PM	\$2,295.00	\$1,491.75
QUINTIX5102-1SPM	5100g	0.01mg	14-557-417PM	\$2,845.00	\$1,849.25
QUINTIX6102-1SPM	6100g	0.01mg	14-557-441PM	\$3,330.00	\$2,164.50
QUINTIX2101-1SPM	2100g	0.1mg	14-557-437PM	\$1,420.00	\$923.00
QUINTIX5101-1SPM	5100g	0.1mg	14-557-419PM	\$1,640.00	\$1,066.00
QUINTIX6101-1SPM	6100g	0.1mg	14-557-440PM	\$1,965.00	\$1,277.25
QUINTIX5100-1SPM	5100g	1mg	14-557-420PM	\$1,310.00	\$851.50
QUINTIX6100-1SPM	6100g	1mg	14-557-439PM	\$1,420.00	\$923.00

Designed to Adapt to the Hazard



Labconco Purifier Axiom Biosafety Cabinets

The new NSF-listed Purifier Axiom Type C1⁺ bridges the gap between Type A and Type B by offering an Omni-Flex design, allowing the cabinet to be installed in a recirculating Type A mode when not working with chemical hazards, or in a ducted Type B mode when the application changes to hazardous vapors. If your application changes over time, simply connect or disconnect the Axiom from the exhaust.

- Omni-Flex dual-operation design allows cabinet to work in either Type A or Type B mode
- Chem-Zone shows where to work safely with chemicals when in Type B mode
- MyLogic OS offers self-guided menus with programmable, intuitive, instructive alarm conditions and at-a-glance status updates
- Dual ECM blowers maintain safety for both operator and the materials in work zone
- Provides protection for personnel, product and laboratory environment by filtering hazardous particulates and aerosols, such as agents that require biosafety level 1, 2 or 3 containment, with the option of venting away hazardous fumes
- Available with NSF-approved telescoping base stand and/or accessory package option. Accessory package includes 254nm UV light, service fixture(s) with ball-type valve(s) and NSF-approved Vacu-Pass Cord and Cable Portal

¹NSF designation is pending definition.

Model	Cat. No.	Price
4' Axiom with 10" Sash, Stand	30-441-0100	\$14,491.00
6' Axiom with 10" Sash, Stand	30-461-0100	\$17,195.00
4' Axiom with 10" Sash, Stand and Options	30-441-1100	\$15,570.00
6' Axiom with 10" Sash, Stand and Options	30-461-1100	\$18,354.00



STEM CELLS: THE HEART OF THE MATTER

By Ralph Birch

A team of researchers from Pennsylvania State University has developed a process that turns human stem cells into epicardium cells, the fibrous layer of heart tissue that surrounds the myocardium.

This method of generating epicardium cells could be useful in a variety of clinical applications, specifically for patients who suffer heart attacks. According to the Centers for Disease Control and Prevention, someone in the United States has a heart attack every 43 seconds.

“Heart attacks occur due to blockage of blood vessels,” said Xioajun Lance Lian, assistant professor of biomedical engineering and biology at Penn State and the leader of the study. “This blockage stops nutrients and oxygen from reaching the heart muscle, and muscle cells die. These muscle cells cannot regenerate themselves, so there is permanent damage, which can cause additional problems. These epicardium cells could be transplanted to the patient and potentially repair the damaged region.”

Choosing the Right Pathway

In 2012, Penn State researchers found that if they treated human stem cells with chemicals that sequentially activate and

inhibit a cell’s Wnt pathway, they become myocardium (or heart muscle) cells, which are responsible for pumping blood through the body.

Wnt signaling pathways are made up of proteins that pass signals into a cell using surface receptors. Researchers were aware of the need for additional information to be passed through the Wnt pathways for the stem cells to become epicardium cells, but the exact nature of that additional information wasn’t immediately clear.

“We needed to provide the cardiac progenitor cells with additional information in order for them to generate into epicardium cells, but prior to this study, we didn’t know what that information was,” Lian said. “Now, we know that if we activate the cells’ Wnt signaling pathway again, we can re-drive these cardiac progenitor cells to become epicardium cells, instead of myocardium cells.”

Sustaining Success

For the purposes of their study, researchers engineered the human stem cells to be reporter cells, which means they expressed a fluorescent protein once they transformed into epicardium cells. Researchers also

found that they could keep the cells proliferating in the lab by treating them with a cell-signaling pathway Transforming Growth Factor Beta (TGF- β) inhibitor.

