

## Teacher Information and Guidelines

### Biomimicry

#### Overview

Biomimicry is the practice of taking inspiration from nature to create solutions to meet human needs in a sustainable way. MSI offers 2 program options that introduce this concept and encourage students to apply it in critical thinking, problem solving, and design. Through hands-on observation of live animals, students learn how to identify and analyze adaptations that can be mimicked to solve human challenges.

#### Option 1: Classroom Biomimicry (3<sup>rd</sup> Grade and up)

This option is done within the student's own school. It consists of a 60-minute introduction to Biomimicry (including animal exploration), a 40-minute Design Challenge, and 20 minutes for peer-to-peer presentations. This program can also be split into two one-hour programs on different days or a 2 hour program on one day.

#### Option 2: Discovery Voyage Biomimicry (5<sup>th</sup> Grade and up)

This option is split between the student's own school and MSI's R/V *Robert G. Brownlee*. It consists of a 60-minute introductory Biomimicry program (Inland Voyage) in the student's own school and a 4-hour hands-on Discovery Voyage aboard our 90-foot research vessel.

### Option 1: Classroom Biomimicry

#### Inland Voyage (in school) Pre-Visit Checklist

- **Please review the invoice.** Note the deposit due date; your deposit must be received by that date in order to hold your reservations. A purchase order will be accepted in lieu of a deposit.
- **Make sure you understand the cancellation policy.**
- **Make sure students have taken pre-surveys**
- **Make sure program balance is paid.**
- **Complete and return the Student Assessment Sheet.** Fax, email, or mail the Student Assessment Form a few days prior to your voyage.
- **Complete and return the Inland Voyage Parking and Set-up Form.** Fax, email, or mail the Inland Voyage Parking and Set-up Form a few days prior to your voyage.
- **Notify MSI if there are any special needs** (e.g. students in wheelchairs or crutches).
- **Use pre-activities and background information.** This helps prepare your students for the visit and can be found on the MSI website [www.sfbaymsi.org](http://www.sfbaymsi.org)

#### Inland Voyage (in school) Day-of Visit Checklist

- **School office is aware of where MSI will be setting up and the room/space is available.**
- **Give MSI staff filled out pre-surveys when they arrive.**

### Post-Visit Checklist

- **Make sure students taken post survey and mail it back to MSI.**
- **Send in Thank You to Sponsors to MSI.** If artwork is involved this also enters the students into MSI's Translating the Tides Competition. See below for more details.
- **Use post-activities** This helps solidify your students grasp of knowledge they gained on the voyage and can be found on the MSI website [www.sfbaymsi.org](http://www.sfbaymsi.org)
- **Make sure program balance is paid.**
- **Book for next year.** We take bookings a year in advance, so book early if you want specific times of year or dates.

## Program Logistics

### Location Considerations

The Inland Voyage program is delivered to a school, library or camp by an MSI vehicle, a truck or van. Since this unit is both transport and life support for the marine organisms, the programs are presented outside or inside and close to the MSI vehicle. We need an area accessible to the vehicle that is large enough to set up a two-station program for up to 30 students. This area can be grassy or paved, and shade is a necessity. If shade is not possible the Marine Science Institute needs to be notified so that shade can be brought. If an indoor space is used, it should be accessible without using stairs, have tables and a non-carpeted floor. If the area is separated from recess activities or any other traffic, the students will be more focused and attentive. Ultimately they will get more out of the experience if these factors are considered.

### Program Length and Student Participation

The program allows one class of up to 30 students to participate at a time. The two instructors will give a 20-minute introduction and then the class will divide into two groups, with each group participating in a 30-minute station. To expedite this transition, we ask that the class be divided in half prior to our arrival. The program will wrap up with a 10-minute closing discussion. We also schedule a ten-minute window between programs. The ten-minute intermission is essential to the well-being of the animals and enables staff to set-up for the next program.

### Weather and Clothing Considerations

If cold or rainy weather is forecasted, please plan on providing an indoor space for the programs.

