Lab#3

Laboratory Setup and Equipment

Laboratory benches are short or long peninsulas with drawers underneath, bottles on shelves above, and small equipment and open working spaces on surface. Each person usually has a bench. The person who shares your bench is your benchmate.

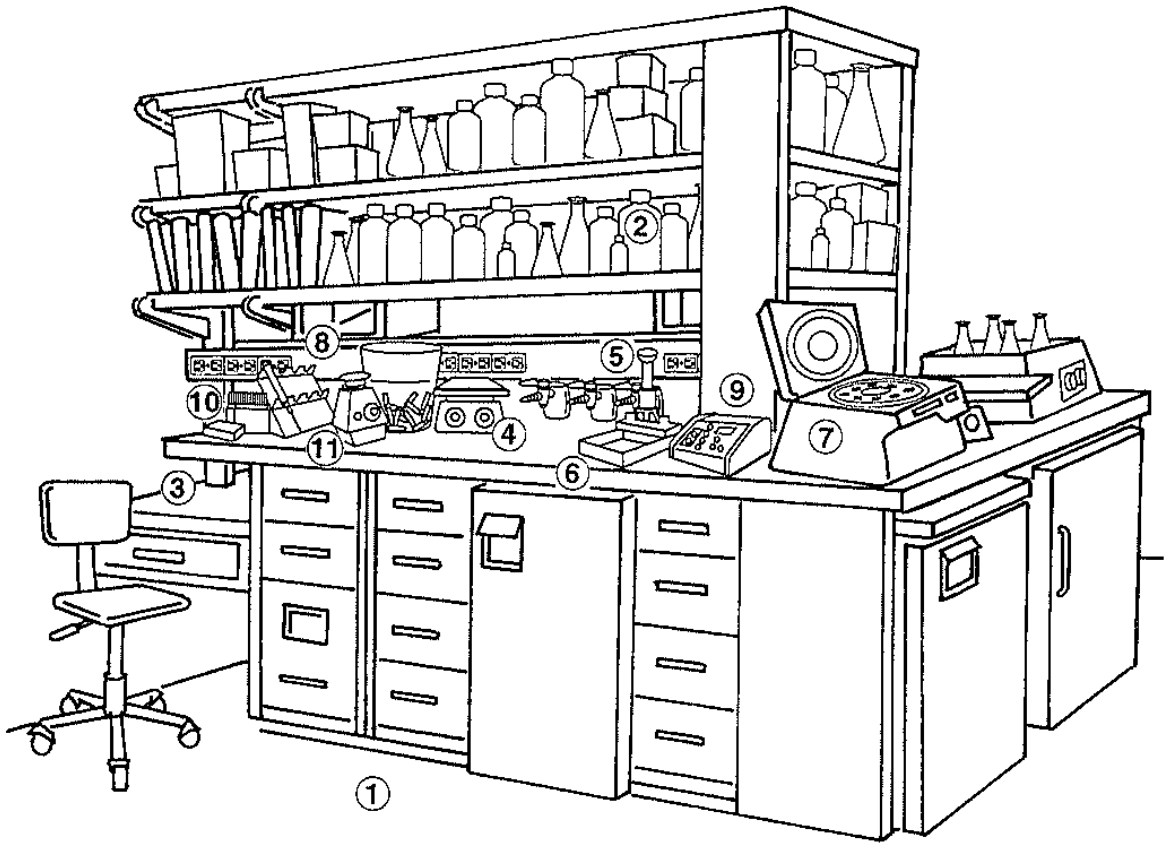
The typical lab bench

A slab of wood, slate, metal, or plastic—this will be the center of your lab life, your primary working area. On the bench are small pieces of equipment, such as a vortex and holders for various pipettors, and supplies such as pipettor tips.

