

Bump and Roll

Developed for the NISE Network with funding from the National Science Foundation under Cooperative Agreement #ESI-0532536.

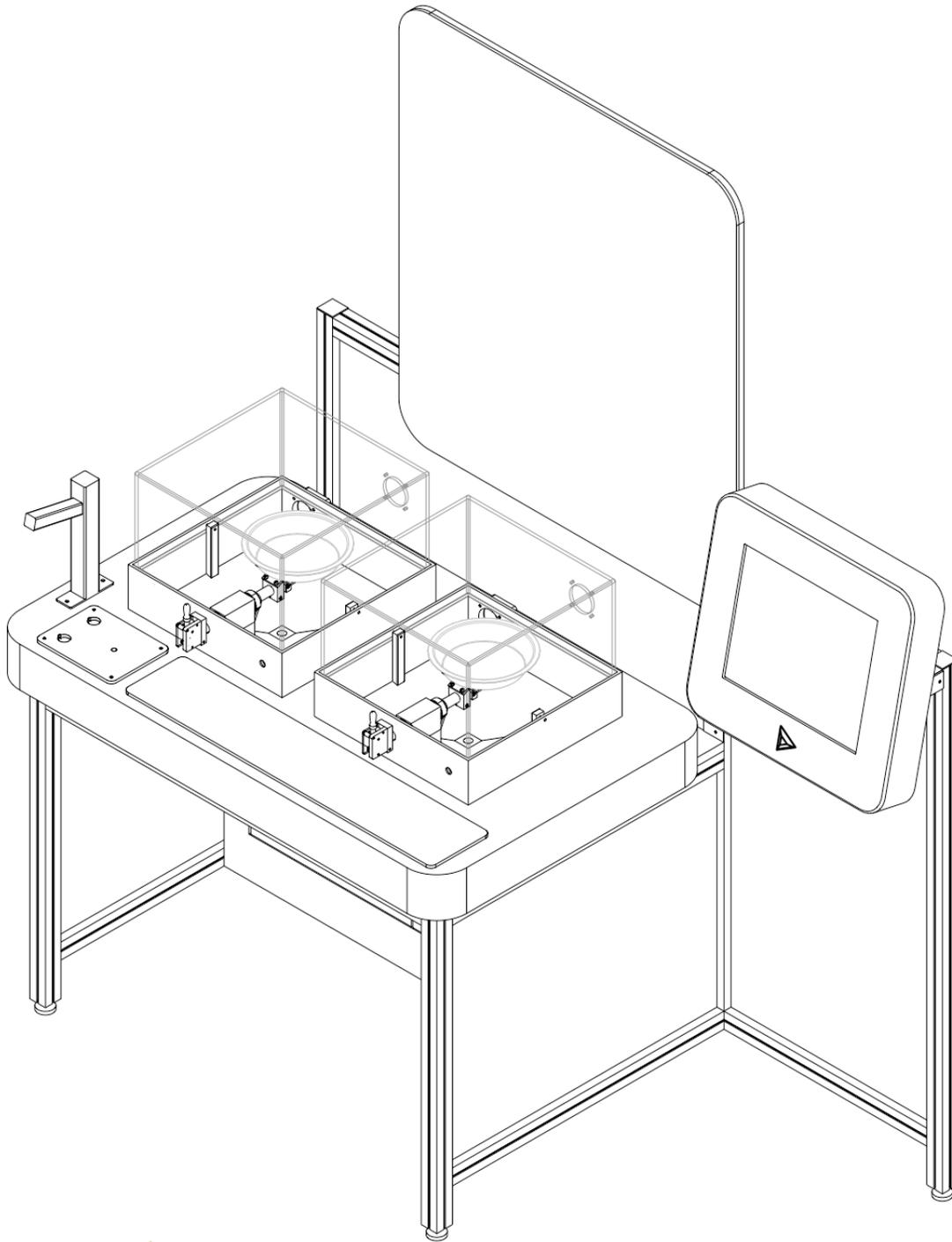


Exhibit Description

Bump and roll demonstrates and explains how similar nanoscale surface structures enhance the super-hydrophobic properties of the leaves of certain plants and new synthetic, water-repellant finishes.

