

The Making of a Scientist

Introduction

This biographical piece has been written by Robert W. Peterson. It highlights the journey of Richard Ebright into becoming a great scientist. Richard Ebright has received the Searle Scholar Award and the Schering Plough Award for Biochemistry and Molecular Biology. This chapter shows how his fascination for butterflies opened the world of Science for him.

Summary

At the age of twenty-two, Richard H. Ebright and his college room-mate, James R. Wong, presented a new theory on how cells work in an article in the 'Proceedings of the National Academy of Science'. It was the first time, this important scientific journal had ever published the work of college students. For Richard Ebright, it was the first in a long string of achievements in science and other fields.

Ebright was the only child of his parents. They lived in north of Reading, Pennsylvania. Ebright could not play football or baseball alone but he could collect things.

So, Ebright started collecting butterflies in kindergarten. His mother encouraged him. She took him on trips. She also bought him telescopes, microscopes and cameras. Ebright's mother said that she was his friend until he started school. Ebright earned top grades in school. When he was in second grade, he had collected all the twenty-five species of butterflies found around his hometown. This would have been the end of his butterfly collection but then his mother got him a children's book called 'The Travels of Monarch X'. That book was about how monarch butterflies migrate to Central America. At the end of the book, readers were invited to help study butterfly migrations by tagging butterflies for research by Dr Frederick A. Urquhart of the University of Toronto, Canada. Ebright's mother wrote to Dr Urquhart and soon Ebright was attaching light adhesive tags to the wings of monarch. Anyone who found a tagged butterfly was asked to send the tag to Dr Urquhart.

Richard found it difficult to catch a monarch butterfly. So, he used to catch a female monarch, take her eggs and raise them in his basement. Then they would tag the butterflies and let them go. For several years, his basement was home to thousands of monarchs in different stages of development.

But then he started to lose interest in tagging butterflies because of lack of feedback.

When he was in the seventh grade, he started participating in county science fairs. When he was in eight grade, he submitted a project on the cause of a disease which killed monarch caterpillars every few years. He won prize for this project.

The next year his science fair project was testing the theory that viceroy butterflies copy monarchs. This project was placed first in the zoology division and third overall in the county science fair.

In his second year in high school, Richard Ebright began the research on the purpose of twelve tiny gold spots on a monarch pupa. He build a device that showed that the spots were producing a hormone necessary for the butterfly's full development. This project won Ebright first place in the county fair and entry into the International Science and Engineering Fair. There he won third place for Zoology. He also got a chance to work during the summer at the entomology laboratory of the Walter Reed Army Institute of Research. As a high school junior, Richard Ebright continued his advanced experiments on the monarch pupa. That year his project won first place at the International Science Fair.

In his senior year, he grew cells from a monarch's wing in a culture and showed that the cells would divide and develop into normal butterfly wing scales only if they were fed the hormone from the gold spots. This project won first place for zoology at the International Fair.

The following summer, while working at the laboratory of the Department of Agriculture, he was able to identify the hormone's chemical structure.

A year-and-a-half later, Ebright got the idea for his new theory about cell life while he was looking at the X-ray photos of the chemical structure of a hormone. His theory throws light on how cell can read the blueprint of its DNA.

If Ebright's theory proves correct, then it will be a big step towards understanding the processes of life. It might also lead to new ideas for preventing some types of cancer and other diseases. And all this has become possible because of Ebright's curiosity.

Ebright had the qualities of a first-rate mind and a will to win. He pursued other interests also like debating and canoeing and photography. He became a champion debater and public speaker.

Message

This story conveys the message that a person's curious mind, his ability to search for answers and his hard work can help him reach places.

Extract Based Questions ↘

Read the following extracts carefully and answer the questions that follow:

1. If the theory proves correct, it will be a big step towards understanding the processes of life. It might also lead to new ideas for preventing some types of cancer and other diseases.

(a) The theory is about:

- (i) being invisible
- (ii) how cells read their DNA
- (iii) a new drug
- (iv) new species

(b) Give a word which is opposite in meaning to the word 'Preventing'.

(c) Who proposed the theory?