### Snack and Lunch

Because of the short duration of the presentations, there is no time for snack or lunches to be scheduled during the presentation. When scheduling your Inland Voyage program, please schedule around recesses and lunches.

**RESTRICTION:** For the animal's safety, no hand sanitizer or food near the animals.

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### **Sponsor Acknowledgement and Translating the Tides**

Translating the Tides is a creative contest run by the Marine Science Institute (MSI) for students in grades kindergarten through college who participate in MSI's hands-on marine science education programs. Translating the Tides is a wonderful opportunity for students to express, in their own voices and styles, what they have learned and what they want others to know about our aquatic environments. All submissions count as sponsor acknowledgement. Winning entries are selected and may be published on the MSI web site, in our newsletter BayLines, on our monthly desktop calendar and other promotional materials. For more details see [www.sfbaymsi.org/translating-the-tides](http://www.sfbaymsi.org/translating-the-tides)

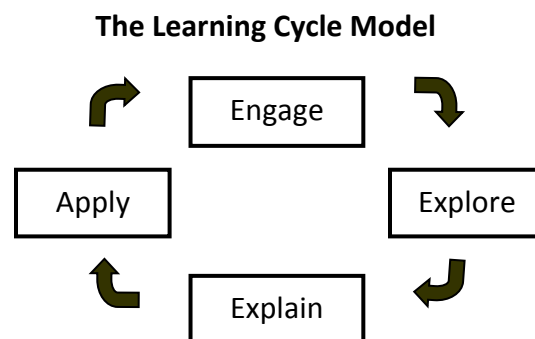
### **Role of Assisting Adults**

In order to keep program costs at a minimum, we require the participation of at least one classroom teacher or adult. Each group of students will be working with one instructor and any available adults. At each station, the groups will break into smaller groups to study individual organisms. Our method of teaching is to ask thought-provoking questions that will lead students to their own answers. We ask that adults do not provide answers to the students, but let them discover the answers on their own.

### **Student Assessment and Learning Cycle**

Since 1970, MSI has tailored science activities to meet the needs of teachers' curriculum. Students and teachers present themselves to our programs with a wide range of interdisciplinary science understandings and skills. Our marine science educators are specially trained to teach all ages with interesting and innovative methods that encourage interaction and problem solving. We encourage you to tailor your program by telling us about a particular theme that your class has been studying. Please fill out the Student Assessment Sheet you received to let us know.

MSI has modified our working educational philosophy to respond to this broad range and to help teachers and students get the most from our programs. What you do before, during, and after the day of the program will determine to a very large extent how strong a partner MSI will be in helping you meet your learning objectives. As you plan a visit to MSI, please consider how this opportunity fits within your overall instructional objective. What learning outcomes do you desire from this experience? How well is the class positioned to move your desired outcomes toward a reality? Please use the following description of the learning cycle to assess your students.



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**Engage – Students are just beginning to generate interest in marine science.**

*“The MSI program will be the hook from which I launch my unit and introduce my class to the excitement of marine science. I’m willing to come into this trip a bit cold...my main objective is to generate curiosity and get the students raising questions.”*

**Explore – Students are ready to actively experience, form predictions, and make observations.**

*“My students are already hooked on marine science. I’m bringing them to the MSI program with basic understandings and tools... They know a bit about the Bay and are ready to actively explore it. My objectives are for my students to make observations and to collect and record data. I’d like to see them make informed predictions and to begin framing their own critical questions.”*

**Explain – Students have been developing understanding for some time, and are now ready to speak the language of marine science.**

*“By the time we participate in our MSI program my students will have conducted serious investigations of topics related to the San Francisco Bay. My objective is to see them using the language of marine science... I’d like them to begin exploring important concepts and to comprehend and analyze other explanations.”*

**Apply – Students have a mature understanding of marine science, perhaps including aspects that are far afield from the San Francisco Bay area, and now are ready to relate that knowledge to their own backyard.**