Visitors press a button to dispense water drops onto either ornamental kale or cabbage leaves (family *Brassica oleracea*) mounted in a pie tin in the lefthand vitrine, or onto a pie tin sprayed with a super-hydrophobic coating in the righthand vitrine. Visitors then rotate a gimbal mechanism via a small knob to manipulate the water drops on the respective surfaces, observing how the minimal attraction of the water to either the plant leaf or the coating allows the water to remain in more spherical drops and race around the surfaces due to minimal surface friction. When the knob is released, the pans automatically tilt to drain the water off into a tank housed in the exhibit cabinetry.

To the left of the interactive a pair of headphones and two pushbuttons delivers an audio description of the exhibit in English or Spanish (or another 2nd language). To the right of the interactive is an LCD screen with changeable graphic content that may be scrolled through via a pushbutton.

Power is delivered to the exhibit via one power cord plugged into a single 120VAC receptacle at the host facility. The exhibit has a “backside,” but may be approached from any direction.

Exhibit Installation and Operation

Assembly requires 2 individuals, each capable of lifting 75 lbs.

Bump and Roll ships almost completely assembled. Once the location has been chosen, and the exhibit removed from its pallet, take a few minutes to level the table if necessary.

The graphic panel, which may be packed separately, should be secured to the top rail with the supplied hardware. Access to the base cabinet is via a National cam lock using a #415A key.

Step 1:

There is a “smart” dc power supply inside the electrical enclosure that powers the DC fans when AC power is supplied to the exhibit and charges the battery as well. When AC power is removed (e.g museum power turned off), the 2 fans are switched to DC power from the battery. This prevents build-up of moisture inside the vitrines and helps decrease the chance of mold.

Check that the small toggle switch on the right side of the enclosure is in the “on” position. This switch is normally on when the exhibit is on display. It should be turned off when the exhibit will be off-line or in transit. The muffin fans at the 2 vitrines should start upon flipping this switch. If not, the battery may have been left connected for too long without recharging, or it may be beyond its useful life. Recharge or replace with a compatible battery.

Step 2:

Be sure both peristaltic pumps are turned on and that they are plugged into their respective switched receptacles on the top of the electrical enclosure (there is typically no reason to turn the pumps off or to unplug them).



Step 3:

Check the GFCI outlet to be sure its breaker trips when you press the “test” button, and that it resets when you press the “reset” button.

All AC power inside the cabinet is protected by this GFCI outlet.



Step 4:

The following should not require any action, but check to be sure that:



1. No wires at the headphone volume control circuit have come loose from their terminals
2. The Roku Player has a flash Card for video and audio description programming properly installed
3. The monitor cable is plugged into the Roku Player
4. The DB25 interconnect cable between the Roku Player and the buttons is plugged in

120 VAC power may now be connected to the exhibit.

Water Supply and Drain Tank Set-up

Fill the right hand tank with ~2 gallons of distilled water (tap water will work, but the minerals deposited on the vitrines mean they will need to be cleaned more often).



Orient the jug as shown, and return the two water supply lines with their weighted strainers back into the tank. Screw the cap down.

Verify that both drain lines are securely placed into the mouth of the drain tank.

Vitrine Removal and Replacement

Use the 1/8" allen wrench to remove 2 each #10-24 stainless steel button head screws from the drain pan.

Note each screw has a #10 stainless steel washer with it to protect the PVC drain pan.

The screws are threaded into stainless steel Helicoil inserts. Use caution so as not to crossthread and do not overtighten or the Helicoil may strip out of the drain pan.



Store the vitrine on a clean towel or blanket. The interior of the vitrine may be washed with warm water and a soft, lint free cloth.