After 50 days, the cells treated with the TGF- β inhibitor did not show any signs of decreased proliferation. The control cells in the study — which were not treated with the TGF- β inhibitor — started to plateau after 10 just days.

The results of the Penn State study, which were published in a recent issue of *Nature Biomedical Engineering*, bring the research team that much closer to regenerating all of the different types of heart tissue using nothing but stem cells. Recreating the inner layer of the heart, known as the endocardium, with stem cells is the next hurdle the research team is hoping to clear.

“We are making progress on that inner layer, which will allow us to regenerate an entire heart wall that can be used in tissue engineering for cardiac therapy,”

Lian said.

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Description	Cat. No.	Price
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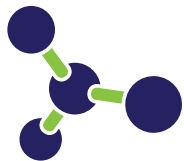
- EverSafe III Touch Control with electronic monitoring of face velocity, filter saturation, and temperature and humidity with audible and visible alarms
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Description	Cat. No.	Price
MY-ISL36 36" Isola Workstation	15-338-900	\$4,500.00
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SHOULD YOU USE DIGITAL OR REAL-TIME PCR?



Quantitative PCR is a method measuring the amount of a nucleic acid by making copies of the molecule with the enzyme DNA polymerase.

DIGITAL

REAL-TIME

Overview



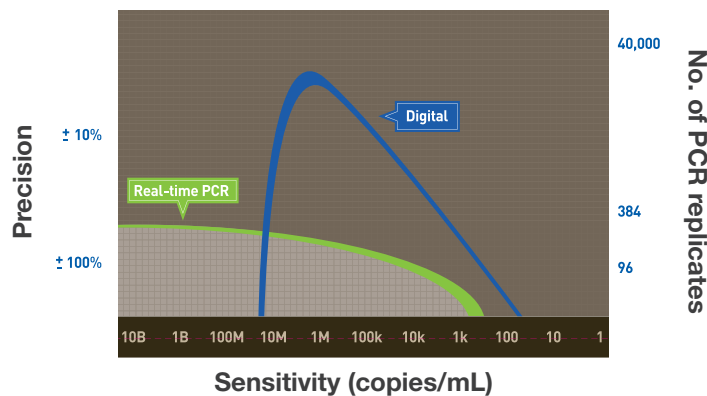
Absolute measurement: Uses single-molecule amplification to count the target-of-interest across a large number of PCR replicates; use limiting dilution to ensure at least one reaction does not contain the target.

Uses a reference to measure PCR amplification as it occurs; data collected during the exponential (log) phase of PCR.



Quantitative:

Sensitivity vs. Precision



Applications

- Rare target detection
- Absolute quantitation of gene expression
- Absolute quantitation of viral load
- Absolute quantitation of nucleic acid references and standards



- SNP genotyping
- Relative gene expression analysis
- MicroRNA analysis
- Standard copy number variation

Advantages

- No need for references or standards
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- Can analyze rare targets against wild type background
- Provides linear response to the number of copies; allows for small fold-change differences to be detected



- Broadly accepted, well-established protocols and assays
- Dynamic range of detection
- Detection down to a two-fold change
- High sample throughput, lower cost
- Data collected during the exponential phase of PCR; provides a permanent record of amplicon amplification with the cleaved probe

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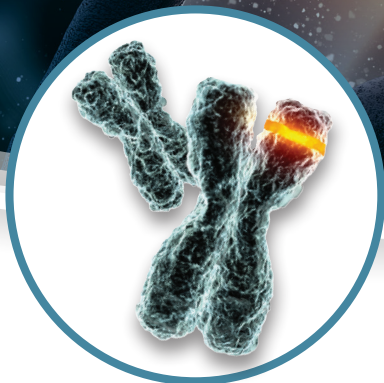
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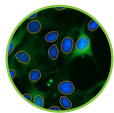
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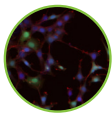
Cytation 5 Cell Imaging Multi-Mode Reader

BioTek Cytation 5 combines automated digital widefield microscopy with conventional multi-mode microplate detection to provide phenotypic cellular information and well-based quantitative data. This unique, patented design can process workflows that would traditionally require multiple instruments and software interfaces, and is simple to setup and operate.

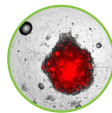
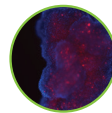
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Price

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OSHA LOWERS PERMISSIBLE EXPOSURE LIMITS FOR BERYLLIUM

By Mike Howie

On January 6, 2017, the U.S. Occupational Safety and Health Administration (OSHA) announced a new standard for beryllium exposure, reducing the permissible exposure limit by 90 percent to 0.2 micrograms per cubic meter of air over eight hours. The agency also established a short-term exposure limit of 2.0 micrograms per cubic meter of air over 15 minutes.