*“My group has a good handle on the major learning objectives I have set for marine science. MSI’s program is going to provide new scenarios for them to consider and address. My objective is to see my students using and applying their new knowledge in a different context.”*

## **Classroom Biomimicry Program Description**

The Classroom Biomimicry Program takes place entirely in the classroom, where students examine live animals and learn about their adaptations. During the first hour-long session students record the ideas and observations that they use for the second session focused on applying biomimetic concepts. The culmination of this program is a final design challenge. This challenge requires students to apply their knowledge of adaptations to creating sustainable solutions for an imaginary research station. They design elements that address mobility, energy, waste management, and other requirements. The students’ final designs are completed in small teams, and presented to the class.

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## Program Objectives

1. To relate physical and behavioral adaptations of marine invertebrates to this unique environment called an estuary.
2. To emphasize how all the living organisms are interconnected in the marine food web, and also how they relate to the physical environment.
3. To gain an understanding, appreciation, and respect for marine ecosystems, and understand the special responsibilities of humans in the natural world.
4. To gain a basic understanding of the concept of biomimicry
5. To experience some of the steps of the design process

## Program Format

The Classroom Biomimicry program is a combination of 2 one hour presentations. These can be done in one day or can be booked on separate days. The first presentation is the 60-minute introduction to Biomimicry, including animal exploration. The second presentation is the 40-minute Design Challenge followed by the 20-minute peer-to-peer presentations.

During the first presentation there will a group introduction to the concept of biomimicry. The students will then be broken up into smaller groups to have time practicing identifying different adaptations of live animals and how those adaptations can be utilized to solve challenges. Throughout the program MSI instructors and adults will provide guidance and encouragement. Students can expect to handle and touch a variety of organisms as part of their observations.

During the second presentation the students will be participating in a biomimicry design challenge. This challenge requires students to apply their knowledge of adaptations to creating sustainable solutions for an imaginary research station. They design elements that address mobility, energy, waste management, and other requirements. The students' final designs are completed in small teams, and presented to the class.

## Option 2: Discovery Voyage Biomimicry

### Inland Voyage (in school) Pre-Visit Checklist

- **Please review the invoice.** Note the deposit due date; your deposit must be received by that date in order to hold your reservations. A purchase order will be accepted in lieu of a deposit.
- **Make sure you understand the cancellation policy.**
- **Make sure program balance is paid.**
- **Complete and return the Student Assessment Sheet.** Fax, email, or mail the Student Assessment Form a few days prior to your voyage.
- **Complete and return the Inland Voyage Parking and Set-up Form.** Fax, email, or mail the Inland Voyage Parking and Set-up Form a few days prior to your voyage.
- **Notify MSI if there are any special needs** (e.g. students in wheelchairs or crutches).
- **Use pre-activities and background information.** This helps prepare your students for the visit and can be found on the MSI website [www.sfbaymsi.org](http://www.sfbaymsi.org)

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### **Inland Voyage (in school) Day-of Visit Checklist**

- **School office is aware of where MSI will be setting up and the room/space is available.**

### **Discovery Voyage Pre-Visit Checklist**

- **Please review the invoice.** Note the deposit due date; your deposit must be received by that date in order to hold your reservations. A purchase order will be accepted in lieu of a deposit.
- **Make sure you understand the cancellation policy.**
- **Make sure program balance is paid.**
- **Arrange for chaperones.** MSI requires the assistance of **one adult per fifteen students.** These adults will assist the students at each station. They do not need to have a science background, but they should be enthusiastic and interested.
- **Complete and return the Student Assessment Sheet.** Fax, email, or mail the Student Assessment Form a few days prior to your voyage.
- **Create list of student groups.** Divide your students into three groups
- **Notify MSI if there are any special needs** (e.g. students in wheelchairs or crutches).
- **Fill out the manifest (emergency phone list)** include both student and adult names and numbers on the form.
- **Use pre-activities and background information.** This helps prepare your students for the voyage and can be found on the MSI website [www.sfbaymsi.org](http://www.sfbaymsi.org)
- **Arrange transportation.** Book buses or arrange for carpools. We recommend booking buses as early as possible to ensure they are available for the times that you need them.

