

BEN FRANKLIN AND THE GULF STREAM

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Human knowledge advances in fits and starts. Sometimes an individual genius comes along (a Galileo, a Newton, an Einstein) and in a burst of inspiration develops a totally new idea that reshapes our understanding of the basic principles governing the physical world in which we live. Other times, knowledge accumulates slowly and undramatically until someone comes along and gathers together what is already known to a few people and makes that knowledge available to a wider audience. The story of Benjamin Franklin and the Gulf Stream shows how that can happen.

As you read, think about:

What were some of the advantages of ocean travel in colonial times?

What were some of the difficulties?

As a child, Ben Franklin had what he called "a strong inclination for the sea." It's hardly surprising. The world into which Franklin was born in 1706 (the world of colonial America) was dependent on the sea and ocean travel to an extent that is difficult to imagine in our modern age of interstate highways, railroads, and intercontinental flight. Woe to the poor 18th-century traveler who tried to make his way any distance in the colonies by land. The roads were terrible: dusty and rutted in the summer, virtually impassable in the winter. A trip by coach from Boston to New York City, a distance of 250 miles, could take a week or more. It made much more sense to go by sea; with good winds, a sailing ship could cover the distance in less than two days. The great cities of the colonies (Boston, New York, Philadelphia, and Charleston) were all port cities. Nine out of ten of the settlers in the 13 British colonies of North America lived within 50 miles of the ocean. Many Americans—whalers, fishermen, shipwrights, sailors, longshoremen—made their living directly from the sea. Most others depended indirectly on the transatlantic trade to carry their goods and crops to distant markets and to bring locally scarce goods to them.



Courtesy NOAA/NASA.

If travel by land was something to be avoided, travel by sea offered a sense of control and freedom. Ships were not bound to narrow paths through the woods; they could go wherever the desire and skill of their captain and crew could steer them. Sailing was about mastery. Growing up along the Charles River in the busy port city of Boston, young Ben Franklin understood this mastery well: "Living by the water, I was much in and about it, learned early to swim well, and to manage boats," he wrote, "and when in a boat or canoe with other boys I was commonly allowed to govern, especially in any case of difficulty." On one occasion, Franklin had been flying a kite next to a pond when he decided to go for a swim. Rather than haul his kite in, he tied its string to a stake in the ground. But then, "being desirous of amusing myself with my kite, and enjoying at the same time the pleasure of swimming," he went back on shore and untied the kite. He then crossed the "mile broad" pond, lying on his back, pulled across by his kite "without the least fatigue and with the greatest pleasure imaginable." He would later propose that giant airborne kites might be employed to propel ships across a large body of water, such as the English Channel.

Dangers of Ocean Travel

Traveling on the ocean was not without drawbacks and hardships, however. The wooden sailing ships of the 18th century could deliver passengers and goods across great distances at speeds unimaginable on land, but the distances across the Atlantic Ocean were very great indeed: 5,000 miles from London to Boston, a trip that could take six to eight weeks—a seeming eternity in the dark, damp, cramped, and smelly quarters below deck on most sailing ships. And the longer a ship stayed at sea, the greater the chance of being caught in a storm.

The North Atlantic Ocean, in particular, was known for the fury of its storms, which could literally tear a boat apart and send it to the bottom. In the midst of the American Revolution, John Adams would sail from Boston to France with his 10-year old son John Quincy Adams, to join Benjamin Franklin, who was seeking French support. Though he would make relatively good time in crossing, the ship very nearly went down at sea. "We found ourselves in the Gulph Stream," John Adams would write in his diary, in one of the most furious storms, that ever Ship survived... To describe the Ocean, the Waves, the Winds, The Ship, her motions, rollings, pitches, Wringings and Agonies, The Sailors, their countenances, language and behavior, is impossible. ...no place or person was dry..." Adams recalled "vast mountains of Water above Us, and as deep caverns below Us," which "threatened to bury Us all at once in the deep." Had the ship gone down, two future presidents of the United States, John Adams, and John Quincy Adams, would have been lost at sea.



*The Frightful, by John Quincy Adams.
Courtesy Massachusetts Historical Society.*

Fascination with the Sea

As you read, think about:

What were some reasons that Ben Franklin was fascinated with the sea?