- (i) Richard Ebright
- (ii) James R. Wong
- (iii) Both (i) and (ii)
- (iv) None of these

(d) What will be the result of the theory's success?

Answers

(a) (ii) how cells read their DNA

(b) Encouraging/Assisting

(c) (iii) Both (i) and (ii)

(d) The theory's success will be a big step towards understanding the processes of life and it might also lead to new ideas for preventing some types of cancer and other diseases.

2. So he did, and did he ever! Beginning in kindergarten, Ebright collected butterflies with the same determination that has marked all his activities. He also collected rocks, fossils and coins. He became an eager astronomer too, sometimes star-gazing all night.

(a) To whom does 'he' refer in the first sentence?

(b) State whether the given statement is True or False.

Ebright collected butterflies apathetically.

(c) What did Ebright use to do?

(d) Which word in the extract is opposite in meaning to the word 'indifferent'?

Answers

(a) In the first sentence, 'he' refers to Richard Ebright.

(b) False

(c) Ebright used to collect butterflies, rocks, fossils and coins. All his activities were marked with determination. He also became an eager astronomer and sometimes star-gazed all night.

(d) Eager

3. The question he tried to answer was simple: What is the purpose of the twelve tiny gold spots on a monarch pupa?

"Everyone assumed the spots were just ornamental," Ebright said.

"But Dr Urquhart didn't believe it."

To find the answer, Ebright and another excellent science student first had to build a device that showed that the spots were producing a hormone necessary for the butterfly's full development. This project won Ebright first place in the county fair and entry into the International Science and Engineering Fair. There he won third place for zoology. He also got a chance to work during the summer at the entomology laboratory of the Walter Reed Army Institute of Research.

(CBSE SQP 2023-24)

(a) State any one inference about Dr Urquhart from the given context:

"Everyone assumed the spots were just ornamental," Ebright said.

"But Dr Urquhart didn't believe it."

(b) State TRUE or FALSE.

None of the terms (i)-(iv) below, can be applied to the question— *What is the purpose of the twelve tiny gold spots on a monarch pupa?*

(i) A hypothesis— a proposed explanation for a phenomenon

(ii) An assumption— something that is taken for granted or assumed to be true without proof

(iii) A premise— a proposition that forms the basis of an argument

(iv) A theory— a well-substantiated explanation for a natural phenomenon

(c) Ebright's approach towards finding the purpose of the gold spots on a monarch pupa was highly effective. Elaborate with reference to the extract.

(d) Which phrase would correctly substitute 'a chance', in the given sentence from the extract.

He also got a chance to work during the summer at the entomology laboratory of the Walter Reed Army Institute of Research.

Answers

(a) From the given context we can infer that Dr Urquhart was a scientist who was not content to accept conventional wisdom.

(b) True

(c) Ebright's approach was highly effective in finding the purpose of the gold spots on a monarch pupa. By building a device that showed that the spots were producing a hormone necessary for the butterfly's full development, he was able to provide evidence that contradicted the prevailing assumption that the spots were purely ornamental.

(d) an opportunity



Short Answer Type Questions

Q 1. Ebright was everything for his mother. How did she help him? (CBSE 2018)

OR

What role did Ebright's mother play in his success? (CBSE 2022 Term-2)

OR

How did Ebright's mother help him to become a scientist? (CBSE 2023)

Ans. Ebright was the only child of his parents. He became everything for his mother after his father's death. She helped him to become a scientist. She was his only companion until he started school. She would take him on trips. She would also bring different instruments for him like microscope, telescope and camera. She encouraged his interest in learning. She bought him a book titled 'The Travels of Monarch X'. This book opened the world of butterflies for Ebright and motivated him to research on them.

Q 2. Which book did Ebright's mother get for him? How did it change his life? (CBSE 2017)

Ans. When Richard was in the second grade, his mother bought him a children's book titled 'The Travels of Monarch X'. At the end of the book, readers were invited to help study butterfly migrations by tagging the butterflies for research by Dr Frederick A. Urquhart of the University of Toronto, Canada. Ebright's mother wrote to Dr Urquhart and soon Richard was attaching light adhesive tags to the wings of monarchs. But the butterfly collecting season lasted for only six weeks in Readings. So, it was not easy to catch them. So, Ebright decided to raise a flock of butterflies. When the pupa changed to an adult butterfly, Ebright used to tag it and then let them go.