### **Discovery Voyage Day-of Visit Checklist**

- **Arrive 20 minutes prior to departure.** AM Voyages run from 8:00 am to 12:00 noon. PM voyages run from 1:00 pm to 5:00 pm.
- **Bring 2 copies of your updated manifest (emergency phone list) on the day of your program.** Include both student and adult names and emergency contact numbers on the form.
- **Dress in layers.** Students will be handling sediment samples and live fish, so their clothes may get wet and dirty. If the forecast calls for rain, please have your students bring rain gear.
- **For safety reasons closed-toed shoes are mandatory for all passengers.** No open toed shoes will be permitted, including on adults.
- **Make sure driver(s) have directions to the dock.** You will find directions to the Institute on our website at: [www.sfbaymsi.org](http://www.sfbaymsi.org) If you will be traveling via carpool to Redwood City, please make sure parent drivers know to park in MSI's dirt lot only, and not in Stanford's lot.
- **Bring non crumbly Snack**

### **Post-Visit Checklist**

- **Send in Thank You to Sponsors to MSI.** If artwork is involved this also enters the students into MSI's Translating the Tides Competition. See below for more details.

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- **Use post-activities** This helps solidify your students grasp of knowledge they gained on the voyage and can be found on the MSI website [www.sfbaymsi.org](http://www.sfbaymsi.org)
- **Make sure program balance is paid.**
- **Book for next year.** We take bookings a year in advance, so book early if you want specific times of year or dates.

## Program Logistics

### Location Considerations

#### Inland Voyage (in school):

The Inland Voyage program is delivered to a school, library or camp by an MSI vehicle, a truck or van that pulls a trailer-mounted, mobile aquarium behind it. Since this unit is both transport and life support for the marine organisms, the programs are presented outside or inside and close to the MSI vehicle. We need an area accessible to the vehicle that is large enough to set up a two-station program for up to 30 students. This area can be grassy or paved, and shade is always appreciated. If an indoor space is used, it should be accessible without using stairs, have tables and a non-carpeted floor. If the area is separated from recess activities or any other traffic, the students will be more focused and attentive. Ultimately they will get more out of the experience if these factors are considered. One class can experience more than one habitat on a given day, but due to vehicle space and set-up needs, we can only offer two different types of programs per each visit to the school.

#### Discovery Voyage:

The *R/V Robert G Brownlee* uses 4 different docks. In March-October the ship is docked at the home port in Redwood City, CA. In late October/November the ship is docked at Marina Bay Yacht Harbor in Richmond, CA. The ship moves to Pier 40 in San Francisco, CA in November. The *Brownlee* returns to Redwood City, CA for the month of December. In January and February the ship does a modified Delta Program in Antioch, CA.

### Program Length and Student Participation

#### Inland Voyage (in school):

The program allows one class of up to 30 students to participate at a time. The two instructors will give a 20-minute introduction and then the class will divide into two groups, with each group participating in a 30-minute station. To expedite this transition, we ask that the class be divided in half prior to our arrival. The program will wrap up with a 10-minute closing discussion. We also schedule a ten-minute window between programs. The ten-minute intermission is essential to the well-being of the animals and enables staff to set-up for the next program.

#### Discovery Voyage:

The Discovery Voyage will be a full four-hour program. The program allows a group of up to 45 students, in the 5<sup>th</sup> grade to university level, to participate. We require at least 3 adults, so that each may chaperone one of three groups during the Voyage. In order to keep the activities truly “hands-on”, we must limit the group size to 45 students. The group should be split into 3

cooperative learning groups prior to your arrival. Please have your students wear color-coded name tags for the program.

