

## Microorganisms for Education

The list of bacterial and fungal strains included in this document are typical for a species and are appropriate for use in microbiology laboratory classes. These strains were selected by the Microbiologics team to assist educators in choosing from the hundreds of strains available from Microbiologics.

### How the Strains Were Chosen

Many of the strains chosen are microorganisms that might be encountered in clinical, food, water, pharmaceutical, or personal care product laboratories. Some belong to species seen in clinical specimens or food samples. Others are used for quality control of tests.

### Biosafety Levels

The biosafety level (BSL) is given for each culture listed in this document. The BSL is based on an assessment of the potential risk of the microorganism to laboratory workers. Microbiologics uses the same BSL as the reference culture organization from which it obtained the microorganism. Biosafety levels range from 1-4 with 4 being the most dangerous level. The strains listed in this document are BSL-1. BSL-1 organisms pose no, or low, risk to individuals and communities. They may, however, cause disease in an individual with a suppressed or compromised immune system.

The Center for Disease Control and Prevention (CDC), together with the U.S. National Institutes of Health (NIH), has written guidelines to help laboratories handle microorganisms safely. See the Microbiologics document, *Microorganism Biosafety Level 1 and 2 Standard Microbiological Practices*, for a summary of the guidelines.

Some molds, such as *Aspergillus*, *Cladosporium*, and *Penicillium*, release airborne spores that can trigger allergic reactions or asthma in susceptible individuals.

### Product Format

For educators looking for small quantities of the strain, Microbiologics recommends purchasing KWIK-STIK™ 2-Packs. A KWIK-STIK™ is a self-contained unit featuring a single microorganism strain in a lyophilized pellet, a reservoir of hydrating fluid, and an inoculating swab. All strains are derived from reference culture collections.

### Support

For microorganisms not listed in this document, visit [www.microbiologics.com](http://www.microbiologics.com). Contact Microbiologics Technical Support at [techsupport@microbiologics.com](mailto:techsupport@microbiologics.com) or 1.320.229.7045 for assistance finding the right strain and format for your laboratory.

## Bacteria

### *Alcaligenes faecalis* subsp. *faecalis*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Found in soil, water, feces, urine, blood, sputum, wounds, pleural fluids, nematodes and insects.
<b>Strain example</b>	Microbiologics Catalog #0402P
<b>Biosafety level</b>	1
<b>Colony appearance</b>	Colonies on Sheep Blood Agar are small, gray, and umbonate with flat spreading edge and fruity odor.
<b>Gram stain</b>	Gram-negative rods or coccal rods
<b>Strain characteristics</b>	Oxidase (Kovacs): Positive Nitrate (broth): Negative Motility Medium B: Positive
<b>Culture method</b>	Grow on Tryptic Soy Agar (Soybean Casein Digest Agar), Nonselective Sheep Blood Agar, Standard Methods Agar (Plate Count Agar), or Nutrient Agar. Grow aerobically at 35°C for 24 to 48 hours.

### *Bacillus cereus*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Endospores are widespread in soil, in milk, and other foods. <i>B. cereus</i> has been implicated in food poisoning.
<b>Strain example</b>	Microbiologics Catalog #0998P
<b>Biosafety level</b>	1
<b>Colony appearance</b>	Colonies on Sheep Blood Agar are large, gray, dull, and raised. They have an irregular shape and are beta-hemolytic (clearing around colonies). As the culture ages, small colonies may appear in the heavily streaked area making the culture appear contaminated.
<b>Gram stain</b>	Straight, Gram-positive rod with an ellipsoidal or spherical, terminal endospore
<b>Culture method</b>	Grow on Tryptic Soy Agar (Soybean Casein Digest Agar), Nonselective Sheep Blood Agar, Standard Methods Agar (Plate Count Agar), or Nutrient Agar. Grow aerobically at 35°C for 24 to 48 hours. Some <i>Bacillus</i> species demonstrate better recovery on subculture when the stock microorganism growth is maintained at room temperature than 2°C to 8°C.

