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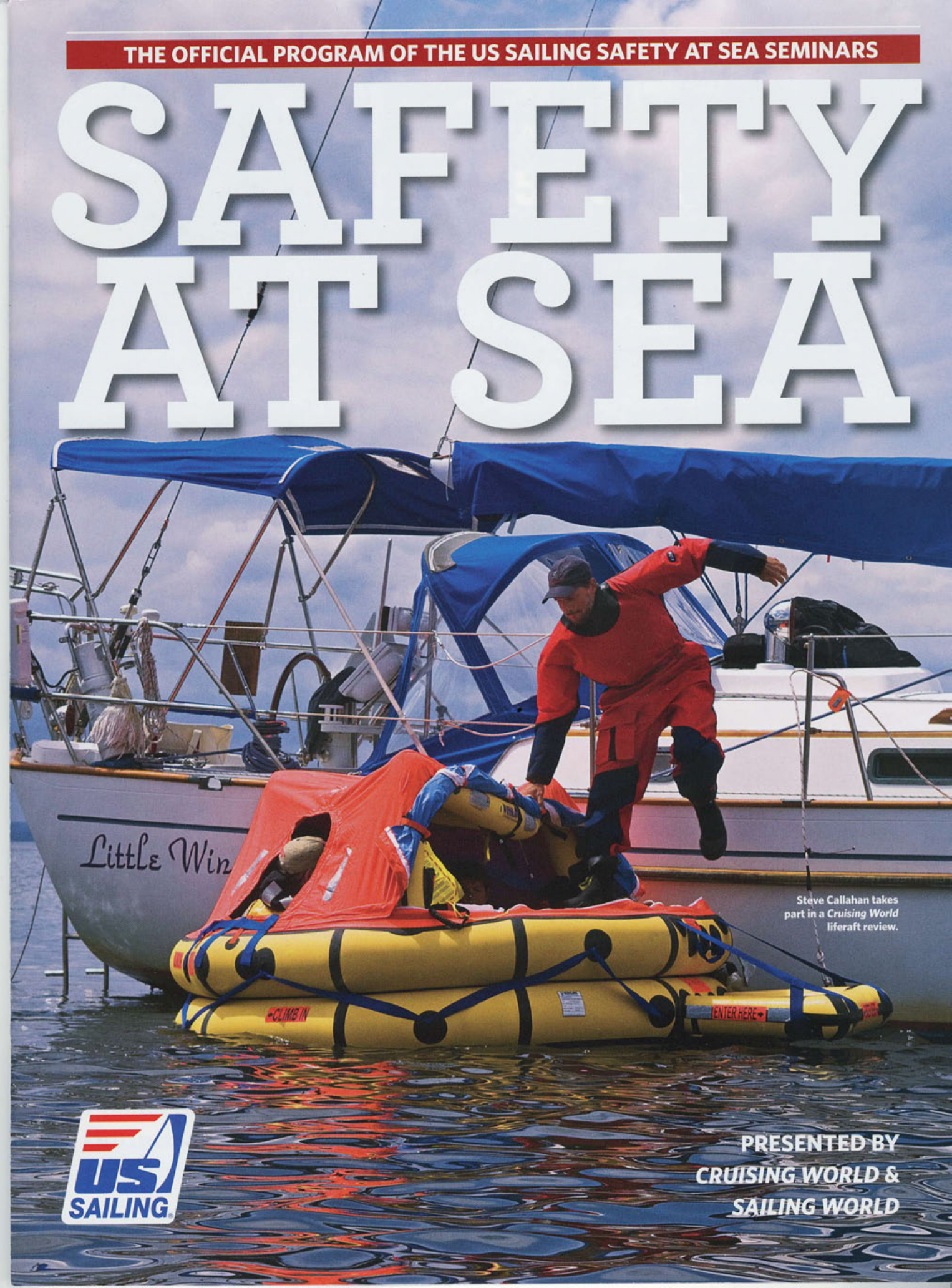

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Preventing and Treating Seasickness

BY CHARLES M. OMAN, PH.D.

That queasy feeling can make life at sea miserable, but there are effective remedies.

SEASICKNESS IS ONE OF THE MORE common medical hazards encountered by those who sail offshore. Mild sickness reduces alertness and initiative. Severe seasickness is supremely unpleasant. In this article, I describe scientifically based ways of limiting the physical stimuli that cause sickness, and review over-the-counter and prescription drugs you can use to reduce your susceptibility, as well as some other non-drug remedies. To use any of these weapons effectively, you must also learn to recognize and react to your very earliest symptoms.

