

The Discovery of Vaccines

INTRODUCTION

Infectious diseases used to kill millions of people every year throughout the world. Nowadays, in developed countries, these diseases kill only very small numbers of people.

One of the main reasons for this is the use of vaccines. The first large scale vaccinations were carried out against smallpox in 1796 by **Dr Edward Jenner**. But no one understood how vaccination worked and no other vaccines were made for eighty-four years.

In 1879 the famous French scientist, Louis Pasteur, was working on this problem. Two of his three daughters had already died from infectious diseases.

He began by studying anthrax, a disease caused by bacteria. Anthrax bacteria are harmless unless they enter the blood through a small cut or scratch.

When this happens, they multiply so fast that the blood turns **black!** After a few hours, millions of bacteria may block a main artery or vein and so cause death.

CAST (16 PEOPLE)

Narrator

Presenter (to read stage directions)

Cast for Scene 1

Monsieur Barbet, a sheep farmer

Madame Barbet, his wife

Monique, their daughter aged about thirteen

Cast for scenes 2 – 4

Louis Pasteur

Dr Roux, assistant to Pasteur

Dr Chamberland, assistant to Pasteur

Lamotte, laboratory technician

Cast for scenes 5 – 8

Louis Pasteur

Dr Roux

Dr Chamberland

Rossignol, a vet

Dr Colin, Scientist opposed to Pasteur

Madame Pasteur

Maid to Louis Pasteur

Dubois, a farmer from Melum

Dr Lebois, Scientist opposed to Pasteur

Dr Pinel, Scientist opposed to Pasteur

SCENE 1

- PRESENTER** A farmhouse in the hill district of the Auvergne, in France, about 1870. The farmer and his wife are working in the fields outside the house. Their daughter runs in very upset.
- MADAME BARBET** Monique, Monique, what has happened?
- MONIQUE** (*very upset*) The sheep – they're all dead – I couldn't help it – it all happened so quickly.
- MONSIEUR BARBET** Calm yourself Monique, tell us slowly now. You went out an hour ago, they can't all be dead.
- MONIQUE** But they **are** all dead, father. All of them. I was walking behind them up on the hill, when suddenly one of them stopped. I could see it trembling and shivering. Then it fell down. When I ran over to it, it was dead and there was horrible black blood flowing from its nose.
- And then, just as I was about to run down to the house another one started and then another and another. When I left them there were only three still alive and they were all trembling too
- MADAME BARBET** (*horrified*) It's the **anthrax**, its come again. What have we done to be punished in this way?
- MONSIEUR BARBET** Thirty-five sheep, each worth a hundred francs, all gone. What are we to do?
- MADAME BARBET** (*very worried*) Monique, did you touch any of them?
- MONIQUE** Only the first one, mother.
- MADAME BARBET** Let me see your hands. Have your any trace of a cut on them?
- PRESENTER** She examines Monique's hands closely
- MADAME BARBET** Thank heavens, no sign of a cut. Only last year, Farmer Ramon across the valley lost his two sons and all his sheep as well. Some of the blood got into cuts on their hands and they died of the anthrax, just like the sheep
- MONSIEUR BARBET** Let us pray we are to be spared that – but we will have to give up keeping sheep here. No one knows when the anthrax will strike again and no one knows how to prevent it. And we can't risk Monique's life as well.

NARRATOR Scenes like these were common in those days, wherever sheep were kept. Deaths of sheep due to anthrax were costing French farmers up to £100,000 a year, and there was always the fear of the shepherd catching the disease as well. Fortunately, help was at hand. In 1876 the famous German scientist Robert Koch proved that anthrax was caused by bacteria and by then many scientists, including Pasteur, had become interested in finding a cure for anthrax.

SCENE 2

PRESENTER Pasteur's laboratory in the Ecole Normale in Paris in 1879. He and his assistants have just returned from holiday. After making little progress with anthrax, they are studying a disease called chicken cholera, which was also the cause of great losses to farmers.

PASTEUR Now that we are all here, let us see where our work has led to and consider the next steps.
I'm afraid there's no sign of a cure for anthrax yet. But how are we getting on with the work on chicken cholera?

DR ROUX I have now injected more than a hundred hens with the chicken cholera germs and have tried twenty different cures, but my hens have all died.

DR CHAMBERLAND I have had the same results. However, there are many more cures to try.

PASTEUR Very well, let us continue. Have we any fresh supplies of the chicken cholera germs for injection?

LAMOTTE I'm afraid there are no fresh cultures ready yet sir, but the old cultures you were using last month still look quite healthy.