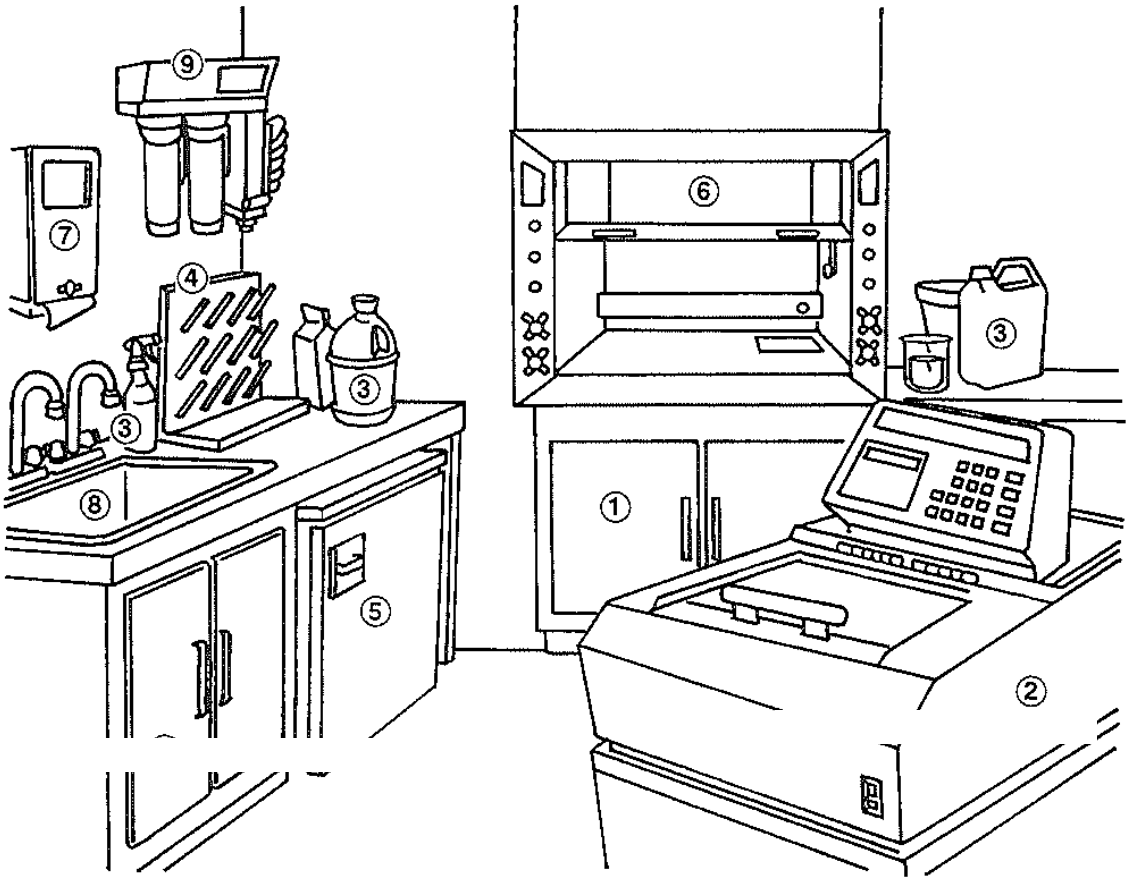
Most lab benches are equipped with a vacuum line, an air line, a gas line, and sometimes, a water line. The *water line* is the most useful in theory but the least in practice: Using it often results in a puddle on the bench. The *air* can be used to blow obstructions from tubes, to dry glassware quickly, and for other brute purposes. But this is dusty air, and it shouldn't be used on glassware that will be used for experiments or buffer preparation. The *gas line* is used to fuel Bunsen burners, needed for aseptic technique at the bench. The *vacuum line* is extremely useful, especially for removing supernatants.

Above the bench are usually shelves. Here are stored personal buffers and reagents. Detergents and Tris buffers often comprise the bulk of the bottles. Pipet tips and containers of microfuge tubes also sit here.

