Chapter 23: The Making of a Scientist

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Exercise 23.1 — Read and Find Out 1 (Page 33)

Q1 How did a book become a turning point in Richard Ebright's life?

SOLUTION

By the time he was in the second grade, Ebright had collected all twenty-five species of butterflies found around his hometown. Having exhausted the collection, he felt this "probably would have been the end of my butterfly collecting."

Then his mother got him a children's book called The Travels of Monarch X, which told how monarch butterflies migrate to Central America.

That book "opened the world of science" to the eager young collector. At the end of it, readers were invited to help study butterfly migrations by tagging monarchs for research by Dr Frederick A. Urquhart. This drew Ebright into real scientific work and set him on the path that led to all his later achievements in science.

Answer: The children's book The Travels of Monarch X opened the world of science to Ebright and, through its invitation to tag butterflies for research, drew him into real scientific work.

Q2 How did his mother help him?

SOLUTION

Ebright's mother encouraged his interest in learning. She took him on trips and bought him telescopes, microscopes, cameras, mounting materials, and other equipment.

She was his only companion until he started school, and afterwards brought home friends for him. Every evening they did things together at the dining room table; when he had nothing to do, she found learning things for him to do. As she

said, "Richie was my whole life after his father died when Richie was in third grade."

Most importantly, she gave him the book The Travels of Monarch X and wrote to Dr Urquhart on his behalf, which started his real involvement in science.

Answer: She nurtured his curiosity — buying him scientific equipment, taking him on trips, spending every evening helping him learn, and giving him the book and the contact with Dr Urquhart that launched his science career.

Exercise 23.2 — Read and Find Out 2 (Page 34)

Q1 What lesson does Ebright learn when he does not win anything at a science fair?

SOLUTION

In the seventh grade Ebright entered a county science fair with slides of frog tissues shown under a microscope, and lost. He said, "It was really a sad feeling to sit there and not get anything while everybody else had won something."

He realised the winners had tried to do real experiments, not simply make a neat display like his.

He learnt that to win he would have to do real, original scientific experiments rather than just present an attractive exhibit.

Answer: He learns that to succeed in science fairs he must do real experiments, not just make a neat display.

Q2 What experiments and projects does he then undertake?

SOLUTION

For his eighth grade project he tried to find the cause of a viral disease that kills nearly all monarch caterpillars every few years, testing whether it was carried by a beetle.

The next year he tested the theory that viceroy butterflies copy monarchs because monarchs don't taste good to birds.

In high school he began the research that led to his discovery of an unknown insect hormone: he studied the purpose of the twelve tiny gold spots on a monarch pupa, built a device showing they produced a hormone necessary for the butterfly's full development, grew monarch wing cells in a culture, and finally identified the hormone's chemical structure — work that led to his new theory on the life of cells.

Answer: He investigates the viral disease of monarch caterpillars, tests whether viceroys copy monarchs, and researches the gold spots on the monarch pupa — discovering an unknown insect hormone and forming a new theory about cell life.

Q3 What are the qualities that go into the making of a scientist?

SOLUTION

The text ends by naming the ingredients: "Start with a first-rate mind, add curiosity, and mix in the will to win for the right reasons."

A bright, first-rate mind and a driving scientific curiosity are essential — Ebright had a driving curiosity along with a bright mind from the first.

A competitive spirit, or the will to win, is also needed — but for the right reasons: Ebright wanted to be the best not to win a prize, but because he wanted to do the best job he could.

Answer: A first-rate mind, a strong scientific curiosity, and a competitive will to win for the right reasons — the desire to do one's best rather than to win a prize.

Exercise 23.3 — Think about it

Q1 How can one become a scientist, an economist, a historian...? Does it simply involve reading many books on the subject? Does it involve observing, thinking and doing experiments?

SOLUTION

Becoming a scientist, economist or historian is not simply a matter of reading many books. Reading gives basic knowledge, but by itself it is not enough.

Richard Ebright's example shows that it also requires observing, thinking, questioning, and doing real experiments. He did not just study butterflies from books — he raised thousands of monarchs, tagged them, and carried out original experiments.

The chapter itself makes the point that winning at a science fair (and real achievement) comes from doing real experiments, not from making a neat display. So one becomes a scientist by combining a first-rate mind and curiosity with active observation, thinking, and experimentation — not by reading alone.

Answer: No — it is not merely reading many books; it requires observing, thinking, questioning, and doing real experiments, as Ebright's example demonstrates.

Q2 You must have read about cells and DNA in your science books. Discuss Richard Ebright's work in the light of what you have studied. If you get an opportunity to work like Richard Ebright on projects and experiments, which field would you like to work on and why?

SOLUTION

Ebright's work connects directly to what students learn about cells and DNA. He grew cells from a monarch's wing in a culture and showed that they would divide and develop into normal butterfly wing scales only if fed the hormone from the gold spots.

Looking at X-ray photos of a hormone's chemical structure, he arrived at a new theory about how the cell can 'read' the blueprint of its DNA — the substance in the nucleus that controls heredity and determines the form and function of the cell. As the text says, "DNA is the blueprint for life." His theory, if proven, could help understand the processes of life and lead to ways of preventing some types of cancer.

(Model answer for the personal part:) Given such an opportunity, I would like to work in the field of genetics and cell biology, because understanding DNA and cell function could help cure diseases like cancer and improve human health — just as Ebright's curiosity about butterfly pupae led to insights into the fundamentals of life.

Answer: Ebright's research on the gold-spot hormone and monarch wing cells led to a theory of how a cell reads its DNA blueprint — linking directly to cell and heredity biology; genetics/cell biology is an appealing field because it can help cure diseases.