### *Bacillus subtilis* subsp. *spizizenii*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Endospores are widespread in soil, dust and on vegetation.
<b>Strain example</b>	Microbiologics Catalog #0486P
<b>Biosafety level</b>	1
<b>Colony Appearance</b>	Colonies on Sheep Blood Agar are large, irregular, flat with an undulate edge. They are gray and wrinkled with a ground glass appearance. Beta hemolysis and slight yellow coloring may appear in the wrinkles by 48 hours.
<b>Gram stain</b>	Straight, Gram-positive rod with an ellipsoidal, central, or terminal endospore
<b>Culture method</b>	Grow on Tryptic Soy Agar (Soybean Casein Digest Agar), Nonselective Sheep Blood Agar, Standard Methods Agar (Plate Count Agar), or Nutrient Agar. Grow aerobically at 35°C for 24 to 48 hours. Some <i>Bacillus</i> spp. Demonstrate better recovery on subculture when the stock microorganism growth is maintained at room temperature than 2°C to 8°C.
<b>Applications</b>	Used by pharmaceutical industry. United States Pharmacopeia (USP) control for the Growth Promotion Test.

### *Corynebacterium pseudodiphtheriticum*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Part of the normal oropharyngeal flora
<b>Strain example</b>	Microbiologics Catalog #0965P
<b>Biosafety level</b>	1
<b>Colony Appearance</b>	Two colony types may be seen on Sheep Blood Agar. One type is medium, circular, low convex, entire edge, light gray, and smooth. The other type is slightly larger, convex, entire edge, pale cream-white, and smooth.
<b>Gram stain</b>	Straight to slightly curved Gram-positive rods with tapered ends, often in characteristic palisade arrangement. Club-shaped forms may be present.
<b>Strain characteristics</b>	Catalase (3% Hydrogen Peroxide): Positive
<b>Culture method</b>	Grow on Tryptic Soy Agar (Soybean Casein Digest Agar), Nonselective Sheep Blood Agar, Standard Methods Agar (Plate Count Agar), or Nutrient Agar. Grow aerobically at 35°C for 24 to 48 hours. Grow aerobically at 35°C for 24 to 48 hours

### *Escherichia coli*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Found in lower intestine of humans and other mammals.
<b>Strain example</b>	Microbiologics Catalog #0335P
<b>Biosafety level</b>	1
<b>Colonies</b>	Two colony types are seen on Sheep Blood Agar. Both types are gray and beta hemolytic. One is circular to irregular, convex, and smooth with a slightly erose edge. The other is larger, irregular, low convex, rough with an erose edge. Colonies on MacConkey Agar are deep pink with surrounding pink precipitate.
<b>Gram stain</b>	Gram-negative straight rod
<b>Strain characteristics</b>	Oxidase (Kovacs): Negative Beta-glucuronidase ( <i>E. coli</i> broth with MUG): Positive <b>Glucuronidase (<i>E. coli</i> broth with MUG): pos</b>
<b>Culture method</b>	Grow on Tryptic Soy Agar (Soybean Casein Digest Agar), Nonselective Sheep Blood Agar, Standard Methods Agar (Plate Count Agar) or Nutrient Agar. Grow aerobically at 35°C for 24 to 48 hours.
<b>Uses</b>	Used by clinical, food, and water laboratories. It is used as a control for Antimicrobial Susceptibility Tests by the Clinical Laboratory Standards Institute (CLSI) and the European Union Committee on Antimicrobial Susceptibility Testing (EUCAST). It is the Environmental Protection Agency (EPA) positive control for Total Coliforms, Fecal Coliforms and <i>E. coli</i> Tests. It is the United States Department of Agriculture (USDA) positive control for the Coliform Count Test.