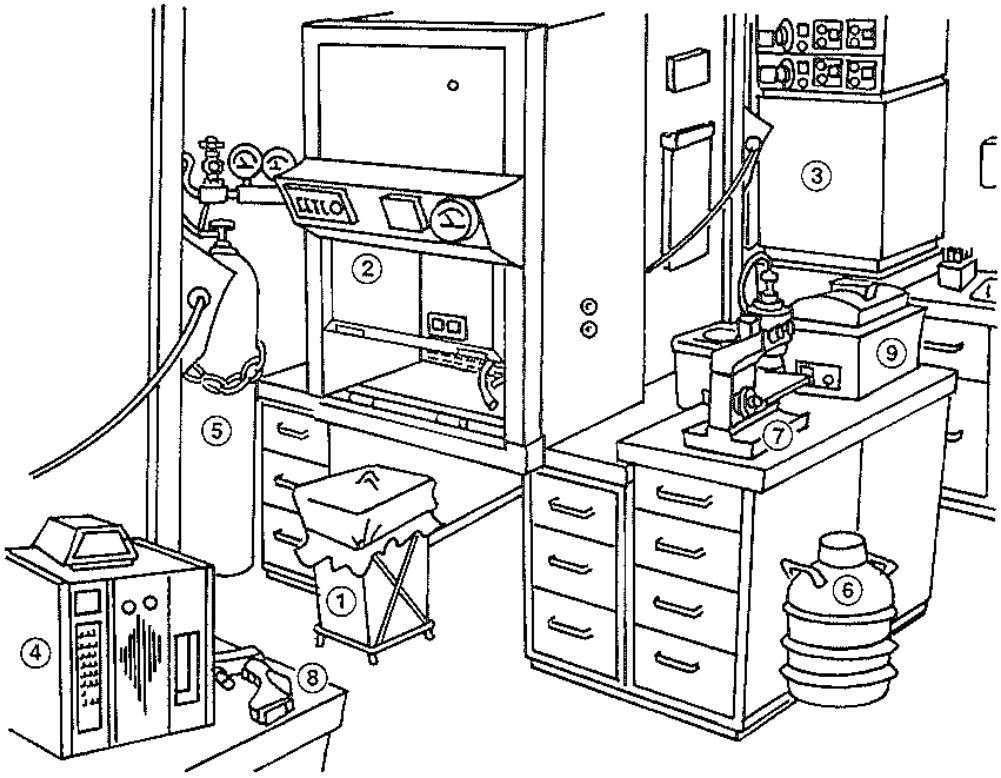
If there are cabinets beneath the lab bench, acids and bases (not in the same cabinet, of course) and large bottles of buffer or solvents will be found. Odd, old, favorite, or infrequently used small equipment might also be here.