## **Weather and Clothing Considerations**

### Discovery Voyage:

The weather on the Estuary can change very quickly from one minute to the next. Please warn students to wear clothes that are appropriate for a variety of weather conditions. Layered clothing that can be easily removed and put back on is the best to wear. Let students and adults know they should wear old clothing that they won't mind getting wet and muddy, because salt water and mud may ruin any good clothing. The deck of the ship will be wet, so appropriate rubber soled shoes or boots are recommended. **Sandals, open-toed shoes, or high-heels are not acceptable.** We are on deck for most of the Voyage, so sunscreen and sunglasses are recommended. Caps are not recommended, since the wind may blow them overboard. We are equipped with rain gear for everyone onboard, but students may be most comfortable in their own clothing and gear. For safety reasons, umbrellas are not allowed. Old towels can be brought to dry your hands, but please do not bring paper towels, since they create a lot of garbage.

## **Snack and Lunch**

### Inland Voyage (in school):

Because of the short duration of the presentations, there is no time for snack or lunches to be scheduled during the presentation. When scheduling your Inland Voyage program, please schedule around recesses and lunches.

**RESTRICTION:** For the animal's safety, no hand sanitizer or food near the animals.

### Discovery Voyage:

Snack time is available if you speak with the crew before the program begins. It is best if the snack is separated from the rest of their belongings so it is easy to access. Teachers may supply a **group snack** for their students during the program on the ship. MSI also recommends that each student brings a bottle of water. We require non-messy food that is easy to eat and is not crumbly (please **do not** bring chips, crackers, crunchy granola bars, etc.). There is not time for lunch during the voyage but you can have lunch on land after a morning trip or before an afternoon trip. Space is available for your class to eat lunch on the grounds of the Institute. MSI has a no trash policy, so please encourage your students to bring "no trash lunches". MSI does not have the facilities to accommodate all the trash generated by participating students so please bring a plastic bag so you can take any garbage back with you. If needed a garbage bag can be requested from the Institute.

**RESTRICTION:** No hand sanitizer, no food near animals(the only eating area is inside the main classroom).

## **Sponsor Acknowledgement and Translating the Tides**

Translating the Tides is a creative contest run by Marine Science Institute (MSI) for students in grades kindergarten through college who participate in MSI's hands-on marine science education programs. Translating the Tides is a wonderful opportunity for students to express, in their own voices and styles, what they have learned and what they want others to know about our aquatic environments. All submissions count as sponsor acknowledgement. Winning entries

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are selected and may be published on the MSI web site, in our newsletter BayLines, on our monthly desktop calendar and other promotional materials. For more details see [www.sfbaymsi.org/translating-the-tides](http://www.sfbaymsi.org/translating-the-tides)

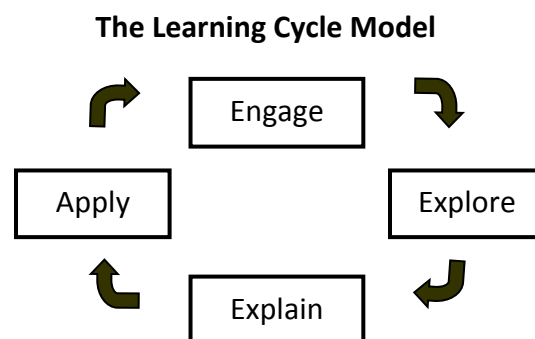
### **Role of Assisting Adults**

Minimum number of adults is 3 and maximum number of adults is 10 for the voyage. For safety reasons and in order to keep costs at a minimum, we require the participation of all adults on the Voyage. We ask that you choose chaperones who will help motivate and excite the students. The role of the adults will be to assist in maintaining group continuity and to help keep students on task. At each station, the group will break into three or four smaller groups to study the individual organisms. At least one adult will be assigned to each group to actively assist their students in observing, identifying, classifying and analyzing the organisms through the use of keys and charts. Our method of teaching is to ask thought-provoking questions that will lead the students to their own answers. We ask that adults do not provide answers to the students, but let them discover the answers on their own. Adults will also assist with overall group organization and safety. All adults will be briefed by our Captain at the beginning of the program.