Initially taking effect on March 10, 2017, the new rule will roll out over three years: Employers have one year to implement most of the provisions, two years to provide required change rooms and showers, and three years to implement engineering controls. Where such controls are not feasible, or where there is the potential for skin exposure, employers must provide respirators and personal protective equipment for their workers, as well as training on the limitations and proper selection, fitting, and use of the equipment. Employers will also be required to provide medical exams to monitor exposed workers and medical removal protection benefits for workers who have a beryllium-related disease.

Essential, but Dangerous

Beryllium, which the U.S. Department of Defense classifies as a strategic and critical material, is stronger than steel and lighter than aluminum, making it popular in the aerospace, electronics, energy, telecommunications, medical and defense industries. However, it is highly toxic as a dust, mist or fume, and can cause skin irritation and lung damage. The metal contributes to chronic beryllium disease, lung cancer and a number of sudden-onset respiratory ailments through both inhalation and skin exposure, and once it enters the human body it cannot be removed.

Under the new rule, employers will be required to teach their employees about the health hazards of airborne exposure to and dermal contact with beryllium, and instruct workers on personal hygiene practices and the other measures they can take to protect themselves. When the new standards are fully in place, OSHA estimates that 94 deaths and 46 serious illnesses will be prevented annually among the estimated 62,000 people who work with beryllium, particularly those in foundry and smelting operations, fabricating, machining, beryllium metal and alloy grinding, beryllium oxide ceramics manufacturing and dental labs.

An Overdue Step

The standard for beryllium exposure was originally established by the Atomic Energy Commission in 1948 before being adopted by OSHA, and was last updated in 1971. OSHA began seeking public comment to revise the rule in 2002, but the effort took on greater urgency in 2012 when Materion Brush Inc., one of the primary manufacturers of beryllium in the U.S., teamed with the United Steelworkers union to address the need for change. OSHA proposed the revised rule in 2015, and then gathered feedback to further refine it before issuing the final rule this year.

Many critics, including some inside OSHA, have expressed frustration about the length of time it took to update a standard based on decades-old studies. The agency even acknowledged this in its announcement of the new rule, which is expected to help protect the health of tens of thousands of workers. "Today we take a long overdue step," said Dr. David Michaels, OSHA assistant secretary of labor. "OSHA's new standard is based on a strong foundation of science and consensus on the need for action, including peer-reviewed scientific evidence, a model standard developed by industry and labor, current consensus standards and extensive public outreach."

Protect Yourself from Splashes and Spills

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Fisherbrand Disposable Frocks and Isolation Gowns

Disposable Frocks

These 58gsm polypropylene and polyethylene frocks create a barrier against particles, microorganisms, and nonhazardous liquids. Features include a front zipper closure, elastic cuffs and a snap-closure collar.

Polypropylene Isolation Gowns

Durable, spunbond polypropylene isolation gowns provide protection from common dirt, dust and grime, minor splashes and particulates. Gowns also feature elastic wrist cuffs and easy neck and waist ties.



Description	Cat. No.	Quantity	Price
Disposable Frocks: Knee-Length, Elastic Cuffs, Front Zipper Closure			
White, X-Small	17-100-960	25/Case	\$225.00
White, Small	17-100-961	25/Case	\$225.00
White, Medium	17-100-962	25/Case	\$225.00
White, Large	17-100-963	25/Case	\$225.00
White, X-Large	17-100-964	25/Case	\$225.00
White, 2X-Large	17-100-965	25/Case	\$235.00
White, 3X-Large	17-100-966	25/Case	\$245.00
White, 5X-Large	17-100-967	25/Case	\$255.00

Description	Cat. No.	Quantity	Price
Polypropylene Isolation Gowns: Knee-Length, Elastic Cuffs, Neck and Waist Ties			
White, Large	17-100-408	10/Pack	\$9.50
		5 Packs/Case	\$45.00
White, X-Large	17-100-409	10/Pack	\$9.50
		5 Packs/Case	\$45.00
White, 2X-Large	17-100-410	10/Pack	\$9.50
		5 Packs/Case	\$45.00
Blue, Large	17-100-411	10/Pack	\$9.50
		5 Packs/Case	\$45.00
Blue, X-Large	17-100-412	10/Pack	\$9.50
		5 Packs/Case	\$45.00
Blue, 2X-Large	17-100-413	10/Pack	\$9.50
		5 Packs/Case	\$45.00
Yellow, Large	17-100-414	10/Pack	\$9.50
		5 Packs/Case	\$45.00
Yellow, X-Large	17-100-415	10/Pack	\$9.50
		5 Packs/Case	\$45.00
Yellow, 2X-Large	17-100-416	10/Pack	\$9.50
		5 Packs/Case	\$45.00

