Jonas Salk

A Reading A–Z Level Z1 Leveled Book
Word Count: 2,040

Connections

Writing

Time magazine named Jonas Salk one of the most important people of the twentieth century. Do you agree? Take a stance. Write a letter to *Time* magazine voicing your opinion. Include details from the text to support your claim.

Science

Explain how antibodies work to make the body immune to disease. Include a labeled diagram of an antibody with your explanation.

LEVELED BOOK • Z1

Jonas Salk

Multi level Y•Z1•Z2

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Focus Question

How did Jonas Salk achieve his goal of making a difference for humanity?

Words to Know

contagious	pharmaceutical
devastating	placebo
epidemic	polio
eradicated	quarantined
field trial	recruited
grant	strain
immunity	vaccine
paralyzed	

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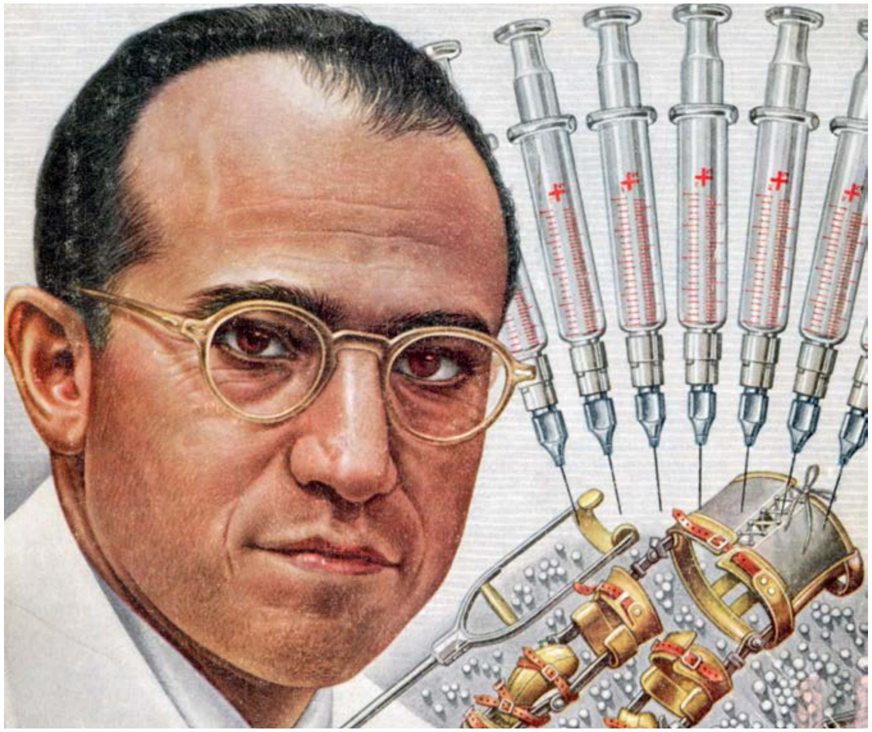
Correlation

LEVEL Z1	
Fountas & Pinnell	W–X
Reading Recovery	N/A
DRA	60



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Signs warned people to stay away from areas stricken by polio.

Summer Terror

In the spring of 1953, parents in the United States braced for another season of terror. *Poliomyelitis*, or **polio**, had sickened nearly fifty-seven thousand people the previous summer. The **contagious** disease had left twenty thousand people, mostly children, crippled and another three thousand dead.

In most cases, the poliovirus caused cold-like symptoms as it passed from the mouth through the digestive system. In some cases, the virus **paralyzed** muscles in the arms and legs, and, in the worst cases, it paralyzed the chest muscles so people could not breathe.

People avoided large crowds, and police **quarantined** homes and took sick children to hospitals, where they stayed for months—even years.

There was one hope. Dr. Jonas Salk told the nation that a **vaccine** for polio was on the way.

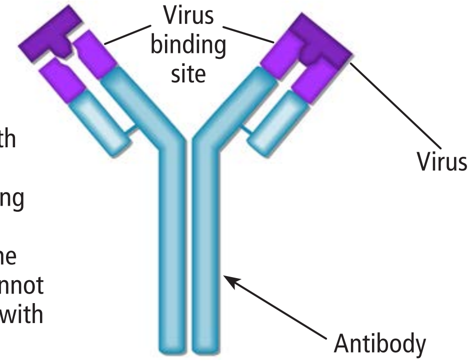
How to Make a Difference

Jonas Salk, born in New York in 1914, was a good student who entered Townsend Harris Hall, a high school for gifted students, when he was twelve. Salk then went on to City College of New York by age sixteen. He wanted to do something to help humanity, so he decided to become a medical researcher and fight diseases.