### **Student Assessment and Learning Cycle**

Since 1970, MSI has tailored science activities to meet the needs of teachers' curriculum. Students and teachers present themselves to our programs with a wide range of interdisciplinary science understandings and skills. Our marine science educators are specially trained to teach all ages with interesting and innovative methods that encourage interaction and problem solving. We encourage you to tailor your program by telling us about a particular theme that your class has been studying. Please fill out the Student Assessment Sheet you received to let us know.

MSI has modified our working educational philosophy to respond to this broad range and to help teachers and students get the most from our programs. What you do before, during, and after the day of the program will determine to a very large extent how strong a partner MSI will be in helping you meet your learning objectives. As you plan a visit to MSI, please consider how this opportunity fits within your overall instructional objective. What learning outcomes do you desire from this experience? How well is the class positioned to move your desired outcomes toward a reality? Please use the following description of the learning cycle to assess your students.



**Engage – Students are just beginning to generate interest in marine science.**

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*“The MSI program will be the hook from which I launch my unit and introduce my class to the excitement of marine science. I’m willing to come into this trip a bit cold...my main objective is to generate curiosity and get the students raising questions.”*

**Explore – Students are ready to actively experience, form predictions, and make observations.**

*“My students are already hooked on marine science. I’m bringing them to the MSI program with basic understandings and tools... They know a bit about the Bay and are ready to actively explore it. My objectives are for my students to make observations and to collect and record data. I’d like to see them make informed predictions and to begin framing their own critical questions.”*

**Explain – Students have been developing understanding for some time, and are now ready to speak the language of marine science.**

*“By the time we participate in our MSI program my students will have conducted serious investigations of topics related to the San Francisco Bay. My objective is to see them using the language of marine science... I’d like them to begin exploring important concepts and to comprehend and analyze other explanations.”*

**Apply – Students have a mature understanding of marine science, perhaps including aspects that are far afield from the San Francisco Bay area, and now are ready to relate that knowledge to their own backyard.**

*“My group has a good handle on the major learning objectives I have set for marine science. MSI’s program is going to provide new scenarios for them to consider and address. My objective is to see my students using and applying their new knowledge in a different context.”*

### **Discovery Voyage Biomimicry Program Description**

The Discovery Voyage Biomimicry Program includes an in-class introductory visit and a voyage aboard Marine Science Institute’s research vessel. In the classroom students are introduced to biomimicry and practice identifying adaptations and functions by interacting with live animals. During the 4 hour voyage students find inspiration by studying the plankton, invertebrates, and fishes using scientific methods and tools. The culmination of this program is a final design challenge. This challenge requires students to apply their knowledge of adaptations to creating sustainable solutions for an imaginary research station. They design elements that address mobility, energy, waste management, and other requirements. The students’ final designs are completed in small teams, and presented to the class.

#### **Program Objectives**

- To provide an exciting educational experience that shows students how marine biologists study in the field; i.e. using oceanographic equipment such as an otter trawl and mud grab; identifying and analyzing live specimens.
- To relate physical and behavioral adaptations of marine invertebrates to this unique environment called an estuary.

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- To emphasize how all the living organisms are interconnected in the marine food web, and also how they relate to the physical environment.
- To gain an understanding, appreciation, and respect for marine ecosystems, and understand the special responsibilities of humans in the natural world.
- To gain a basic understanding of the concept of biomimicry
- To experience some of the steps of the design process

### **Arrival Times**

Two, four-hour Voyages are scheduled on most days. They depart from the dock at 8:00 a.m. and 1:00 p.m. (Exception being programs run from the Antioch dock.) We suggest you plan to be at the dock 20-30 minutes prior to departure to allow time for using the shore restroom, getting into lifejackets, and if on an afternoon voyage eating lunch on shore. There will not be time to eat lunch during the program.