Q 3. Why did Richard Ebright raise a flock of butterflies? (CBSE 2023)

Ans. Ebright started tagging monarch butterflies. He realised that chasing the butterflies one by one wouldn't enable him to catch very many. So, he decided to raise a flock of butterflies.

Q 4. Ebright soon lost interest in tagging butterflies. Why?

Ans. Ebright responded to Dr Frederick A. Urquhart's appeal to tag monarch butterflies to help him in his research regarding their migration. Ebright attached light adhesive tags to the wings of monarchs. He lost interest in tagging butterflies because it was a tedious job. Also, there was no feedback. In all the time that he tagged butterflies, only two were caught and that too not more than 75 miles from where he lived.

Q 5. What lesson did Ebright learn when he did not win anything at a science fair? (CBSE 2023)

Ans. Ebright learnt a lesson that the real experiments would help him to win a prize and he decided to do a real experiment. The real experiments showed the

things clearly and proved the point. He tried to find the cause of a viral disease that killed all monarch caterpillars every few years. His next theory was to see whether birds ate monarch butterflies.

Q 6. Which project of Ebright was placed first in zoology division and third overall in the County Science Fair?

OR

Why did viceroy butterflies copy the Monarchs?

(CBSE 2022 Term-2)

Ans. Ebright intended to test the theory that viceroy butterflies copy monarchs. This theory was that viceroys look like monarchs because monarchs don't taste good to birds. Viceroys, on the other hand, do taste good to birds. So, the viceroys try to look like monarchs so that the birds do not catch them. Ebright's project was to see whether, in fact, birds would eat monarchs. He found that a starling would not eat ordinary bird food but it would eat all the monarchs it could get. This project was placed first in zoology division and then third overall in the County Science Fair.

Q 7. What was the actual purpose of tiny gold spots on a monarch pupa that was discovered by Ebright?

Ans. It was believed that tiny gold spots on a monarch pupa were only ornamental. But, Ebright proved that the actual purpose of these tiny gold spots was to produce a hormone that helps a butterfly for its complete development.

Q 8. How did Ebright identify the hormone's chemical structure?

Ans. After his freshman year at Harvard University, Ebright went to research at the laboratory of the Department of Agriculture. He did more work on the hormone found in the gold spots of the monarch pupa. Using the laboratory's sophisticated instruments, he was able to identify the hormone's chemical structure.

Q 9. Validate the importance of small, fun learning tasks towards successful careers, in the context of Richard Ebright in 'The Making of a Scientist'.

(CBSE SQP 2022-23)

Ans. Richard Ebright inspired by his child intuition started the collection and breeding of butterflies as a fun activity. He got curious and found out the cause of a disease which killed monarch caterpillars every few years. He further investigated the gold spots and secretion from them. His interest and discoveries led him to develop a theory of cell structure and later DNA. His fun learning to collect butterflies and discovering more about them resulted in a career as a renowned scientist.

Q 10. Did Ebright have other interests besides science? If yes, mention them.

Ans. Yes. Ebright had various other interests besides science. He was a champion debater and public



speaker. He was a good canoeist. He was an expert photographer, particularly of nature and of scientific exhibits.

Q 11. What are the qualities that go into the making of a scientist?

Ans. There are many qualities that go into making of a scientist. These qualities are: first-rate mind, curiosity and the will to win for the right reasons.

Long Answer Type Questions

Q 1. Discuss the role of Ebright's mother in making him a scientist.

OR

How did Richard Ebright's mother help him?

(CBSE 2017)

OR

How did Ebright's mother help him in becoming a scientist?