ESTABLISH A SPILL CONTROL PROGRAM

Fisherbrand Absorbents



Leaks, drips and spills are an unavoidable reality in nearly every workplace environment. Fluid handling is essential, and the ability to contain those fluids can have a significant effect on workplace safety, financial performance and overall productivity.

Consider the numbers — workplace slips, trips and falls:

- Are a leading cause of unintentional injuries that require approximately 8.9 million annual emergency room visits in the U.S.¹
- Lead to more than 17 percent of all disabling occupational injuries²
- Account for 95 million lost workdays per year³
- Cost an average of \$20,000 per incident⁴

Take the right steps to better contain these hazards and reduce the rate of consequential accidents and injuries. Start by establishing a spill control program for your facility that includes two components: a general maintenance program and an emergency spill response protocol.

General Maintenance

A key part of general maintenance is maintaining a supply of and effectively deploying absorbents, which are available in two primary forms.

Granular/loose absorbents can absorb an amount of liquid equivalent to their own

weight (a 1:1 ratio). Polypropylene-based absorbents are usually packaged as a sheet, pad or roll and can absorb up to 20 times their weight in liquid. These products are also designed to meet specific durability, absorbency and traffic requirements to ensure their effectiveness in various environmental conditions.

When choosing absorbents, consider:

The Environment

Is there a lot of traffic where leaks, drips and spills occur? If so, look for products designed for high-traffic areas. These usually include multiple layers and are thicker for added durability.

Common Fluids

When dealing primarily with oil or oil-based fluids, go for oil-only absorbents which are generally less expensive. If you encounter a variety of fluids in your facility, use a medium or heavyweight universal pad to provide maximum versatility and reduce the need to stock multiple products.

Storage

Absorbents are only effective when your employees use them. Keep a supply of absorbents readily accessible in multiple clean, dry areas of your facility to give your employees fast access for expedited cleanup.

Emergency Spill Response

Absorbent spill kits provide the best temporary solution for larger spills. Spill kits typically contain a variety of absorbent

pads, socks, pillows and personal protective equipment. Kits usually include instruction manuals to guide you through the cleanup process and present best practices during and after spill containment.

Spill kits are available in a variety of sizes to help with small, medium or large spill clean-up. Keep smaller spill kits in laboratories, on mobile work stations, and in manufacturing work cells. Place large kits near entrances and exits, in distribution centers, and in areas with significant fluid storage.

Fisherbrand Products

The Fisherbrand line of absorbents features a variety of color-coded absorbent pads and rolls to support your needs. Choose universal (gray), oil-only (white) and chemical (yellow/green) absorbents or Fisherbrand spill kits (ranging in size from 2- to 95-gallon fluid-absorbing capacity).

Slips, trips and falls have a significant impact on every aspect of the workplace. Instituting a two-pronged spill control program anchored by absorbents can help reduce the likelihood of these events in your facility. You can rely on Fisherbrand to support all of your absorbent and spill control needs.

Content Provided by:

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1. National Safety Council. (2011). Slips, Trips and Falls Fact Sheet. Retrieved from http://www.nsc.org/NSCDocuments_Advocacy/Fact%20Sheets/Slips-Trips-and-Falls.pdf.
 2. OSHA. (2007). Slips, Trips & Falls Identification & Prevention. Retrieved from https://www.osha.gov/dte/grant_materials/fy07/sh-16625-07/slipstripsfalls.ppt.
 3. Smith, S. (2013, July 15). The High Costs of Slips, Trips and Falls. Retrieved from EHS Today.
 4. Smith, S. (2013, July 15). The High Costs of Slips, Trips and Falls. Retrieved from EHS Today.