### *Escherichia coli*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Found in lower intestine of humans and other mammals
<b>Strain example</b>	Microbiologics Catalog #0483P
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Sheep Blood Agar are medium to large, gray, mucoid, and convex. Colonies on MacConkey Agar are deep pink with surrounding pink precipitate.
<b>Gram stain</b>	Gram-negative straight rod
<b>Strain characteristics</b>	Oxidase (Kovacs): negative Beta-glucuronidase ( <i>E. coli</i> broth with MUG): positive
<b>Culture method</b>	Grow on Tryptic Soy Agar (Soybean Casein Digest Agar), Nonselective Sheep Blood Agar, Standard Methods Agar (Plate Count Agar) or Nutrient Agar. Grow aerobically at 35°C for 24 to 48 hours.
<b>Uses</b>	Used by pharmaceutical and water laboratories. USP control Growth Promotion Test and Antimicrobial Effectiveness Test. EPA positive control for Total Coliforms, Fecal Coliforms and <i>E. coli</i> Tests.

### *Escherichia coli*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Found in lower intestine of humans and other mammals
<b>Strain example</b>	Microbiologics Catalog #0706P
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Sheep Blood Agar are large, circular to irregular, convex, entire edge and gray. There are rough and smooth colonies. Very slight beta hemolysis may be present. Colonies on MacConkey Agar are medium to large, circular to irregular, convex, and have an entire to slightly erose edge. They are pink and glistening.
<b>Gram stain</b>	Gram- negative straight rod with rounded ends
<b>Strain characteristics</b>	Oxidase (Kovacs): Negative Strain Designation: K12
<b>Culture method</b>	Grow on Tryptic Soy Agar (Soybean Casein Digest Agar), Nonselective Sheep Blood Agar, Standard Methods Agar (Plate Count Agar) or Nutrient Agar. Grow aerobically at 35°C for 24 to 48 hours.

### *Klebsiella aerogenes* (formerly *Enterobacter aerogenes*)

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Isolated from water, sewage, soil, dairy products, human and animal intestinal tracts.
<b>Strain example</b>	Microbiologics Catalog #0306P
<b>Biosafety level</b>	1
<b>Colony Appearance</b>	Colonies on Sheep Blood Agar are medium to large, gray, mucoid, convex, and circular.
<b>Gram stain</b>	Straight Gram-negative rod.
<b>Strain characteristics</b>	Oxidase (Kovacs): negative
<b>Culture method</b>	Grow on Tryptic Soy Agar (Soybean Casein Digest Agar), Nonselective Sheep Blood Agar, Standard Methods Agar (Plate Count Agar), or Nutrient Agar. Grow aerobically at 35°C for 24 to 48 hours.
<b>Uses</b>	Used by Water and Food Laboratories. EPA Positive Control for Total Coliforms Test Food and Drug Administration (FDA) Bacteriological Analytical Manual (BAM) control USDA positive control for enumeration of Indicator/Spoilage Microorganisms.

### *Lactobacillus plantarum* subsp. *plantarum*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Isolated from dairy products and environments, silage, sauerkraut, pickled vegetables, sourdough, cow dung, sewage, and the human mouth, intestinal tract and stools.
<b>Strain example</b>	Microbiologics Catalog #01144P
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Sheep Blood Agar are small, circular, entire edged, and gray.
<b>Gram stain</b>	Gram-positive rod.
<b>Strain characteristics</b>	Catalase positive
<b>Culture method</b>	Grow on Nonselective Blood Agar or Columbia CNA with Sheep Blood Agar. Grow at 35°C in 5% to 7% Carbon Dioxide for 48 hours.
<b>Uses</b>	Used by food laboratories. USDA control for enumeration of Indicator/Spoilage Microorganisms.

### *Lactococcus lactis* subsp. *lactis*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Isolated from raw milk, udders, and dairy products.
<b>Strain example</b>	Microbiologics Catalog #0149P
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Sabouraud Dextrose Emmons Agar are medium circular, convex, pale white, glistening, and translucent with an entire edge. Both alpha and gamma hemolytic colonies are present. Alpha hemolytic colonies turn blood agar greenish underneath them. Gamma hemolytic colonies are non-hemolytic.
<b>Gram stain</b>	Gram-positive cocci and ovoid cells present
<b>Strain characteristics</b>	Catalase (3% Hydrogen Peroxide): Negative
<b>Culture method</b>	Grow on Nonselective Sheep Blood Agar. Grow aerobically at 35°C 24 to 72 hours.