But danger and destruction did little to discourage boys who dreamed of exchanging a humdrum life on shore for a dashing and romantic life at sea. That was Ben Franklin's dream. His older brother Josiah had gone off to become a cabin boy on a merchant ship when Ben was still a very young child. Years later, Josiah went down with his ship and drowned, but still Ben was drawn to the sea. The possibility that Ben might follow his brother's example and run off to sea finally convinced his father that he should find a trade for Ben on land, and one suited to his talents and interests. And so, at the age of 12, Ben was apprenticed to his brother James, a Boston printer. But Ben was not yet done with the Atlantic Ocean, not by a long sight.

Although James proved a good teacher, and Ben soon learned the rudiments of the craft and business of printing, the two could not get along. At the age of 17, Ben abandoned his apprenticeship and left Boston (by ship, of course) for Philadelphia. After a few years working in Philadelphia as a printer, he took his first transatlantic voyage, sailing to London, where he found work in a print shop and perfected his craft.

On his return trip from London, in 1726, Franklin, now 20, noted a curious phenomenon. After several weeks at sea, the color of the water began to change. There were "hot damp winds," he noted in his journal, along with "an abundance of grass" and other seaweed visible in the water. To Franklin, the

warmer air and warmer water suggested that the ship must be very near the coast, but the ship's captain scoffed at that idea. And, indeed, after six days, the water regained its former darker color, and the hot wind and abundant seaweed disappeared. The ship was nowhere near the coast. For the moment, Franklin had no explanation for the peculiar changes in the character of the ocean he had seen in the mid Atlantic. In fact, what young Ben Franklin had encountered was the Gulf Stream.

Returning to Philadelphia, Franklin set up his own printing business. Prospering in that trade, he soon branched off into other ventures, including publishing a newspaper and "Poor Richard's Almanack," a compendium of information and pithy advice. (Some of "Poor Richard's" formulas for success became famous throughout the colonies and are still quoted today. Among them are, "An ounce of prevention is worth a pound of cure," and, "Early to bed and early to rise, makes a man, healthy, wealthy, and wise.") By the time he reached middle age, the headstrong boy had become a successful and influential figure; indeed, he had become the prototype of the American "self-made man." He had also won respect for acts of good citizenship. Among many public-spirited ventures, he helped launch Philadelphia's first lending library, an insurance company, a college, a hospital, and a volunteer fire company.

A Man of Science

At the same time, Franklin began to gain an international reputation as a man of science, notwithstanding the fact that his formal education had come to an end at the age of 10. Franklin was endlessly curious to learn about how the physical world worked and how such knowledge could be put to use for the benefit of humankind. He undertook his best-remembered and riskiest experiment when he flew a kite in a thunderstorm, hoping to prove that lightning was a form of the then little-understood phenomenon, electricity. He went on to invent the lightening rod, a device which saved his own house from burning down when it was struck by lightning and has saved countless dwellings and lives since then. He was interested in heat and convection, and he invented an iron stove that proved a big improvement over the drafty fireplaces of the day; in fact, the "Franklin stove" is still in use today.



*Franklin's kite experiment.
Courtesy NOAA/NASA.*

In 1737 Franklin became postmaster for the city of Philadelphia, and in 1753 he was appointed deputy postmaster general for all the colonies. Postal service in early America was notoriously poor; mail delivery was slow and haphazard. Franklin worked hard to bring improvements to the postal system. He sped delivery on land by hiring more riders to carry the mail from community to community. He sped delivery from America to Europe by seeing to it that only the fastest ships, called packet ships, were used to carry the mail across the Atlantic.

The Mystery of the Mail

As you read think about:

What did Timothy Folger help Ben Franklin to understand?

But here he encountered a mystery, one that challenged his scientific curiosity as well as his practical business instincts. Mail sent from England to the American colonies was taking a long time to arrive—two months on average. And yet merchant ships, which were heavier and took a longer route than the mail packet ships, made the same trip from England in just a month and a half on average. It didn't seem to matter whether the packet ships sailing from England enjoyed good weather or bad, whether the wind was in their sails or not, something still held them back. What, Franklin wondered, was causing the delays?