(CBSE 2015)

Ans. Richard Ebright's was the only child of his parents. His father died when he was in third grade. Thus, he became everything for his mother. Ebright had a driving curiosity along with a bright mind. His mother encouraged his interest in learning. She took him on trips, bought him telescopes, microscopes, cameras, mounting materials and other equipments. She was his only companion until he started school. After he started his school, his mother used to invite his friends over so that he did not felt lonely. Richard's mother spent every evening with him at the dining table. If he didn't have things to do, then she used to find work for him. Seeing his interest in butterflies, his mother bought him a book titled 'The Travels of Monarch X'. This book opened the world of science for Richard. So, we can see that Ebright's mother played an important role in making him a scientist.

Q 2. How will Ebright's new theory about cell life be useful for humanity?

Ans. When Richard was in his second year in high school, he undertook a project on the purpose of twelve tiny gold spots on a monarch pupa. Everyone assumed that these spots were just ornamental but Richard showed that these spots were producing a hormone which was necessary for the butterfly's full development. Later on when he was working in the laboratory of the Department of Agriculture, he was able to identify the hormone's chemical structure. A year-and-a-half later, Ebright got the idea for his new theory about cell life while he was looking at the X-ray photos of the chemical structure of a hormone. His theory on cell life gives the answer to one of biology's puzzles, *i.e.*, "How the cell can read the blueprint of its DNA?"

If the theory proves correct, it will be a big step towards understanding the processes of life. It might also lead to new ideas for preventing some types of cancer and other diseases.

Q 3. The author compares Ebright's achievement with 'a home run'. Why does he do so?

(CBSE 2018)

Ans. During his junior year at Harvard University, Ebright got the idea for his new theory about cell life. He got the idea when he was looking at the X-ray photos of the chemical structure of a hormone.

His new theory provided the answer to the question that how the cell can read the blueprint of its DNA. Ebright and his college room-mate, James R. Wong, worked all night drawing pictures and constructing plastic models of molecules to show how it could happen. Together they wrote the paper that explained the theory. This paper was published in an important scientific journal, 'Proceedings of the National Academy of Science'. This was the first time this important scientific journal had ever published the work of college students.

Therefore, the author compares this achievement of Ebright as being equivalent of hitting a home run by a fifteen year old when he comes to bat for a first time. It is extremely difficult to achieve this feat.

Q 4. To participate in the competition is more necessary than to win a prize. Explain this statement in the light of Ebright's participation at the County Science Fair.

Ans. We know very well that to win is human nature. Everyone wants to get a win (everywhere). Our life is full of different competitions at different levels. In these competitions, everyone of us wants to become a winner. But, it is always not possible because while participants can be many, only one can win. When we enter any competition, we try our best to get the top position there. But, if we don't achieve our goal, we feel disappointed. Great thinkers have said that participation is more important than winning. The same is proved in Ebright's success. Richard Ebright participated in the County Science Fair, when he was in the seventh grade, but he lost. There, he showed slides of frog tissues. He realised that he should have done some real experiments to be a winner. This helped him to understand the importance of experiments in the field of science and proved to be the foundation stone of his future research.

Q 5. How did Ebright use determination and perseverance to achieve his aim of becoming a scientist?

(CBSE 2019)

Ans. Ebright used his determination and perseverance to achieve his aim of becoming a scientist. From childhood only, he had a driving curiosity along with a bright mind. He earned top grades in school. When he was in the second grade, Ebright had collected all twenty-five species of butterflies found around his hometown. He also helped Dr Frederick A. Urquhart in his research on butterfly migrations. To facilitate the research, he also started raising butterflies in his basement. For several years, his basement was home to thousands of monarchs in different stages of development. Also when he was in the seventh grade, he started participating in science fairs.

This fuelled the competitive spirit in him and kept him busy all through high school and led to prize projects in County and International Science Fairs. In his senior years, his project on monarch butterfly won first place at the International Science Fair and gave him a chance to work in army laboratory and at the laboratory of the US Department of Agriculture. He graduated from Harvard with highest honours.

second in his class of 1510. He then went onto became a graduate student researcher at Harvard Medical School. There he conducted experiments to test his theory on 'how the cell can read the blueprint of its DNA'. Richard has proved that if one has the will power and the ability to work hard, no goal is unachievable. ●