### *Micrococcus luteus*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	<i>Micrococcus luteus</i> is part of human skin flora. It has been isolated from the skin of the head, legs and arms.
<b>Strain example</b>	Microbiologics Catalog #0689P
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Sheep Blood Agar are small to medium, circular, convex, and pale yellow-green with an entire edge. Colonies turn yellow and orange with age.
<b>Gram stain</b>	Gram-positive cocci occurring in tetrads and irregular clusters of tetrads.
<b>Strain characteristics</b>	Catalase (3% Hydrogen Peroxide): Positive. Coagulase (rabbit plasma – tube): Negative.
<b>Culture method</b>	Grow on Tryptic Soy Agar (Soybean Casein Digest Agar) or Non-selective Sheep Blood Agar. Alternatively, the strain may be grown on Standard Methods Agar (Plate Count Agar) for a minimum of 72 hours. Grow aerobically at 35°C for 24 to 48 hours.

### *Mycobacterium smegmatis*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Isolated from soil, water, and plants.
<b>Strain example</b>	Microbiologics Catalog #0721P
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Middlebrook 7H11 Agar are small to medium, circular to irregular, flat, dull and rough, translucent and cream with an entire edge. They turn yellow/orange with age.
<b>Gram stain</b>	Gram-positive rod, medium to long
<b>Strain characteristics</b>	Kinyoun Acid Fast Stain: Positive; Catalase (3% Hydrogen Peroxide): Positive
<b>Culture method</b>	Grow on Middlebrook or Lowenstein Jensen Agar. Will also grow on Tryptic Soy Agar (Soybean Casein Digest Agar) but an additional incubation period may be needed. Grow at 35°C aerobically or in 5% to 7% Carbon Dioxide for 48 hours.

### *Pseudomonas fluorescens*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Isolated from soil, water, plants, sewage, and hospitals.
<b>Strain example</b>	Microbiologics Catalog #0241P
<b>Biosafety level</b>	1
<b>Colonies</b>	There are two colony types on Sheep Blood Agar. One type is large, irregular, pale gray, and glistening, with an erose edge. The other type is small, and compact with an entire edge.
<b>Gram stain</b>	Straight or slightly curved Gram-negative rod with rounded ends.
<b>Strain characteristics</b>	Oxidase (Kovacs): Positive; Motility B Medium: Positive Produces fluorescein pigment
<b>Culture method</b>	Grows on Tryptic Soy Agar (Soybean Casein Digest Agar), Nonselective Sheep Blood Agar, Nutrient Agar and Standard Methods Agar (Plate Count Agar). Grow aerobically at 25°C for 24 to 48 hours.
<b>Uses</b>	Used by personal care product laboratories for antimicrobial effectiveness testing.

### *Serratia marcescens*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Isolated from water, soil, plants, animals.
<b>Example of strain</b>	Microbiologics Catalog #0806P
<b>Biosafety level</b>	1
<b>Colonies</b>	There are two colony types on Sheep Blood Agar. Both types are medium to large. One type (95%) are red/pink. The other type (5%) are grey, circular, convex, and slightly beta-hemolytic (slight clearing around colonies).
<b>Gram stain</b>	Gram-negative straight rod
<b>Strain characteristics</b>	Oxidase (Kovacs): negative
<b>Culture method</b>	Grow on Tryptic Soy Agar (Soybean Casein Digest Agar), Nonselective Sheep Blood Agar, Standard Methods Agar (Plate Count Agar) or Nutrient Agar. Grow aerobically at 35°C for 24 to 48 hours.