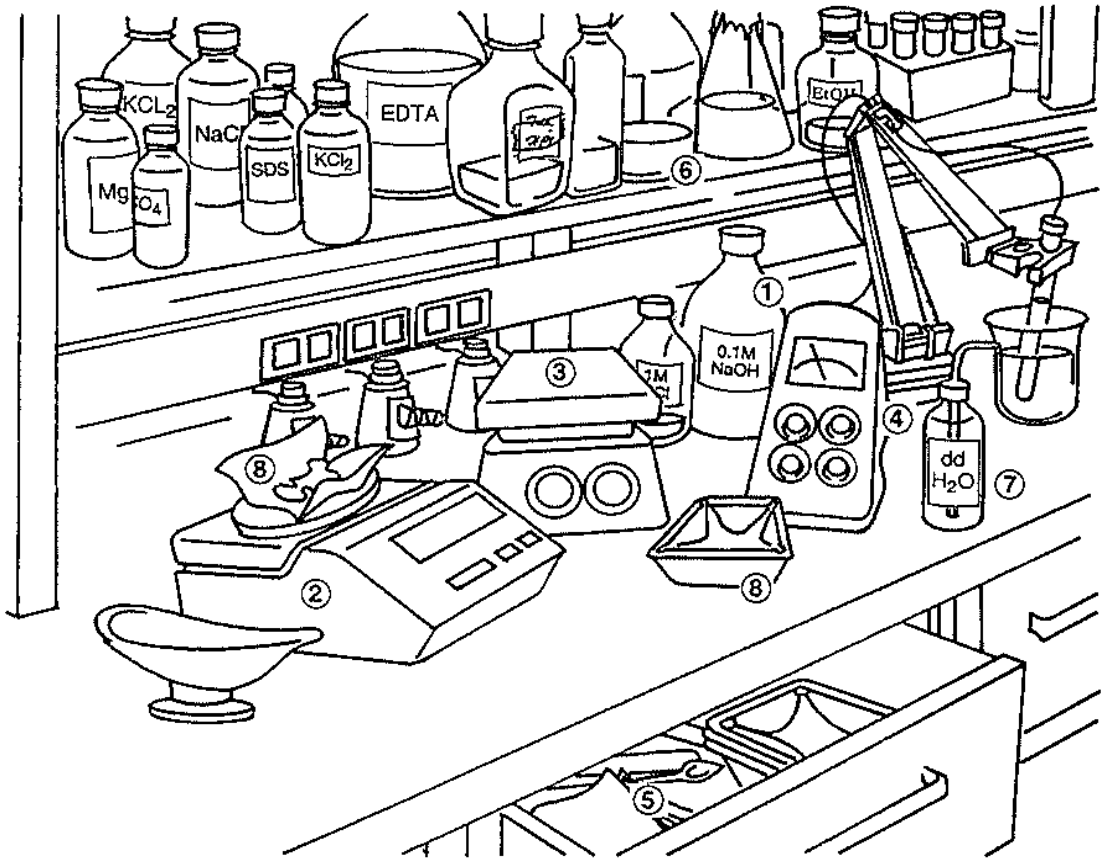
The laboratory bench. Key: (1) *Bays.* The area between benches, and more a psychological than a physical entity; sharing a bay with someone is a close and somewhat intimate relationship. Equipment tends to be shared in bays, reagents borrowed and lent, favors asked, stories told. Be kind to your baymate. (2) *Buffers and other reagents.* After being autoclaved, most buffers can be stored at room temperature. These belong to the owner of the lab bench, and should not be touched without permission. (3) *Desk.* Desks, particularly in older labs, may not be part of the lab bench, but may be found wherever there is space. Very few desks are found in some labs, and there are instead rooms filled with desks for all the departmental students and/or postdocs. Sometimes, not everyone gets a desk but must use the department library or conference room to read or to make notebook entries. Usually, however, desks are found at the end of the lab bench and against the wall. (4) *Hot plate.* Used to heat liquids. Samples are usually boiled in a beaker on a hot plate. **Hazards:** Burns, liquids bubbling over. **Alternatives:** Water bath, microwave. (5) *Flame burner* (also known as a Bunsen burner). Vital to aseptic technique, for heating bottles and loops. Hooked up to house gas supply. Turn off after each use. **Alternatives:** Electric loop sterilizers and disposable plastic loops. (6) *Gel box.* Plastic containers used to run protein, DNA, or RNA gels. They range in size from mini-gels to sequencing gels. (7) *Microfuge.* A small, benchtop centrifuge that spins volumes up to 2 ml at approximately 12,000*g*. Used to pellet cells, precipitate DNA ... a workhorse. Some models are refrigerated, most are not. Some units are kept in a refrigerator or cold room. **Alternatives:** Adapters can be used in larger centrifuges and rotors. (8) *Pipettors.* Instruments used to measure and transfer small volumes of liquid. (9) *Power supply.* Used to run electrophoresis, perform transfers of gels to filters. Shocks can result from careless handling. Not all power supplies perform all tasks, so be sure you have the correct one for the job. (10) *Tip boxes.* Pipettors require the right size tips to dispense fluids accurately. These tips are usually autoclaved before use, and are disposable. (11) *Vortex.* Used to mix the contents of tubes.



