The Gulf Stream: A River in the Ocean

by Josh Hughes

1 While sailing between North America and Europe in the late 1700s, deputy postmaster general, scientist, and keen observer Benjamin Franklin was never idle. During eight voyages, Franklin gathered data about the Atlantic Ocean. He observed different types of seaweed. He noted color changes in the water. He recorded the temperature differences at various depths as his ship moved into a warm ocean current called the Gulf Stream. Franklin was once asked to explain why North American postal ships could make the journey between England and the colonies faster than the English merchant ships. His answer was the Gulf Stream.

2 Others before Franklin knew of the Gulf Stream. In fact, Spanish explorer Ponce de León described and used its benefits in the sixteenth century. Yet Franklin was one of the first to chart its flow with some degree of accuracy.

3 The Gulf Stream is a warm current that flows in a clockwise direction in the Atlantic Ocean. It is one of the world's gyres (jīrz), or huge ocean loops. The path of this circling river of rapidly moving water begins at the Gulf of Mexico. From there, the current moves northward and runs parallel to the east coast of the United States. It then turns east across the North Atlantic. Next it swings south along the coast of Europe and moves toward North Africa. Finally it heads west across the South Atlantic into the Caribbean basin. Then it turns back toward the Gulf of Mexico. If you put your hand in a tub of water and stir the water clockwise, you can imitate the motion of the Gulf Stream.

4 The Gulf Stream has tremendous energy and speed. Scientists estimate that it moves 30 million cubic meters (or 1.06 billion cubic feet) of water per second as it passes Miami, Florida. It is nearly fifty miles wide and one-quarter mile deep. It flows so fast that little of its water mixes with the colder ocean through which it travels. Near Florida its temperature is about 75°F to 80°F. As it moves northward and then east across the North Atlantic, the Gulf Stream loses some of its volume, speed, and warmth.

5 Although the Gulf Stream travels in a circular path, it is also part of a much larger system. Ocean currents throughout the world are interconnected in the Great Ocean Conveyor. As if traveling on a giant conveyor belt, ocean water is propelled along a continuous watery course. Its direction and speed are affected by waves, winds, and the density—or amount of salt—in the water.

6 The sun's energy and Earth's rotation are greatly responsible for the Gulf Stream's flow. They also influence ocean and wind interactions that, in turn, affect climates. How is this so? The sun heats the air near the equator, north of the Atlantic. The air rises; cooler air takes its place and creates winds. Earth rotates from west to east, causing winds off the northeastern coast of North America to blow in a westerly direction. Winds nearer the equator blow in a more easterly direction. Movement of air near the ocean surface pushes the water along. Water in the Gulf Stream in the North Atlantic is pushed eastward. In the South Atlantic it is pushed westward. The winds also make waves and push the water in the direction of the wind. Additionally, as water moves from the equator toward the poles, it becomes colder, rich with salts, and heavy. The colder water sinks to the bottom of the ocean and drifts south toward the equator. When it reaches warm water again, it becomes lighter and then rises toward the surface.

7 Most oceanographers believe that the Gulf Stream acts like a giant thermostat. As the Gulf Stream moves in a continuous path from south to north, it loses heat and moisture to the atmosphere. The air blows toward the east, warming places like the coasts of Western Europe. This maintains mild winter temperatures.

8 Sailors use currents like the Gulf Stream and winds called trade winds, which blow in the same direction the water is moving, to their advantage. While sailing from North America to Europe, sailors use the North Atlantic. Here the wind and water move from west to east. For the return trip, they catch and ride the Gulf Stream and the winds in the south that move from east to west. That is why Benjamin Franklin easily claimed that the Gulf Stream allowed North American sailing ships to be faster than British ships. The British ships tended to stay in the North Atlantic while sailing both directions. They moved quickly sailing from west to east but fought the current and the winds going the other direction.

9 In some places, the Gulf Stream, like other rivers, has swirling currents that branch off sending water in other directions. The bulk of the water remains in the main stream and follows a circular path, but some offshoots take warm water northward toward Newfoundland and Norway. In the south, some of the water spins off and flows in a counterclockwise motion near the equator.

10 Among the earliest studies used to prove ocean circulation were the releases of drift bottles with message cards in them. Bottles were sent into currents and picked up when they washed ashore. The cards asked the finder to tell where and when the bottle was found and return the information to the sender. Today orbiting satellites gather and map information about the complex network of currents that flow in the oceans.