Clean and polish the vitrines only with products made explicitly for acrylic. **Novus 1** is the preferred cleaner and polish for clear acrylic.

Cabbage Installation and Replacement

- The plant leaves in the left vitrine may need to be replaced on a daily basis. In some cases, we've been able to use a piece for roughly two days.
- Ornamental kale is a good-looking choice, but plain cabbage works just as well. Look for heads in the grocery store with large leaves. A head will store refrigerated for about 1-1.5 weeks



Secure the leaf to the steel plate with the three magnets.

The water drip tube may be gently realigned so that it drips at the center of the pan.

The 2' muffin fans on the vitrines have a foam filter unit. The media should be checked weekly and replaced as required. (McMaster-Carr Part #19155K7)



Do not touch the coating on the right-hand pie pan or it may compromise the super-hydrophobic properties.

Occasionally, the coating may lose its effectiveness. If the coating appears to be in good condition, you may be able to “recharge” it. Rinse the coating with alcohol and dry it with a dry heat. A hair dryer would work well.

Return Spring Adjustment, Pan Angle Adjustment:



The pans are tipped to the side by a short length of urethane round belting acting as a spring. The tension can be adjusted by loosening the aluminum shaft collar and turning it to either increase or decrease the tension on the belting. Once the desired tension is achieved, tighten the shaft collar again.

Additionally, the pan may eventually wander toward the right so that the visitor cannot level it with the gimbal mechanism. This can be adjusted by loosening the black bracket and returning it to the proper orientation.

Peristaltic Pump Speed Adjustment:

Both peristaltic pumps should have similar dispensing rates – around 2 drops/second.

There is a trim pot that is adjustable via a small, straight bladed screwdriver. Turn it clockwise to speed up the flow, counterclockwise to slow down the flow. Replace the cover cap when finished.



Electrical Equipment

In general, no one but a qualified exhibits technician or electrician should access the electrical enclosure. Everything except the recessed male Edison connector is DIN rail mounted. The recessed male power inlet (lower left) projects into the enclosure.

All power run into the enclosure runs first to the GFCI in the 4x4 junction box. This outlet provides power to the multimedia equipment. The outlets on the top of the larger enclosure are switched (separately) by the relays to control the peristaltic pumps.

The DIN rail mounted power supply is a Powerstream PST-SP12AL DC UPS supply, rated for 6A at 12 VDC
(PowerStream Technology, 140 South Mountainway Dr.
Orem, UT 84058
Phone: 801-764-9060)



The output voltage is adjusted to ~13.3 VDC to charge the 18 Ah sealed lead acid battery (McMaster Carr #7448K76)