Salk finished his studies just as the United States entered World War II. The military needed a vaccine to protect soldiers from respiratory illnesses and influenza (flu) because a flu **epidemic** had killed more than forty thousand U.S. soldiers during World War I. Dr. Thomas Francis at the University of Michigan received a **grant** to develop a flu vaccine and hired Salk to work in his lab.

The U.S. Army began influenza vaccinations in 1943.

How Antibodies Work



Antibodies bind with viruses to stop the viruses from infecting the body. Once the viruses bind with the antibodies, they cannot break off and bind with other healthy cells.

Salk knew that when exposed to a virus, the body protects itself by producing special proteins called *antibodies* to fight the disease. A vaccine promotes the production of antibodies, usually without causing the disease. Salk developed a test to detect the number of antibodies in the blood, which allowed researchers to tell how well a vaccine worked without having to wait for someone to get sick.

Salk and other researchers used a chemical called *formalin* to kill the flu virus without changing the way it looked on the outside. This meant that the body would recognize the virus and develop antibodies. It worked. The team produced a killed-virus flu vaccine that saved thousands of lives.

Now thirty-two years old, Salk accepted a position as head of the Virus Research Laboratory at the University of Pittsburgh.

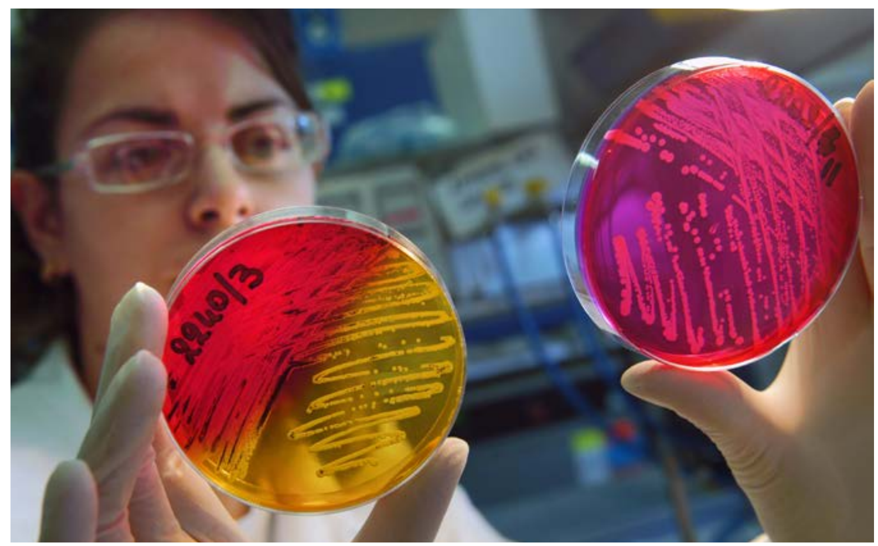
The National Foundation for Infantile Paralysis (NFIP) changed its name to the March of Dimes in 1979.

Doing Things His Way

Salk needed money for his new lab, and the National Foundation for Infantile Paralysis (NFIP) wanted to fund research on a polio vaccine. Franklin D. Roosevelt, the thirty-second president of the United States and a polio survivor, founded the NFIP in 1938 and **recruited** Basil O'Connor to run it. O'Connor, impressed with Salk's eagerness to get things done, gave Salk a grant.

The first step in developing a polio vaccine was discovering how many types of poliovirus existed. If there were dozens of types, as there are with the common cold virus, a single vaccine would not provide **immunity** against all of them.

Poliovirus was hard to work with. Only humans get polio naturally, but monkeys can be infected with it in a laboratory. Traditionally, figuring out if a **strain** of poliovirus was a whole new type required giving a monkey one polio type—say, type 1—in order to develop antibodies in the monkey. If the monkey recovered from the disease, the scientist injected it with a small amount of the unknown strain being tested. If the monkey didn't get sick, they increased the amount little by little until the monkey got sick. If the monkey never got sick, the process was repeated for type 2 and then type 3. This took months as researchers waited for monkeys to get sick, recover, and get sick again.



Scientists grow virus samples in glass plates called *petri dishes*, which fit under microscopes.

Salk thought this was backward. Why not first infect a monkey with a light dose of an unknown virus strain? The monkey might not get sick, but the infection would produce antibodies in its blood. Then, when given a known type 1 virus, the monkey's blood would flood with antibodies if the unknown strain were type 1. If the virus grew, it meant the strain was type 2, type 3, or an unknown type.

Most of the scientists at the NFIP conference that year, including Dr. Albert Sabin, a well-known and vocal polio researcher, scoffed at the new idea, and the NFIP decided to fund the traditional typing method instead of Salk's.