### *Staphylococcus epidermidis*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Isolated from moist areas such as the axillae, inguinal area, interior nares and toe webs.
<b>Strain example</b>	Microbiologics Catalog #0371P
<b>Biosafety level</b>	1
<b>Colonies</b>	There are two colony types on Sheep Blood Agar. Both are small to medium, smooth, circular, convex, and glistening, with an entire edge. One type is white and the other type is gray to translucent.
<b>Gram stain</b>	Gram-positive cocci usually in pairs and tetrads.
<b>Strain characteristics</b>	Catalase (3% Hydrogen Peroxide): Positive Coagulase (rabbit plasma-tube): Negative
<b>Culture method</b>	Grow on Tryptic Soy Agar (Soybean Casein Digest Agar), Nonselective Sheep Blood Agar, Standard Methods Agar (Plate Count Agar) or Nutrient Agar. Grow aerobically at 35°C for 24 hours.

### *Streptomyces griseus* subsp. *griseus*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	Isolated from soil.
<b>Strain example</b>	Microbiologics Catalog #0859P
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Sabouraud Dextrose Emmons Agar are cream and irregular. Over time the colonies become concave and wrinkled, with hyphae forming on top of the colony.
<b>Gram stain</b>	Gram-positive, many short rods, some medium rods and delicate branching filaments.
<b>Strain characteristics</b>	Urea slant: Positive Casein Agar Decomposition: Positive Tyrosine Agar Decomposition: Positive Xanthine Agar Decomposition: Positive
<b>Culture method</b>	Grow on Sabouraud Dextrose Emmons Agar. Grow aerobically at 25°C for 2 to 7 days. Nonselective Sheep Blood Agar is an appropriate alternative. Nutrient Agar, Tryptic Soy Agar (Soybean Casein Digest Agar), Potato Dextrose Agar and Standard Methods Agar (Plate Count Agar) are appropriate alternatives together with an additional period (24 hours) of incubation.

## Fungus

### *Aspergillus brasiliensis*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	<i>Aspergillus brasiliensis</i> is a mold is found in soil.
<b>Strain example</b>	Microbiologics Catalog #0392P
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Potato Dextrose Agar grow rapidly. Initially white or pale yellow, they quickly become black with conidia (spore) production. The reverse side is pale yellow.
<b>Lactophenol Blue Stain</b>	Chains of small conidia which arise from short sterigmata are arranged radially over the surface of the vesicle.
<b>Culture method</b>	Grow on Sabouraud Dextrose Emmons Agar, Nutrient Agar, Tryptic Soy Agar, Potato Dextrose Agar, Standard Methods Agar (Plate Count Agar), or Nonselective Sheep Agar. Grow aerobically at 25°C for 2-7 days.

### *Candida albicans*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	<i>Candida albicans</i> is normal flora found in the skin, mouth, and gastrointestinal and vaginal tracts. It may cause opportunistic infections such as thrush and vaginal candidiasis.
<b>Strain example</b>	Microbiologics Catalog #0443P
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Nutrient Agar are small to medium, white, circular, convex, and dull.
<b>Gram stain</b>	Gram positive, ovoidal, budding yeast cells
<b>Strain characteristics</b>	Germ Tube Test: Positive Cornmeal Agar: Positive for chlamyospore production
<b>Culture method</b>	Grow on Sabouraud Dextrose Emmons Agar. Grow aerobically at 25°C for 2 to 7 days. Nonselective Sheep Blood Agar is an appropriate alternative. Nutrient Agar, Tryptic Soy Agar (Soybean Casein Digest Agar), Potato Dextrose Agar and Standard Methods Agar (Plate Count Agar) are appropriate alternatives together with an additional period (24 hours) of incubation.
<b>Application</b>	Used in clinical and pharmaceutical laboratories. Quality control strain for antimicrobial susceptibility testing. Quality control strain for growth promotion test and antimicrobial susceptibility testing.

### *Chaetomium globosum*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	<i>Chaetomium globosum</i> is a mold found in soil and decomposing plant materials, especially woody or straw-like materials.
<b>Strain example</b>	Microbiologics Catalog #1094P
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Malt Extract Agar are large and cream with a peppered to a very dark green appearance. The reverse side is cream to olive and grows into the agar.
<b>Lactophenol Blue Stain</b>	Ascomata spherical, ovoidal or obovoidal with hyphal appendages.
<b>Culture method</b>	Grow on Sabouraud Dextrose Emmons Agar or Malt Extract Agar. Grow aerobically at 25°C for 2 to 7 days. Nonselective Sheep Blood Agar is an appropriate alternative. Nutrient Agar, Tryptic Soy Agar, Potato Dextrose Agar, Standard Methods Agar (Plate Count Agar) are appropriate alternatives together with an additional period (24 hours) of incubation.