Getting a good answer to a question is sometimes a matter of knowing whom to ask. And in 1768, while on a trip to London, Franklin asked the right person: his cousin, Timothy Folger, a whaling captain and merchant from Nantucket, Massachusetts. What was it, Franklin asked Folger, that accounted for the speedy Atlantic crossings achieved by some ships sailing from England? The answer, Folger replied, was simple, at least to those prepared to understand that the shortest distance between two points on a map is not always the fastest. Land travelers going to a distant city know that they might have to make detours to avoid a mountain range or some other physical obstacle. The Atlantic Ocean, too, poses an obstacle that requires a detour in the interest of saving time.

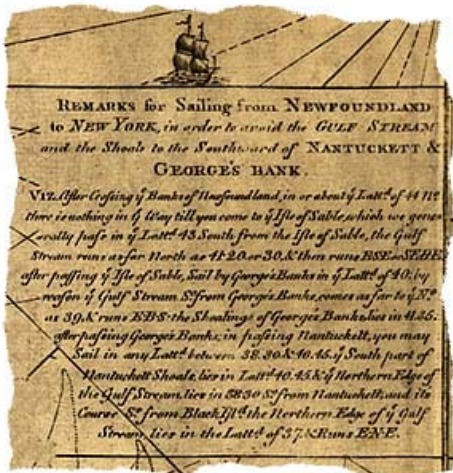


Franklin-Folger 1769 Gulf Stream chart. Reproduced with permission from US Library of Congress.

That obstacle is the Gulf Stream, a pattern of currents carrying a river of warm ocean water in a counterclockwise direction up out of the Gulf of Mexico, along the coast of eastern North America, then eastwards across the chilly waters of the North Atlantic Ocean to the shores of northwestern Europe. The current moves eastwards at a rate of 3-4 miles an hour, a boon to ships traveling eastwards but a hindrance to ships trying to cross westwards. Running against the current could cost a ship as much as 70 miles a day in westward progress. Whalers like Folger knew about the Gulf Stream because its warm waters attracted an abundance of sea life, including plankton and fish and the whales that feed on both. But the packet ship captains carrying the mail from England to America, were ignorant of its existence.

A Map of the Gulf Stream

Folger's explanation made sense to Franklin, and may have reminded him of his own wonder, at age 20, when he encountered warm water and seaweed in the mid Atlantic Ocean while traveling from London to Philadelphia. At Franklin's request, Folger sketched out a map of the Gulf Stream, which Franklin had printed in London in 1769 as a chart to guide the packet ship captains on their westward voyages. The published chart included a detailed account of how "to avoid the Gulph Stream," which would allow most ships to cross the Atlantic Ocean in a mere "20 to 30 days." As a general rule, "A Stranger may know when he is in the Gulph Stream, by the warmth of the water, which is much greater than that of the water on each side of it. If then he is bound to the westward, he should cross the Stream to get out of it as soon as possible."



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In the light of later research, including satellite observations in the late 20th century, the Franklin-Folger chart proved a remarkably accurate portrayal of the path taken by the Gulf Stream currents. Unfortunately, most of the packet ship captains ignored the new charts, and mail service between Europe and America continued to lag. All the original copies of the Franklin-Folger chart were soon lost (one was finally located in a French library in 1978), but subsequent versions were published in France in the early 1780s and in Philadelphia in 1785.

On his frequent travels to and from Europe in the years that followed the original publication of his map, Franklin continued to study the Gulf Stream. Carefully noting the latitude and longitude of his ship's position several times every day, he would then lower a thermometer over the side to measure the temperature of the water. When surface water temperatures rose, he knew the

ship was in the Gulf Stream; this information allowed Franklin to test and refine the accuracy of Folger's original depiction of its currents. On later voyages, Franklin refined his technique, lowering a barrel fitted with a valve at each end so he could measure water temperature not only at the surface of the ocean, but up to 100 feet below.

Benjamin Franklin made his last trip across the Atlantic Ocean in 1785 (he would die in 1790). On his arrival home in Philadelphia, he published a scientific paper describing the results of his Gulf Stream experiments, bringing to a conclusion more than 60 years of questioning and observation about the mysterious river of warm water in the Atlantic Ocean. Benjamin Franklin did not discover the Gulf Stream, but he certainly deserves credit for spreading the news of its existence beyond the small community of whaling captains and others who had known it in the mid 18th century.