Susceptibility and Causes

Less experienced sailors, who seem to be most prone to seasickness, often assume (incorrectly) that the cause of seasickness is "psychological" and are reluctant to admit being ill. In fact, seasickness occurs because in all of us there is a neurochemical link between the brain areas that control your balance and those that trigger vomiting. Everyone who has normal inner ear balance function can experience motion sickness if the stimulus is strong enough. Many experienced offshore sailors consider themselves relatively unsusceptible. But if you sail offshore enough, eventually you will encounter sea conditions that will bother your stomach.

According to the "sensory conflict theory," motion sickness originates in brain centers responsible for maintaining your balance. Each time you make an active body movement, your "balance brain" receives signals from motion sensors in your inner ear signaling exactly how your head has moved. Beginning early in childhood, your "balance brain" learns to predict the exact pattern of inner ear signals it will receive each time you initiate a self-generated movement. The balance brain compares actual and expected inner ear signals, and the difference—called a "sensory conflict" signal—is then used to trigger corrective head, eye, and body movements. As a result, whenever we are bumped or we stumble, we are still able to keep our heads and trunk balanced over our feet, and our gaze fixed on stationary objects.

In everyday life ashore, this rarely happens, so sensory conflict signals occur only briefly. However, when you go out on the ocean, the signals coming from our inner ears signal not just self-created motion, but also the motion of the boat. This increases sensory conflict in a prolonged way. If the increase is maintained for several minutes, neurochemical signals in the "balance brain" begin to stimulate the nearby "emetic brain" and symptoms of motion sickness soon appear, such as nausea. Fortunately, the "balance brain" also has the capacity to learn to anticipate the boat's rhythmic motion. As this happens, sensory conflict signals and seasickness disappear. Walking about on the moving deck feels much more natural. No wonder sailors traditionally call the process of recovering from *mal de mer* "getting your sea legs." The sooner your balance brain can learn to anticipate your boat's motion, the better.

Visual cues to your body's orientation can also play a critical role in causing and curing motion sickness. This is because they can influence what inner ear cues the balance brain expects. While on deck, the motion you sense with your inner-ear organs is confirmed by the tilt of the horizon and the motion of objects in your peripheral vision, and you can see the next wave coming. However, when you go below decks to work, the familiar correlation between vision and inner ear motion cues is altered. Your inner ear responds to both your motion relative to the boat, and the motion of the entire boat in the waves. Your eyes tell the balance brain only about your motion relative to the cabin. Based on vision, the balance brain expects only small changes in inner ear signals, not the large ones actually experienced. This is why working below greatly enhances sensory conflict, and accelerates the onset of seasickness. Returning topside, where you have a broad view of the boat's motion relative to the distant horizon, will immediately decrease sensory conflict, and may reduce your symptoms, provided you've not let them become too advanced.

There isn't much strong scientific evidence showing that seasickness susceptibility is greatly influenced by eating or avoiding specific foods. Feel free to eat moderate amounts of whatever foods you find appealing. The emetic centers in your brain also receive messages from elsewhere in the body besides the balance brain, and the emetic reflex is highly conditioned. If you smell or taste something that has previously made you nauseous; have eaten something that irritates or distends your stomach; feel queasy from the flu; or if you are a woman suffering from morning sickness, expect your threshold for seasickness to be much lower.

When you are first exposed to a conflict stimulus, the linkage between the balance and emetic brain centers initially takes many minutes to become activated. The relationship between sensory conflict and nausea isn't immediately apparent. However, once symptoms do start to appear, the linkage becomes quite sensitive: a single lurch of your boat can trigger a rush of nausea with little delay. Unfortunately, existing anti-motion-sickness drugs (see "Useful Drugs for Seasickness") can't completely block the emetic linkage. They simply raise your threshold for sickness and are more effective in preventing symptoms than reversing them. Hence the key in using drugs is to take them in advance, or failing that, at the very first signs of sickness. Drug treatment alone is

often not enough to prevent seasickness in rough conditions. Sailors need to know ways of reducing the sensory conflict stimulus, so you'll immediately start to feel better, and to "buy time" for drugs to become fully effective.

Prevention and Treatment

What can you do to prevent or control seasickness when out on the ocean?

Recognize: The key to prevention is to recognize to your earliest symptoms. Each person's pattern of symptom onset is somewhat different, but it is usually repeatable. The very first symptoms are often yawning, drowsiness, and lethargy. If you already are bored and tired from standing watch, these can go unrecognized. For many people, the first obvious symptoms of seasickness are stomach awareness, mild nausea, and a warm feeling.