Salk was convinced that the new method was better. Back in his lab, he worked overtime to try both methods and found that the new process worked, was faster, and required far fewer monkeys. He took notice of another team's discovery for growing poliovirus in tissue cultures, or living material grown outside the body, and successfully tested for antibodies in the cultures. Using these new methods, Salk's team determined that there were only three types of polio in one year instead of the expected three years.

Polio in the World Today

Polio occurs in seven countries as of 2015. The incidents of polio have increased in the last few years, as some countries refuse to vaccinate or are at war. At one time, polio was contained in three countries. Although officially eradicated in the United States, vaccinations continue because an outbreak is still possible if the disease is brought from elsewhere—unlike smallpox, which has been eradicated worldwide.

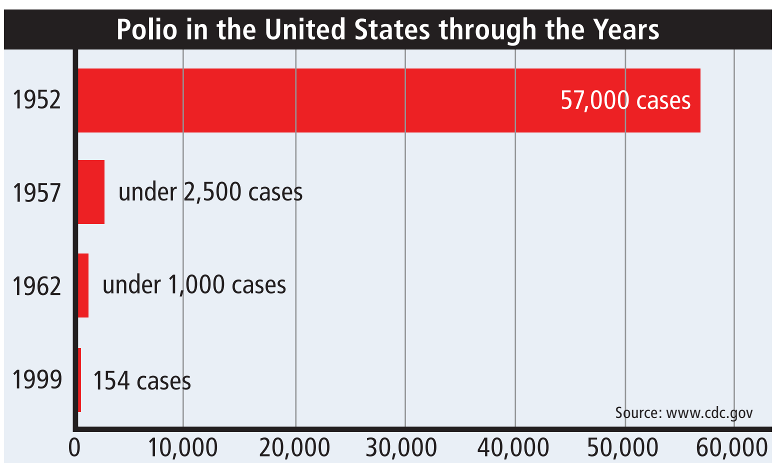
Dead or Alive?

In 1950, the majority of scientists, including the outspoken Sabin, believed that only a live-virus vaccine would give people long-lasting protection from polio. A live-virus vaccine involves scientists developing a weak virus to put in a vaccine. When injected, the weak virus causes the body to produce antibodies, in most cases without causing the disease.

Salk believed that a killed-virus vaccine, like the one he and Francis had produced for the flu, would work just as well—plus, it was safer. A killed virus could never give someone polio.

The NFIP decided to fund both methods, so, with a team of fifty researchers, Salk went to work, but it was not an easy task to kill the poliovirus without damaging it. Salk's team used the same chemical used to kill the flu virus and experimented with different temperatures and strengths to kill the poliovirus. They strained and mixed the solution to make sure every poliovirus was dead. Viruses are tiny—a million of them can line up in one inch—but just one live poliovirus could cause the deadly disease.

As Salk's team worked, the beds in the hospital above the lab filled with sick children.



The First Tests

By 1952, Salk had a vaccine that worked on monkeys, but did he dare try it on children? Attempts at polio vaccines in the 1930s had **devastating** effects: vaccinated children developed polio.

Jonas Salk evaluated hundreds of vials of vaccine in his lab at the University of Pittsburgh.

Salk did his first tests with children at the Watson Home for Crippled Children who, having had the disease, could not get polio again. The vaccine worked—the vaccinated children showed an increase of antibodies in their blood. Next, Salk vaccinated children who had not had polio. They developed antibodies to protect them from the disease, and they had no ill effects. He prepared to present his results at the next NFIP conference.

Work at Salk's lab was a closely guarded secret, but reporters found out about the coming announcement. When *Time* magazine ran an article with Salk's picture on the cover, people began calling and visiting the lab to get more information.

Albert Sabin worked with his staff at the University of Cincinnati.

The constant interruptions made it hard to concentrate. Salk went to O'Connor for help, and they decided that Salk should explain on the radio that, although it was close, the vaccine wasn't ready and interruptions caused delays. Salk became famous overnight as the man who would save the children.

Sabin and other researchers were furious. Although Salk discussed the contributions of other polio researchers on the radio, they thought he was trying to take all the credit. Real scientists, they fumed, presented their research at science conferences or in scientific journals—not on the radio!

Salk ignored the distractions and went back to work as polio sickened another thirty-five thousand people in 1953.

The Trial

When Salk was sure he had a safe, effective vaccine, he vaccinated himself, his wife and three sons, and workers in the lab. O'Connor pushed for a huge **field trial** of the vaccine before the next summer. This meant vaccinating hundreds of thousands of children. Salk wanted more time to perfect the vaccine but agreed that it was wrong not to try to help the thousands of children likely to get polio if Salk and his team delayed.

O'Connor went to work recruiting volunteers to take the vaccine, organizing thousands of health-care workers, and raising money. The NFIP needed $7.5 million for the field trial—an event that would cost more than $66 million today—and they only had a few months before polio season.