### *Cladosporium cladosporioides*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	<i>Cladosporium cladosporioides</i> is a mold found in the air, soil, textiles, and foodstuffs. Also common in indoor environment.
<b>Strain example</b>	Microbiologics Catalog #0537P
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Potato Dextrose Agar are expanding, velvety to powdery, and olivaceous green to olivaceous brown. The reverse side becomes olivaceous black.
<b>Lactophenol Blue Stain</b>	Conidiophores arising from hyphae, bearing conidial chains laterally and terminally; Ramoconidia towards base of the chain, 0-1 septate, more or less cylindrical; Conidia in acropetal branched chains, ellipsoidal to lemon shaped, smooth walled, olivaceous to brown.
<b>Culture method</b>	Grow on Sabouraud Dextrose Emmons Agar. Grow aerobically at 25°C for 2 to 7 days. Nonselective Sheep Blood Agar is an appropriate alternative. Nutrient Agar, Tryptic Soy Agar (Soybean Casein Digest Agar), Potato Dextrose Agar, Standard Methods Agar (Plate Count Agar) are appropriate alternatives together with an additional period (24 hours) of incubation.

### *Geotrichum candidum*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	<i>Geotrichum candidum</i> is found in soil, water, air, plants, bread, milk and milk products. It is considered part of the normal microbiota of humans. It has been isolated from feces, urine and vaginal secretions.
<b>Strain example</b>	Microbiologics Catalog #0519P
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Sabouraud Dextrose Emmons Agar at 48 hours are large, slightly irregular, raised, white, powdery, and dry, with a filamentous edge.
<b>Microscopic characteristics</b>	Lactophenol Blue Stain: Mycelium formation which breaks up into characteristic arthrospores
<b>Culture method</b>	Grow on Sabouraud Dextrose Emmons Agar. Grow aerobically at 25°C for 2 to 7 days. Nonselective Sheep Blood Agar is an appropriate alternative. Nutrient Agar, Tryptic Soy Agar (Soybean Casein Digest Agar), Potato Dextrose Agar, Standard Methods Agar (Plate Count Agar) are appropriate alternatives together with an additional period (24 hours) of incubation..



### *Mucor racemosus*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	<i>Mucor racemosus</i> is a mold isolated from soil, food, tomatoes, tea, rice, decaying organic material and stool specimens.
<b>Strain example</b>	Microbiologics Catalog #1142P
<b>Biosafety level</b>	1
<b>Colonies</b>	Potato Dextrose Agar becomes consumed by tan-cream, filamentous growth. Reverse is cream.
<b>Microscopic characteristics</b>	Lactophenol Blue Stain: Sporangiohores are straight, simple, unbranched, forming large, terminal, spherical, multi-spored sporangia. Remnants of the sporangial wall are usually visible at the base of the columella after sporangiospore dispersal. Chlamydo spores can also be seen at various positions along the sporangiohores.
<b>Culture method</b>	Grow on Sabouraud Dextrose Emmons Agar. Grow aerobically at 25°C for 2 to 7 days. Nonselective Sheep Blood Agar is an appropriate alternative. Nutrient Agar, Tryptic Soy Agar (Soybean Casein Digest Agar), Potato Dextrose Agar, Standard Methods Agar (Plate Count Agar) are appropriate alternatives together with an additional period (24 hours) of incubation.