As your symptoms advance, nausea becomes stronger, your face becomes pale, and your hands and face start to sweat and feel cold and clammy. Belching, salivation, and passing gas are common. Concentration becomes increasingly difficult. Eventually nausea begins to come in waves, and crescendos to vomiting. The latter usually brings temporary relief, but if the conflict stimulus remains, further cycles of nausea and vomiting occur, typically at 15-30 minute intervals. Nausea and vomiting typically avalanche with far less warning than during the first attack, so you need to be prepared.

React: As soon as you notice your first symptoms, address them. If you haven't done so already, take an anti-motion sickness drug. If you're below, avoid navigating, reading, cooking, or similar visual tasks that enhance sensory conflict. If you can, go on deck and stay amidships or aft where the motion stimulus, due to pitching and rolling, is less severe. Once on deck, use a technique called horizon viewing: Station yourself to windward where you have a good, broad view of the Earth/sky boundary in your peripheral vision, so you can see oncoming waves and more easily anticipate the motion. You needn't stare steadfastly at the horizon; it's okay to look around. If you're an experienced helmsman, take the wheel and steer by reference to oncoming waves, the horizon, and clouds and distant sails, with only an occasional glance at the compass.

Ride the waves: Remember that postural anticipation of the boat's motion is the natural cure for seasickness. Whatever you do, don't sit or lie inert in the cockpit, lean against the cabin or coaming, passively let the motion toss you around. Instead, use a method I call "wave riding" that experienced sailors all use naturally: Sit upright and let your trunk and neck muscles keep your head and upper body balanced over your hips as the boat moves. Once you get the rhythm, you'll find it is far less tiring than fighting to hang on. If it is safe to do so, stand up, walk around and develop your "sea legs."

When you go off watch, wedge yourself into your bunk so you can relax completely.

Communicate: Let the skipper know that the motion is starting to bother you. Don't be embarrassed. Most experienced skippers have been seasick themselves at some point, and have learned firsthand that even a small course change can change the boat's motion in the waves, often with miraculous results.

Minimize time below: To avoid visual conflicts, minimize the time you spend below, particularly if you are beginning to feel queasy. When you awaken for your watch, dress quickly and get on deck. You may feel fine when you first wake up, but symptoms may appear once your balance brain is put back to work. Wear clothing that is absorbent, easily ventilated, and quickly removed (e.g., zipper front instead of a pullover foul-weather top). Err on the side of overdressing. It is easier to remove excess clothing on deck and hand it below than to go below yourself while sick. If necessary, eat on deck.

Wedge in: When you go off watch, change and get into your bunk promptly. Choose a narrow berth or arrange soft duffels and sail bags around you so you can wedge yourself in, close your eyes, and relax completely. Your balance brain can go "off watch" only if you don't have to hang on to stay in your berth. It is amazing what a difference wedging in makes. Then try to go to sleep. Sleeping turns off the balance brain, allowing the emetic brain to recover.

Pace yourself: If your duties require you to work below, remember that you often can keep your symptoms under control if you pace yourself properly with intervals of horizon viewing. Take a break every few minutes, go on deck, or stand in a hatch or look out a large cabin window. Peeking out a porthole won't work so well: You need to have a wide view of the ocean in your peripheral vision. Remember that when symptoms are minimal, the delay between what you are doing and how you are feeling can be several minutes. Be alert to changes in your symptoms. With experience, you'll usually be able to keep your nausea below the point of no return.

Think ahead: Seasickness is the curse of cooks and navigators. Advance preparations and technology can really

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help. Knowing exactly where your food is stowed, moving items in calm weather from deep stowage up forward to a handy spot aft near the galley, and "cooking ahead" using refrigeration have saved many a sea cook's stomach. Prolonged reading and writing inherent in offshore navigation can be quite provocative. Read the manuals before leaving the dock.

Avoid alcohol: Drink alcohol only in moderation before going to sea, and avoid it altogether for at least six to twelve hours before setting out. Alcohol has a direct physical effect on your inner balance organs, and if you drink to the point where you are badly hung over, you will also feel a little dizzy anytime you—or the boat—tilts or heels. Plan accordingly.

Replace nutrients: Diet becomes important in seasickness only if you vomit repeatedly. Most people can respond physically to real emergencies even when nauseous. However, if you don't replace the fluid, electrolytes, and sugars you've lost, after six to twelve hours you will feel increasingly fatigued, and eventually "hit the wall." Your body literally runs out of energy, and you'll become confused and incapacitated. Your breath will smell like acetone, and if you remain on deck, you'll be a danger to yourself and others. To prevent this scenario, between vomiting episodes, force yourself to eat and drink—water, broth, crackers, candy, sports drinks—frequently and in small amounts. It won't all stay down, but your net loss of fluids, glucose, and electrolytes will be greatly reduced.