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Lightweight Chemical Absorbent Pads, 19 x 15 in.	CH200	19-103-101	200/Case	\$156.00
Heavyweight Chemical Absorbent Pads, 19 x 15 in.	CH100	19-150-260	100/Case	\$153.00
SOCs, 3 in. x 4 ft.	CH412	19-000-678	12/Case	\$120.00
SOCs, 3 in. x 12 ft.	CH124	19-000-676	4/Case	\$120.00
Pillows, 18 x 18 in.	CH1818	19-000-677	16/Case	\$120.00
Portable Chemical Spill Kit, 5 gal. Capacity	SKCH-PP	19-000-683	Each	\$100.00
Chemical Spill Kit, 9 gal. Capacity	SKCH-BKT	19-000-682	Each	\$120.00
Chemical Spill Kit, 17 gal. Capacity	SKCH20	19-000-679	Each	\$400.00
Chemical Spill Kit, 38 gal. Capacity	SKCH-55	19-000-680	Each	\$685.00
Chemical Spill Kit, 75 gal. Capacity	SKCH-95	19-000-681	Each	\$1,310.00

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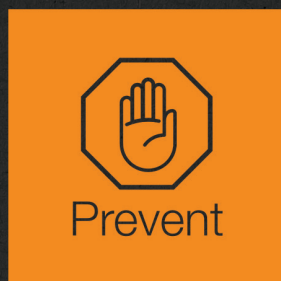
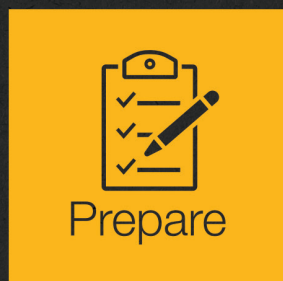


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Uvex Genesis Safety Eyewear	S3200HS	19-018-520	\$19.46
Uvex Stealth Safety Goggles	S3960HS	19-018-530	\$28.50
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Small	UF524S	19-167-302	300/Pack	\$35.05
Medium	UF524M	19-167-303	300/Pack	\$35.05
Large	UF524L	19-167-304	300/Pack	\$35.05
X-Large	UF524XL	19-167-305	300/Pack	\$35.05

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2 Manual Doors, 1 Shelf	30 gal. (114L)	44 x 43 x 18 in.	19-120-2333	\$1,300.00
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2 Manual Doors, 2 Shelves	45 gal. (170L)	65 x 43 x 18 in.	19-120-2335	\$1,654.00
2 Self-Close Doors, 2 Shelves			19-120-2336	\$1,844.00
2 Manual Doors, 2 Shelves	60 gal. (227L)	65 x 34 x 34 in.	19-120-2337	\$1,758.00
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- Low toxicity, non-flammable, and zero VOC profile assists in VOC compliance
- Used for cleaning hard, non-porous surfaces in labs and production areas

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Peroxigen is a ready-to-use 6% hydrogen peroxide solution in a convenient trigger bottle.

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- Low toxicity, non-flammable, and zero VOC profile assists in VOC compliance
- Used for cleaning hard, non-porous surfaces in labs and production areas

Description	Mfr. No.	Cat. No.	Quantity	Price
Peroxigen ST, Trigger Bottle, 16 oz.	9716	04-355-161	12/Case	\$325.00
Peroxigen, Trigger Bottle, 16 oz.	9816	04-355-160	Each	\$14.30
			12/Case	\$171.62

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Typical Applications:

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- Industrial fire brigades
- Clandestine lab investigations
- Industrial chemical processing plants
- Laboratories



Description	Cat. No.	Price	Description	Cat. No.	Price
Sleeveless Aprons, 4/Case					
Orange, Small	19-122-004	\$817.00	Gray, Small	19-122-000	\$817.00
Orange, Medium	19-122-005	\$817.00	Gray, Medium	19-122-001	\$817.00
Orange, Large	19-122-006	\$817.00	Gray, Large	19-122-002	\$817.00
Orange, X-Large	19-122-007	\$817.00	Gray, X-Large	19-122-003	\$817.00
Orange, 2X-Large	19-141-761	\$866.00			

Description	Cat. No.	Price	Description	Cat. No.	Price
Sleeved Aprons, 2/Case					
Orange, Small	19-122-055	\$522.00	Gray, Small	19-122-048	\$522.00
Orange, Medium	19-122-056	\$522.00	Gray, Medium	19-122-049	\$522.00
Orange, Large	19-122-057	\$522.00	Gray, Large	19-122-050	\$522.00
Orange, X-Large	19-122-058	\$538.00	Gray, X-Large	19-122-051	\$538.00
Orange, 2X-Large	19-122-059	\$570.00	Gray, 2X-Large	19-122-052	\$570.00
Orange, 3X-Large	19-122-060	\$604.00	Gray, 3X-Large	19-122-053	\$604.00
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