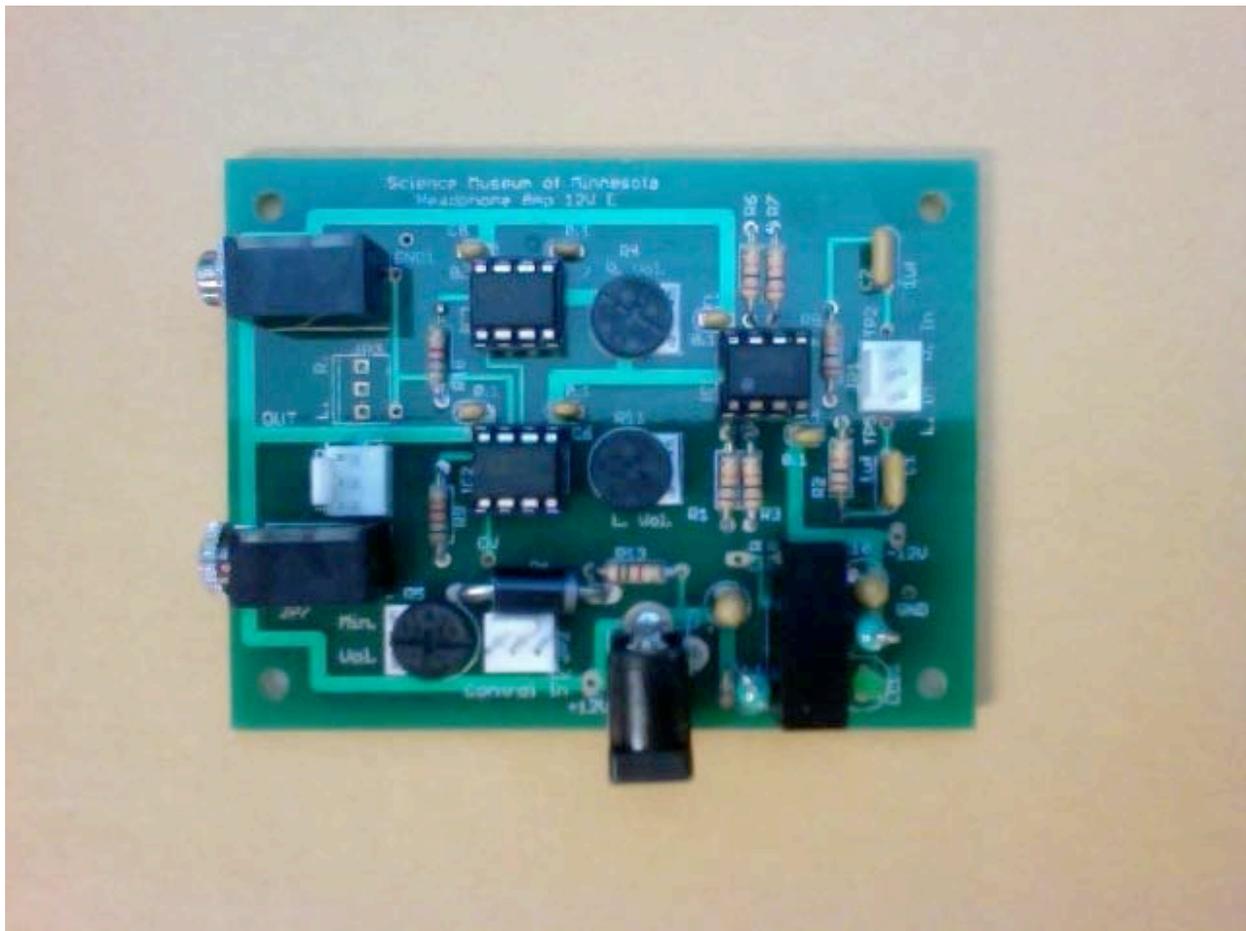
There is a fuse holder immediately above the power supply with a 1 A AGC (Buss) fuse on the positive (+) battery lead before it enters the power supply)

Relays are Ultra-Thin Long-Life Relay 4-28 VDC Control Voltage, 3 Amps @ 12-280 VAC (McMaster Carr #8299K11)

Low voltage out of the enclosure is 1 line to power 12V fans on the vitrines and 2 lines to control the relays.

Headphone Volume Control

The headphone volume is controlled by a custom amplifier built by SMM. (Actual board may be mounted in another orientation. The following positions refer to the photo.)



- Power In** is a standard 5.5mm DC connector.
- Audio In** is the 3-pin molex on the right hand side of the board.
- Audio Out** is the 1/8" stereo jacks on the left side.
- The **volume knob** connects to the 3-pin molex terminal on the bottom center of the board.
- Left and Right Maximum volumes** are adjusted independently with the two pots at the center of the board.
- Minimum volume** is set with the pot in the lower left corner. This can prevent the volume being turned all the way down so that visitors don't think the exhibit is broken.

If you require any information not included in this document, more complete drawings and diagrams are available online at www.nisenet.org. With any other questions, please contact:

Cliff Athorn
Science Museum of Minnesota
120 Kellogg Blvd. W.
St Paul, MN 55102
651-221-9427
manderson@smm.org