Watch out for others: Watch leaders should be alert for weakness, extreme drowsiness, and confusion in those suffering from prolonged seasickness. Severely afflicted crewmembers are often reluctant to go below because they might feel worse and they don't want to leave the rest of their watch shorthanded. Instead, they linger on deck, sometimes even falling asleep at the lee rail. Seasick crewmembers easily can fall or be washed overboard. Insist that they use harnesses. Don't permit them to remain on deck under storm conditions. They are more likely to be able to respond in a real emergency if you get them wedged in a berth down below, medicated, fed and resting.

Plan in advance: When preparing for a trip, the skipper or "medical officer" should develop individualized plans for seasickness management. Find out what antiseasickness drugs each crewmember plans to use and keep them all in a dry place very handy to the deck, not in a medicine locker located in the lurching, smelly confines of the head. Plan in advance how you will treat severely seasick crew. Designate a narrow sea berth aft for use by the afflicted and have a supply of emesis bags, disposable towels, easily opened juice or water bottles, and candy available in the bunk. Bags really are far superior to the traditional bucket. Airline bags are adequate, but the "sic-sacs" available at aviation stores are much easier to use, even when lying down. Make sure you know whether any crewmembers have pre-existing medical conditions such as ulcers or diabetes, or require special medications. These people may develop additional problems if they suffer from severe seasickness.

Check your raft: Be certain your life raft or grab bag is stocked with anti motion sickness drugs sufficient for everyone for several days. Rafts have a jerky motion and the canopy on the raft—although it provides essential protection from the elements—deprives the occupants of outside visual references. Because of this, chronic seasickness in rafts is common, making everyone miserable and dehydrated.

Medications

Lab experiments have proven that anti-motion sickness drugs *are* an effective way of raising your threshold for seasickness. However, many sailors are reluctant to use them, since many can cause drowsiness or other side effects. Different people react differently to different drugs. Finding an anti-motion-sickness medication that works acceptably for you is very beneficial. Waiting until you first feel moderately seasick is not a good time to begin experimenting. Oral drugs require 45-60 minutes to become effective, so the drug you take probably won't stay down. The best strategy is to first evaluate several different types ashore, taking them on the same schedule you will use them on the ocean, even for several days. There are many choices. Most are relatively inexpensive, particularly the over-the-counter variety.

However, before choosing *any* drug, even of the over-the-counter variety, consult with your physician. Not all physicians are experts on motion sickness drugs, but your physician knows your medical history and can advise on what drugs you should not take. People who have an enlarged prostate, asthma, or irregular heartbeat must choose drugs particularly carefully. Not all anti-motion sickness drugs are appropriate for use by children. Women who are, or might be, pregnant should avoid drugs entirely.

When choosing a drug, the "duration of action" is an important consideration, because bad weather offshore can last for several days and you must take doses at regular intervals. Longer acting over-the-counter oral drugs such as cinnarizine, meclizine, promethazine, or dimenhydrinate come in time-release form, and therefore have practical advantages for sailors. Of these, cinnarizine is relatively less sedating, and has been popular among European sailors, though it's not currently available in the U.S. or Canada. Oral scopolamine is highly effective and fast acting, but side effects such as blurred vision and urinary retention can be a problem, particularly with repeated doses, so it is better suited to short-term use. It is only available in the U.S. by prescription.

Another alternative is Transderm Scōp, an adhesive patch worn behind the ear. It continuously administers scopolamine through the skin over a three-day period. The idea is to try to minimize side effects by maintaining a relatively constant blood level of scopolamine. The patch is sold in the United States only by prescription, but it is available without one in Bermuda and in some Canadian provinces. Side effects, such as blurred vision, are sometimes a problem, particularly in smaller people and on the third day of use. Be sure to apply it to a truly hairless area, and wash your hands after handling it, so you won't inadvertently rub the drug into your eyes. The patch requires six hours to become effective, so if you plan to wait till symptoms occur, you may be better off using a different drug.