PASTEUR All right, we'll inject the hens with germs from the old cultures and then see if we can cure them.

SCENE 3

PRESENTER Ten days later in the laboratory, Roux, Chamberland and Pasteur are at work. Enter Lamotte.

LAMOTTE I'm afraid those old cultures weren't any use. None of the chickens have caught chicken cholera.

ROUX That's odd, we've never had that happen before.

PASTEUR *(slowly)* That culture has been changed in way – it's become weaker. I wonder how? Where was it kept during the holidays Lamotte?

LAMOTTE Why, just as you left it sir, on the bench, exposed to the air.

PASTEUR Perhaps the air has weakened it in some way? We must investigate this further. But meanwhile we need new cultures and fresh hens. Lamotte, can you get some more hens and a new culture?

LAMOTTE The new cultures will soon be ready sir, but there's a shortage of hens in the market at present. We may need to use those hens we injected with the weak culture. They seem quite healthy.

PASTEUR Very well, buy any fresh hens you can find but by all means use the old hens as well. They won't recover twice from being injected. Meanwhile, let's find out more about why this old culture became so weak.

NARRATOR Pasteur soon discovered that he could produce 'weak' chicken cholera bacteria simply by leaving the bacteria growing in an open dish for a week or more. But meanwhile a much greater discovery awaited him.

SCENE 4

PRESENTER Ten days later, in the laboratory, Pasteur and his assistants are at work. Enter Lamotte.

LAMOTTE I'm afraid it's happened again, sir.

PASTEUR What do you mean?

LAMOTTE Those hens – the ones which recovered from the old cholera culture, they're still alive. They didn't catch cholera from the new culture either.

CHAMBERLAND *(very excited)* What's happened to the fresh hens, the ones you bought in the market?

LAMOTTE Oh, they're dead all right.

ROUX So the fresh hens from the market died, but the old hens who had that weak dose have now survived a much stronger dose. What can have happened?

PRESENTER There is a pause, everyone looks at each other amazed.

PASTEUR *(speaking very slowly and emphatically)* Don't you see that these birds have been **vaccinated!**

NARRATOR So Pasteur was the first man to find a vaccine for a disease since Jenner in 1796. He deliberately used the word 'vaccinated' to describe his experiment with the hens because he saw the similarity to Jenner's work at once.

PRESENTER You can see what happened so far on the next page.

SCENE 5

NARRATOR Pasteur had now discovered that once an animal has been given a dose of specially weakened microbes, it was then protected against a stronger dose of the same microbes.

So he set to work to produce an anthrax vaccine. But Pasteur's work was not popular with everyone in France at that time.

PRESENTER Inside the office of the vet in the town of Melun, near Paris, in 1881. The vet, Rossignol, is talking to Dr Colin, a scientist from Paris, and to Monsieur Dubois, a local farmer.

ROSSIGNOL *(sneering)* I hear the great Pasteur has announced a new wonder vaccine for anthrax. Is it any good, Colin?






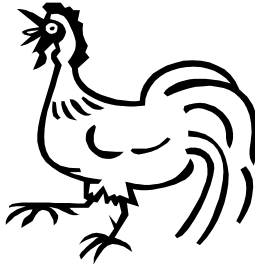
COLIN I don't suppose so. Most of his ideas are nonsense, but it's no good telling Pasteur that. If you try to criticise him, he soon shows what he thinks of you. He called me an idiot at a public meeting last month.

ROSSIGNOL That's no way for him to treat a fellow scientist like yourself. But I hear he has suggested using his vaccine on a large scale. Suppose we forced him to do it in public – it would only take a few deaths of vaccinated sheep to ruin him forever.

COLIN Excellent idea! It's time Monsieur Pasteur learned what it is like to be called an idiot in front of his fellow scientists.

ROSSIGNOL But we shall need animals, and money. Will you help us gentlemen?

DUBOIS I can't say I share your opinion of Pasteur. He may have called Colin an idiot, but that doesn't prove his ideas are wrong. I will gladly pay for a trial to settle this argument.