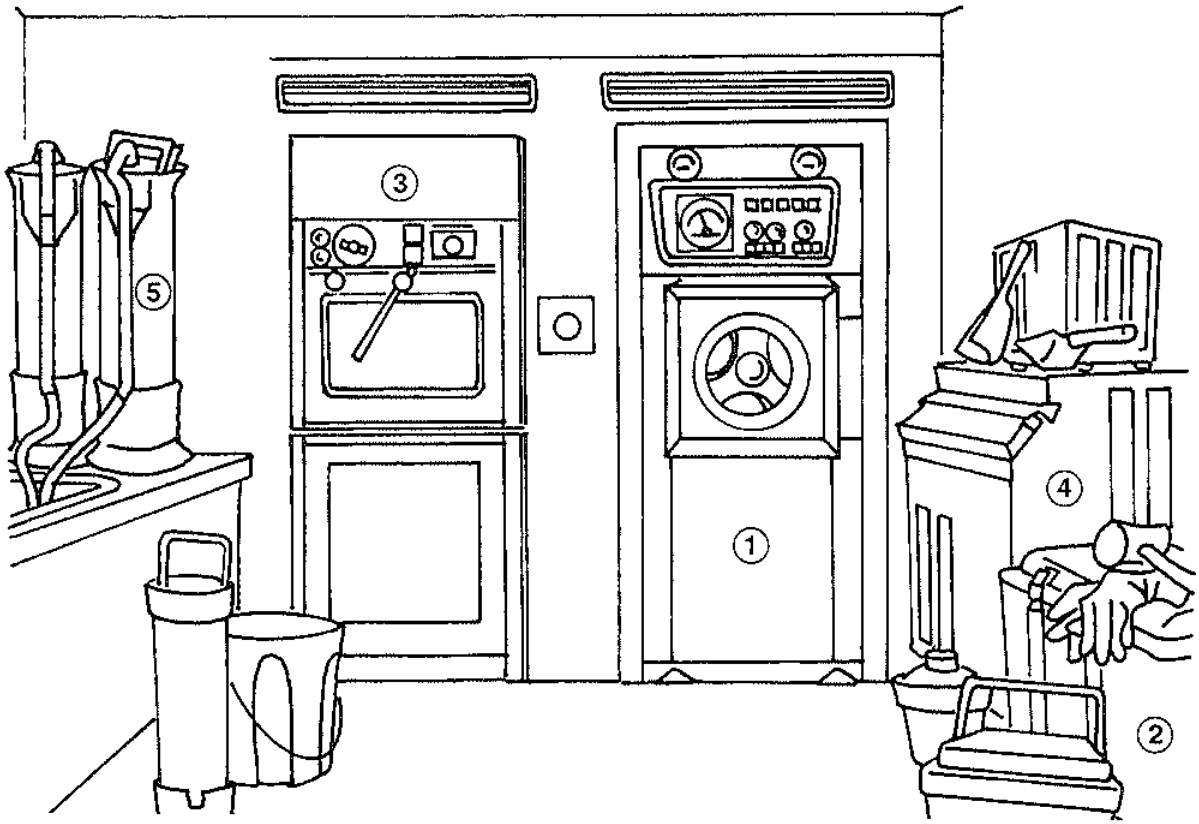
Sink area, centrifuge, fume hood. Key: (1) *Cabinets.* Acids or bases or organic solvents are stored in common areas throughout the lab. (2) *Centrifuge.* Spins tubes filled with a liquid/solid mix, separating the mix into (hopefully) distinct phases and concentrating solid phases. There are several kinds of centrifuges, categorized by speed and tube size capabilities. **Alternatives:** No practical alternative. Filtration can remove the media and trap solids for some material. **Hazards:** Generation of aerosols and mechanical failure. Aerosols of biohazard or toxic materials can be produced if good laboratory technique and centrifuge safety and containment equipment aren't used when centrifuging such substances. A mechanical failure can produce fragments moving at great velocity, and if such fragments escape the protective bowl of the centrifuge, they can cause traumatic injury to personnel. (3) *Detergents.* There may be several kinds of detergents and cleaning agents here: for hands, for glassware, and for radioactivity. (4) *Drying rack.* After handwashing, beakers and other labware are placed here. (5) *–20°C Freezer.* Used to store serum, most enzymes, reagents. There are often several freezers in the lab. (6) *Chemical fume hood.* Air is vented out of a chemical hood, making this the place of choice for working with volatile substances such as chloroform (and phenol-chloroform). Volatile radioactive labeling is done in some hoods, which are certified for this purpose. If this is true of the hood you are using, check for radioactivity with a Geiger counter. (7) *Paper towels.* Used for wiping hands and lab benches, and sometimes, for recording data. Replenish the stock if you use the last one. (8) *Sink.* Keep the sink clear for disposal and work. Be careful what you pour down the sink. Untreated supernatants from cells and bacteria should not be disposed of here, nor should hazardous chemicals. (9) *Water purification unit.* Tap water cannot be used for most laboratory applications. By distillation, or by reverse osmosis and ion exchange, the unit removes particles and other impurities from water. **Alternatives:** Purified water can be purchased in small quantities of 500 or 1000 ml.