Like sailors, NASA astronauts have to deal with motion sickness over periods of several days. They now generally avoid oral and transdermal premedication and rely on the intramuscular injection of promethazine. The injections leave a painful sore spot and will make you very sleepy. But, when combined with bed rest, injected promethazine can give fast and effective relief, and the dose is not lost if you vomit again. The use of injected medications may make sense when sailing offshore, but you must have

Useful Drugs for Seasickness

Generic Name/ Brand Name (Manufacturer)	Form (OTC/Rx)	Duration of Action
Dimenhydrinate		
Dramamine (McNeil)	Tablet or Chewable (OTC)	4-6 hours
Gravol (Carter-Horner)	Tablet, Chewable, Liquid, Time Release, and Suppository (OTC in Can)	
Meclizine Hydrochloride		
Bonine (Pfizer)	Tablet or Chewable (OTC)	24 hours
Antivert (Pfizer)	Tablet (Rx)	
Dramamine Less Drowsy (McNeil)	Tablet (OTC)	
Cinnarizine		
Stugeron (Janssen)	Tablet (OTC in Bda and UK)	6-12 hours
Cyclizine		
Marezine (Burroughs)	Capsule (OTC)	4-6 hours
	Injection (Rx)	
Transdermal Scopolamine		
Transderm Scop (Novartis)	Skin patch (Rx; OTC Bda & Can)	3 days
Scopolamine		
Scopace (Hope Pharmaceuticals)	Tablets (Rx)	4-6 hours
Kwells (Bayer)	(OTC in Australia)	
Promethazine		
Phenergan (Wyeth-Ayerst)	Tablet (Rx)	12 hours
Phenergan (Wyeth-Ayerst)	Suppository (Rx)	12 hours
Phenergan (Elkins-Sinn)	Injection (Rx)	4-6 hours

C.M.O.

Rx = by prescription; OTC = over the counter; Bda = Bermuda; Can = Canada

a person aboard who is properly qualified to prescribe and administer them. More practical, but slower-acting alternatives are promethazine or dimenhydrenate rectal suppositories. However, suppositories, too, require a prescription in the U.S. and must be stored in a cool place.

Alternative Strategies

Not everyone is able to take drugs. There are several other methods to address the problem, which work with varying degrees of success for different sailors.

Wristbands: Another widely used method for preventing seasickness is based on Chinese medicine. Mechanical pressure or electrical stimulation is applied to a *nei-kuan* point on the forearm, three finger-widths above the wrist joint, between the two prominent flexor tendons going to the fingers. Elastic wrist straps fitted with buttons to apply pressure are widely available. A variant is a battery-powered device that applies mild electrical stimulation to the same point, creating a pulsating tingling sensation in your middle fingers. The methods avoid the usual side effects associated with drug use. However, in several separate tests, the elastic versions were no more effective than a placebo treatment. Even so, wristband manufacturers offer numerous written testimonials, and I know a number of people who swear by them. If you suffer from seasickness, they may be worth a try.

Placebos: Physicians have long known that placebos—inert drugs or sham procedures—can be clinically useful in relieving pain and other symptoms, provided the patient has confidence in the doctor and the effectiveness of the "cure." Although the brain does secrete its own pain reducing agents when some placebos are used, the primary mechanism is usually suggestion and distraction. If you expect to feel better, you think less about your symptoms. If they disappear naturally it is easy to be convinced the placebo was responsible. Doctors prescribe placebos because they frequently do provide some relief. Indeed, studies have shown that placebo treatments do work against seasickness to some degree. However, the overall success rate isn't great, and it varies between subjects. Traditional folk remedies for seasickness—an ice bag to the forehead, drinking tea or ginger ale, eating bland foods, or powdered ginger root—should probably be considered in the same light. Important note: All of the drugs in the accompanying table are significantly more effective than *any* of the placebos, which is the reason sailors should considering using seasickness drugs if they are not medically contra-indicated.

Biofeedback: Using biofeedback (progressive relaxation or autogenic imagery), many people can learn to control, to a degree, their own heart rate, blood pressure, and skin temperature. Because the emetic brain is closely coupled to centers controlling these functions, there is some reason to hope that these same methods could be used actively to suppress symptoms of motion sickness. NASA and Air Force psychologists have experimented with this approach for several decades, though it's never been officially sanctioned.

The bottom line: you can do a great deal to prevent and treat seasickness when you know what causes it. Linkage of the emetic brain to the balance brain occurs in everyone exposed to an abnormal motion environment. Susceptibility to seasickness only disappears when your balance brain learns to subconsciously anticipate your boat's motion. Drugs can be of real value until you adapt. So, too, can techniques such as wave riding and horizon viewing, provided you recognize and react to your earliest symptoms. If you do become severely sick, there are important things you can do to make the experience less unpleasant and accelerate recovery. Over the long term, the best way to prevent seasickness happens to be the most enjoyable: Sail frequently.

Charles M. Oman, Ph.D., is the director of the Man Vehicle Laboratory at MIT, where his research has included experiments on the Space Shuttle. He is an expert on aerospace physiology, inner-ear function, and motion sickness, and a speaker at US Sailing Safety-at-Sea Seminars. A lifelong sailor, he has extensive cruising and racing experience.