### *Penicillium chrysogenum*

Strain Information	Strain Characteristics and Features
<b>Ecology</b>	<i>Penicillium chrysogenum</i> is a mold found in various food products and indoor environments.
<b>Strain example</b>	Microbiologics Catalog #0178P
<b>Biosafety level</b>	1
<b>Colonies</b>	There is rapid growth of expanding, floccose colonies on Malt Extract Agar. Colonies are initially white, turning dark, blue-green with age, exudes bright yellow pigment into medium.
<b>Lactophenol Blue Stain</b>	Hyaline septate mycelia that produce hyaline conidiophores; The conidiophores branch into brush-like penicillus. Spores are borne in long chains from terminal sterigmata.
<b>Culture method</b>	Grow on Sabouraud Dextrose Emmons Agar or Malt Extract Agar. Grow aerobically at 25°C for 2 to 7 days. Nonselective Sheep Blood Agar is an appropriate alternative. Nutrient Agar, Tryptic Soy Agar (Soybean Casein Digest Agar), Potato Dextrose Agar, Standard Methods Agar (Plate Count Agar) are appropriate alternatives together with an additional period (24 hours) of incubation.

### *Rhizopus stolonifer* (+), *Rhizopus stolonifer* (-)

Strain Information	Characteristics and Features of the Strain
<b>Ecology</b>	<i>Rhizopus stolonifer</i> is a mold isolated from air, soil, grain, vegetables, fruit, bread, nuts. Occurs in warmer zones.
<b>Strain example</b>	Microbiologics Catalog #0209P, <i>Rhizopus stolonifer</i> (+), #0208P, <i>Rhizopus stolonifer</i> (-)
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Potato Dextrose Agar are very fast growing. They quickly fill the culture plate with dense, cottony, aerial mycelium. At first the colonies are white. Later they become gray.
<b>Lactophenol Blue Stain</b>	Mycelium aseptate with many stolons (hyphal branches) connecting groups of unbranched sporangiohores. Rhizoids are present. The sporangiohores terminate with a dark brown or black spherical sporangium containing columella.
<b>Culture method</b>	Grow on Sabouraud Dextrose Emmons Agar. Grow aerobically at 25°C for 2 to 7 days. Nonselective Sheep Blood Agar is an appropriate alternative. Nutrient Agar, Tryptic Soy Agar (Soybean Casein Digest Agar), Potato Dextrose Agar, Standard Methods Agar (Plate Count Agar) are appropriate alternatives together with an additional period (24 hours) of incubation.

### ***Saccharomyces cerevisiae***

Strain Information	Characteristics and Features of the Strain
<b>Ecology</b>	Found on surfaces of plants, in gastrointestinal tracts of insects, and in soils. Used in baking and brewing. Can cause fungemia in immunosuppressed or critically ill patients.
<b>Strain example</b>	Microbiologics Catalog #0699P
<b>Biosafety level</b>	1
<b>Colonies</b>	Colonies on Sabouraud Dextrose Emmons Agar are medium to large, circular, dull, and white to cream.
<b>Gram stain</b>	Gram positive, yeast cells, oval to spherical, spores are Gram-negative when present.
<b>Culture method</b>	Grow on Sabouraud Dextrose Emmons Agar. Grow aerobically at 25°C for 2 to 7 days.

### **Microbiologics Resources**

The following instructions and technical information bulletins are available at <http://www.microbiologics.com/>.

Instructions for Use: LYFO DISK™, KWIK-STIK™, KWIK-STIK™ Plus

Maintenance of Quality Control Strains

Microorganism Biosafety Level 1 and 2, Standard Microbiological Practices

Microbiologics Dilution Guide

Pour Plate Method: Best Practices

Streak Plate Method for Colony Isolation: Illustrated Instructions

### **Free Online Resources**

United States Environmental Protection Agency. *Manual for the Certification of Laboratories Analyzing Drinking Water*

FDA *Bacteriological Analytical Manual*

European Committee on Antimicrobial Susceptibility Testing (EUCAST). Explains how to perform AST and provides QC tables.

MSG ERC Doctor Fungus, an online reference to all things mycological

Sutton, Scott. *Determination of Inoculum for Microbiological Testing*. 2011 Sutton's article explains how to create quantitative suspensions of bacteria.

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