The ship has one head (toilet). Due to the nature of marine heads, sometimes it does not work. We have emergency plans as necessary for problems, but we urge you and your group to use the toilet on land before boarding. Please let your students know this beforehand, so if your group is running late, they know to get off the bus and head immediately to the restrooms.

### **About the Research Vessel**

- The *R/V Robert G. Brownlee* is a 90-foot research vessel that is documented and inspected by the U.S. Coast Guard as an OCEANOGRAPHIC VESSEL.
- The Captain is licensed by the U.S. Coast Guard for 100-ton vessels.
- All instructors have been trained as deck hands; handling the lines is part of their duties.
- The Institute carries liability insurance in excess of School District requirements.
- A more than adequate supply of life jackets is kept on board, including plenty for both youths and adults. The introductory talk explains the procedures for when and how to put them on.
- Motion sickness medication is not recommended; the *Brownlee* is large enough so that it does not roll much during normal weather. If someone becomes queasy during the Voyage, a few soda crackers will usually suffice.

**THERE IS NO SMOKING ABOARD THE SHIP!!**

### **Rescheduling**

Generally, the boat operates regardless of the weather. Rain gear is available for everyone. The Voyage will be rescheduled at no additional cost to the school if we have to cancel the program before the boat leaves the dock. Program cancellation will be at the Captain's discretion. If the Captain decides to return to the dock early due to unsafe weather conditions on the Bay, we will continue the program at the dock.

### **Program Format**

The Discovery Voyage program is set up with three main stations: Ichthyology, Plankton Ecology and Benthic Ecology. After an introduction, the group will divide in three groups (each with one instructor), and go to one of the stations. After rotating through the three approximately 45-

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minute stations, a closing activity helps students apply all the new information they have learned. Throughout the program MSI instructors and adults will provide guidance and encouragement. Students can expect to handle and touch a variety of organisms as part of their observations.

#### Possible Timeline

7:40 or 12:40 Arrival: Group uses restrooms, and prepares to board the ship. Chaperones are briefed on their role in the program.  
8:00 or 1:00 Students board vessel and assemble in main cabin. Introduction  
8:55 or 1:55 First Station begins  
9:40 or 2:40 Second station begins.  
10:25 or 3:25 Third station begins.  
11:10 or 4:10 Closing begins:  
12:00 or 5:00 Ship arrives back at the dock.

#### Station Overview

##### Introduction:

Students will be briefed on safety procedures and some facts about the San Francisco Bay Estuary. The concept of biomimicry will be reviewed and the students will be asked to think about why the Estuary is vitally important to the fish and wildlife in the area. Also discussed is our location, the program format, and the boat layout.

##### Ichthyology (Fish) Station:

*Students* deploy a 16-foot otter trawl (fish net) to catch fish. Students study the fish adaptations and brainstorm how these concepts can be applied to human's needs. The group then breaks into smaller work groups.

##### Benthic Ecology (Mud/Invertebrate) Station:

Students deploy a Peterson benthic grab to gather a bottom sediment sample. The sample is rinsed through screens to wash away sediment, leaving invertebrates to be collected and placed in buckets for closer study. Students study the invertebrate adaptations and brainstorm how these concepts can be applied to human's needs. The group breaks into smaller work groups.

##### Plankton Ecology Station:

Students collect a plankton sample and examine it under a video microscope. Students study the plankton adaptations and brainstorm how these concepts can be applied to human's needs.

##### Closing:

This challenge requires students to apply their knowledge of adaptations to creating sustainable solutions for an imaginary research station. They design elements that address mobility, energy, waste management, and other requirements. The students' final designs are completed in small teams, and presented to the class.

\*Snack time is available during the plankton station if you speak with the crew before the program begins. All of the students must have a snack with them. We encourage non-messy food that is easy to eat and is not crumbly (please **do not** bring chips, crackers, crunchy granola bars, etc.)