Salk could not make enough vaccine in his lab, so he trained lab workers in large **pharmaceutical** companies on the precise method of killing the

Children lined up for the polio trials in 1954.

Thomas Francis spoke for an hour and forty minutes before announcing that Salk's vaccine worked.

virus while maintaining its structure. It was so difficult that only two of the five manufacturers succeeded in time to make vaccine for the start of the trial.

Almost two million children participated in the trial: some received the vaccine, some a **placebo**, and the rest would be tracked as a control group. Then came the months of waiting as Dr. Thomas Francis, Salk's old boss, collected and analyzed the results. Salk was about to become a national hero—or a villain.

On April 12, 1955, millions of people listened to the radio and on department store speakers as Francis announced at the NFIP conference, "The poliomyelitis vaccination was sixty-eight percent effective against polio type 1, one hundred percent effective against type 2, and ninety-two percent effective against type 3. The vaccine works. It is safe, effective, and potent."

Reporters ran to announce the news, church bells rang, and people cheered in the streets.

Salk rose quietly to give his speech. He was unhappy that the vaccine was not 100 percent effective and blamed the manufacturers for adding an untested ingredient, which later proved to be true. He thanked past polio researchers, the volunteers, and those who had donated money. He neglected, however, to mention the members of his team specifically.

Blaming someone else for the less-than-perfect score and not giving credit to his colleagues angered many other scientists; some never forgave him.

However, Salk was a public hero. He was interviewed on the radio and for newspapers, and people sent him money and gifts. He gave everything to NFIP and returned to his lab to improve the vaccine.

Signs at vaccination stations advised people on a daily basis of how many suffered serious effects from being vaccinated.

What Went Wrong

With summer coming, the NFIP began distributing free vaccine from all five manufacturers. The first indication of trouble came within weeks when some children given the vaccine got polio. The vaccine distribution was suspended.

Salk didn't panic because he knew that the vaccine, if properly prepared, was safe. Investigators soon tracked the problem to one manufacturer that had not properly killed the virus, so that vaccine was pulled and the vaccinations continued.

By 1962, the number of polio cases in the United States dropped to fewer than one thousand. Salk's vaccine was effective but expensive to produce, so that year the United States approved Sabin's live-virus vaccine, which was cheaper than the killed-virus vaccine and given on a sugar cube instead of in a series of shots. The last cases of naturally occurring polio in the United States were in 1979. Since most of the few remaining cases were caused by the live-virus vaccine, the United States decided to use only the killed-virus vaccine after 2000. Salk had not only developed the first polio vaccine, his vaccine finally **eradicated** the disease in the country.

New Challenges

In 1960, Salk founded the Salk Institute as a place for scientists to work for the good of humanity. He researched diseases such as cancer and HIV/AIDS until his death in 1995. Today, the Salk Institute does cutting-edge medical research and has produced several Nobel Prize winners.

Salk did not receive a Nobel Prize. At the time, many in the science community agreed with Sabin when he said that Salk's work was "pure kitchen chemistry. He didn't discover anything." Salk was the only major polio researcher never elected to the prestigious National Academy of Sciences.

Time magazine named Salk one of the hundred most important people of the twentieth century. He brought together discoveries from decades of polio research and applied new ideas to create the first polio vaccine. He received thanks from his country and the rest of the world for saving thousands of children from the crippling disease.

Signs sent the message that people were rewarded with lollipops for being vaccinated.

Salk believed that medical research should focus on making a difference for humankind, and he achieved his goal.

Glossary

contagious *(adj.)*	able to spread through contact with people or other living things (p. 4)
devastating *(adj.)*	causing great physical or emotional damage (p. 12)
epidemic *(n.)*	the rapid spread of a disease within a community (p. 5)
eradicated *(v.)*	completely destroyed (p. 17)
field trial *(n.)*	a test of a new product or process in its intended situation to determine its effectiveness (p. 14)
grant *(n.)*	a formal gift of land or money from a government or other institution that is to be used for a particular purpose, such as research (p. 5)
immunity *(n.)*	resistance to disease or illness (p. 7)
paralyzed *(v.)*	caused one or more parts of a body to become unable to move (p. 4)

pharmaceutical *(adj.)*	having to do with drugs used for medicine (p. 14)
placebo *(n.)*	a pill or substance that has no actual effect on a patient, often used as a control in experiments testing another substance, such as a drug (p. 15)
polio *(n.)*	an acute viral infection that attacks skeletal muscle and the spinal cord (p. 4)
quarantined *(v.)*	isolated to prevent the spread of disease (p. 4)
recruited *(v.)*	brought someone in to join (p. 7)
strain *(n.)*	a group of viral organisms of the same species (p. 8)
vaccine *(n.)*	a medicine made of weak or dead microbes that teaches the body to fight stronger microbes of the same type (p. 4)