11 Marine life typically found in the Gulf Stream includes blue fin tuna, Atlantic salmon, and flying fish. As the stream moves across different landforms or mixes with colder water, turbulence is created. Eddies, or rings of swirling water, stir up nutrients and salts. Marine life-forms other than those already in the Gulf Stream are attracted to these churning whirlpools. Commercial fishing here can be very productive.

12 Although satellites and computer models help scientists understand the Gulf Stream, it remains a complex system with many opportunities for scientific study. One group of researchers now touts the idea that the Gulf Stream has little effect on European winter climates. Using computer models, they are trying to show that the Rocky Mountains, not the Gulf Stream, affect European climates. Gulf Stream questions also include reasons for disappearances and reappearances of currents over time. One of the most pertinent questions about the Gulf Stream concerns how global warming might affect it, and in turn, global climates. Scientists will continue studying this river in the ocean and the questions it raises for a long time.

Comprehension

1 This article was probably based on
   a general resources about ocean currents and weather.
   b a sailor's handbook.
   c an oceanographic study.

2 The author's main purpose was to
   a supply factual information about the Gulf Stream.
   b explain Benjamin Franklin's interest in the Gulf Stream.
   c pass on to the reader the author's feelings about the sea.

Based on the article, which of the following statements are true of the Gulf Stream? Write *T* for true or *F* for false for each statement.

3 The sun, Earth's rotation, wind, waves, and density of ocean water affect the Gulf Stream.

4 The Gulf Stream circulates throughout the oceans on Earth.

5 Many scientists believe that the Gulf Stream makes the climate on the west coast of Europe mild.

6 Benjamin Franklin was the first person to understand how the Gulf Stream works.

7 Marine life tends to like places along the Gulf Stream where water is turbulent.

8 Many questions about the Gulf Stream remain unanswered.

9 The main point of this article is that the Gulf Stream is a
   a mysterious phenomenon that is difficult to explain.
   b complex yet important system that affects life on Earth.
   c special waterway that is important to sailors.

10 Calling the Gulf Stream a "river in the ocean" is intended to
   a make the article humorous.
   b cause the reader to wonder about rivers.
   c help the reader understand that the Gulf Stream is only part of the ocean.

Learn about Words

A Often you can tell the meaning of a word from its context—the words around it. Find the word in the paragraph that means

1 with great mental sharpness (1)
2 running side to side (3)
3 instrument that regulates temperature (7)
4 things that develop from something else (9)
5 circling (10)
6 state of agitation (11)
7 stirring violently (11)
8 relevant (12)

B A word may have more than one meaning. Its meaning depends on the way it is used.

Decide which meaning fits the word as it is used in the paragraph. Write the letter that stands before the meaning you choose.

9 **degree** (2)
   a measure
   b rank
   c one in a series of steps

10 **stir** (3)
   a disturbance
   b urge
   c to mix

Learn about Words *(continued)*

11 course (5)
- **a** class
- **b** path
- **c** part of meal

12 heavy (6)
- **a** moving slowly
- **b** of great weight
- **c** serious

13 raises (12)
- **a** lifts
- **b** brings up
- **c** increases in amount

Word Study

C Many words are built on shorter base, or root, words that you already know.

Each line below contains three words that have a root word in common. Write the root word for each set of three words.

14 complain, plaintively, plaintiff
15 reflexive, inflexible, flexor
16 erratic, aberration, erroneous
17 monarch, patriarchy, archangel
18 refinement, confines, defined
19 omniscience, conscience, sciences
20 secretary, secretion, secrete
21 dissect, intersect, section
22 mistaken, takers, takedown

D Synonyms are words that have the same or nearly the same meaning.

For each word in Column I, find a synonym in Column II and write it.

	Column I	Column II
23	voyages	endless
24	wondrous	begin
25	interminable	system
26	doom	journeys
27	originate	understanding
28	steadily	many
29	logical	marvelous
30	pattern	grandeur
31	myriad	destruction
32	majesty	reasonable
33	comprehension	constantly

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Comprehension

1 a
2 a
3 T
4 F
5 T
6 F
7 T
8 T
9 b
10 c

Learn about Words

A
1 keen
2 parallel
3 thermostat
4 offshoots
5 orbiting
6 turbulence
7 churning
8 pertinent

B
9 a
10 c
11 b
12 b
13 b

Word Study

C
14 plain
15 flex
16 err
17 arch
18 fine
19 science
20 secret
21 sect
22 take

D
23 journeys
24 marvelous
25 endless
26 destruction
27 begin
28 constantly
29 reasonable
30 system
31 many
32 grandeur
33 understanding