Tissue culture area. Key: (1) *Biohazard waste disposal.* Anything living or used to hold anything living must be autoclaved before disposal. (2) *Biosafety cabinet.* Sometimes casually referred to as a hood or a *laminar flow hood*, this has a forced airflow to minimize the entrance of any dust or organisms into the working area. Laminar flow hoods should always be left on. (See Chapter 8.) **Alternatives:** If a biosafety cabinet is not required—if there is not a biohazard associated with the work material—a still-air box or traffic-less and draft-free place can be used for tissue culture. (3) *CO_2 incubator.* Used primarily for tissue culture, CO_2 is piped into an incubator for CO_2-requiring organisms or to maintain pH in the culture medium. **Remarks:** Buzzing may indicate a need to fill the water jacket, or a lack of CO_2. **Alternatives:** CO_2 can be pumped or generated in a container and incubated at the correct temperature. A buffer such as HEPES in a closed system can be used instead of CO_2 to maintain the pH of some cultures. (4) *Coulter counter* (also known as a cell counter). Electronically counts cells or particles. **Alternatives:** A counting chamber can be used with a microscope to manually count cells. (5) *Gas cylinders.* Pressurized gases have many uses in the lab, such as CO_2 for incubators, or nitrogen for disrupting cells. Most gas cylinders in use have a regulator attached to the valve, which is used to close the tank and regulate the outward flow of gas. The tank should always be roped or chained to a wall when standing and should be manipulated carefully when being moved. There is a danger of explosion or fire with oxygen and hydrogen, and you should get instruction from the EHS about the use of these gases. Valves open by turning counterclockwise. (6) *Liquid nitrogen tank.* A metal container filled with liquid nitrogen, it is used for the long-term storage of cells, viruses, and microorganisms. (7) *Microscope.* Used to magnify and observe tissues, cells, and microorganisms; there are two designs found in the lab. A standard compound microscope is used to observe samples that have been removed from culture medium and placed on a slide. An inverted microscope (the objective lens is situated below, not above, the sample) can magnify cells and organisms while they are still in the culture container. Microscopes often have attachments for fluorescence, and a camera. (8) *Pipet aids.* Liquids (volumes over 1 ml) are measured and transferred with pipets. Since no mouth pipetting is allowed, pipet aids such as automatic pipettors or bulbs are used to provide controlled suction. (9) *Water bath.* Used to thaw serum and do enzyme reactions. The contents of test tubes will reach the desired temperature much more quickly in water than in the air of an incubator. **Alternatives:** An insulated ice bucket filled with water at a moderate temperature will maintain a stable temperature for a while.



pH and weighing area. **Key:** (1) *Acids and bases.* Concentrated and dilute acids and bases are used to adjust the pH of solutions. (2) *Balance.* A scale used for weighing. There are several kinds, with the top-loading balance being the most useful for weighing lab amounts of solids (and liquids). A two-pan balance is usually used to weigh tubes for centrifugation, and an analytical balance is used for accurately weighing small amounts, usually under a gram. (3) *Hot plate stirrer.* When making solutions, a little bit of heat with mixing is needed to get some materials into solution. **Alternatives:** Hot plate with occasional hand stirring. (4) *pH meter.* Used to measure and adjust the H^+ concentration in a solution. **Alternatives:** pH paper, acid and base addition determined by calculation, but no practical alternative. (5) *Spatulas, scoopulas.* Metal or plastic instruments used to transfer solids from a container to a weighing vessel. These are usually stored in a drawer with weigh boats and stir bars. (6) *Stock reagents.* Supplies of chemicals to be used to make up solutions are kept near the prep area for convenience. (7) *Wash bottle.* A plastic bottle with a spout that delivers distilled water to wash the electrode of the pH unit. (8) *Weigh boats, weigh paper.* Solids must be placed on a support, such as weigh boats and weigh paper, before being placed on the balance to be weighed.



The kitchen. Key: (1) *Autoclave.* Sterilizes by subjecting material to saturated steam under pressure. It is used to render glassware, media, and buffers sterile before use, as well as to sterilize biohazard waste before disposal. **Hazards:** *Scalding.* Wait until all steam has been released from the chamber before taking anything out or looking into the autoclave. **Alternatives:** Liquids can be filter-sterilized. Glass and plastic ware can be radiation-treated, but few places have this capability. (2) *Dry ice storage chest.* Dry ice is delivered once or twice a week and is kept in a chest where pieces can be broken off as needed. A mallet and gloves should be beside the chest: Always use the gloves to transfer pieces of dry ice. (3) *Glassware washer.* Washes and dries lab glassware. (4) *Ice maker.* Ice is made constantly as the level of ice goes down. Remove the ice with a scoop, not with your ice bucket. Never eat this ice! People might use ice buckets or other contaminated labware to remove it, and there could easily be hazardous substances in the ice. (5) *Pipet washer.* Water is circulated to wash reusable glass pipets. The pipets may be plugged with cotton and loaded onto canisters at a station in the kitchen.