<p>1. Some hens are given a weak dose of chicken cholera, by mistake.</p>	<p>2. Ten days later, they are still healthy, much to everyone's surprise.</p>
	
<p>3. A new, strong dose of chicken cholera is given to the original hens.</p>	<p>4. A strong dose is also given to a fresh group of hens from the market.</p>
	
<p>5. The 'old hens' survive once again.</p>	<p>6. The 'fresh hens' die.</p>
	

SCENE 6

- PRESENTER** Rossignol's farm at Poilly le Fort, near Melum. On May 5th 1881, a huge crowd of farmers, doctors, vets, scientists and journalists have gathered. Even The Times newspaper has sent a reporter.
- COLIN** Well done, you've arranged this splendidly.
- ROSSIGNOL** I hope it means the end for Pasteur. Maybe he'll be a bit less pleased with himself when this is all over.
- PASTEUR** *(standing up to speak to the crowd)* Ladies and gentlemen, Monsieur Rossignol and his friends have kindly provided us with these sixty sheep. We are going to vaccinate twenty-five of them today with a weak dose and revaccinate them on the 17th May with a stronger dose. Then on the 31st May we will inject a strong dose of anthrax bacteria into the twenty-five vaccinated sheep and also into the twenty-five unvaccinated sheep.
- DR LEBOIS** *(opponent of Pasteur)* But that makes fifty altogether. What will you do with the other ten?
- CHAMBERLAND** *(Pasteur's assistant)* We will leave the ten extra sheep alone. This will allow us to check that there are no anthrax bacteria in the soil of this field.

SCENE 7

- PRESENTER** The farm at Pouilly le Fort on 31st May.
- PASTEUR** *(addressing the crowd)* As you can see, ladies and gentlemen, the sheep are all well. We will now inject the twenty-five vaccinated sheep and twenty-five of the unvaccinated sheep with a very strong dose of anthrax bacteria. This dose is usually fatal to all sheep.
- COLIN** *(aside to Rossignol)* The man's tricky. He will give a dose from the top of the bottle to the vaccinated sheep and use the bottom of the bottle for the unvaccinated. Everyone knows the microbes are all in the bottom.
- ROSSIGNOL** I will shake the bottle myself, and we will insist that the sheep are injected alternately – first an unvaccinated sheep and then a vaccinated sheep, until all fifty have been treated.

NARRATOR The experiment was carried out as Rossignol wanted. At the end, Pasteur made a prophecy – a rash one to many who heard it.

PASTEUR Thank you all for coming, ladies and gentlemen. We will meet here again on the 2nd of June at 2pm. And I predict that by that day every one of the unvaccinated sheep will be dead, and every one of the vaccinated animals will be alive.

SCENE 8

PRESENTER Pasteur's home in Paris on the morning of June 2nd. Pasteur is pacing up and down and talking to his wife Marie.

PASTEUR (*very agitated*) I didn't sleep a minute last night. Why did I sound so certain? So much can go wrong. Only yesterday a telegram arrived to say that one of the vaccinated sheep looked ill.

MADAME PASTEUR Calm yourself Louis, you know your vaccine works.

PRESENTER A knocking is heard on the door. The maid enters with a telegram.

MAID Telegram for you, Monsieur Pasteur.

PASTEUR I can't open it – Marie, tell me what it says.

MADAME PASTEUR (*opens the telegram very slowly*) It contains just two words that matter – **complete success!**

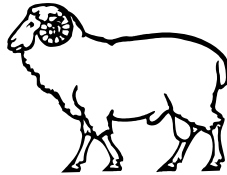
NARRATOR When the crowds reassembled at the farm, Pasteur's prophecy had come true. Every one of the twenty-five unvaccinated sheep was dead or dying and every one of the vaccinated sheep was alive and well, along with the ten untouched animals.

Pasteur was a hero and fame and rewards were showered upon him. The 2nd of June 1881 marked the beginning of the end for some infectious diseases which had killed so many people in the past.

How Pasteur designed the experiment to test his anthrax vaccine

5 May 1881

Twenty-five sheep are vaccinated with a weak dose of anthrax vaccine. Their ears are pierced.

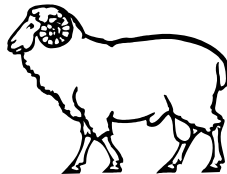


Another group of twenty-five sheep are left untouched.



17 May

The twenty-five vaccinated sheep are given a stronger dose of vaccine.

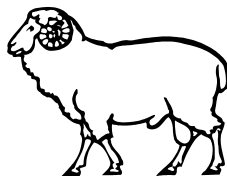


The second group are still untouched.



31 May

Injected with a strong dose of anthrax bacteria.

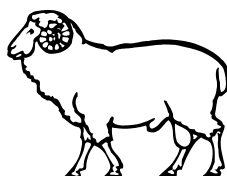


Injected with a strong dose of anthrax bacteria.



2 June

The twenty-five vaccinated sheep are alive and well.



The twenty-five unvaccinated sheep are all dead or dying.

