The Life and Legacy of Dr Edward Jenner FRS, pioneer of vaccination

Tim Wallington
For Edward Jenner's House
Berkeley, Gloucestershire
www.jennermuseum.com

Edward Jenner's Breakthrough: The Crucial Vaccination Experiment

14th May 1796, inoculation of James Phipps with lymph from a cow pox ulcer on the hand of Sarah Nelmes.

1st July James variolated (i.e. infected with smallpox) with no "take"

1. BEGINNINGS (1749 – 1773)

2. BEFORE FAME, SURGEON, GENTLEMAN SCIENTIST & MIDWIFE TO VACCINATION (1773 – 1798)

3. VACCINE CLERK (1798 -1823)

4. LEGACY

5. JENNER’S HOUSE, BERKELEY, GLOUCESTERSHIRE

Beginnings

Jenner antecedents, bakers based around Slimbridge in the Severn Vale

Edward’s father, born 1702, Oxford educated churchman, vicar of Berkeley 1729 (gift of the Earl), he married Sarah in the same year.

There were 9 children, 6 surviving to adulthood, Edward was number 8

Edward was born in the vicarage in Berkeley in 1749

Both parents died within two months of each other when he was five

He was left in the care of 3 sisters, eldest 19

His brothers were at Oxford

Aged 8 he was sent to Wooton-under-Edge Grammar School (Lady Katherine Berkeley)

Variolated there by local surgeon, Mr Holbrow

He was only at this school for one year

An aside on Variolation

Recovery from smallpox gives life long immunity

Variolation: deliberate innoculation with smallpox, usually in childhood to avoid later natural infection

Significant mortality (2%) (natural smallpox 12 – 20% and up to 40% in some outbreaks)

Spread smallpox

LADY MARY WORTLEY MONTAGU IN TURKISH DRESS

Learnt of variolation in Constantenople, had her first daughter variolated.

Introduced variolation to England in 1721 having her second daughter variolated here

Jenner’s experience of Variolation at Wooton-under-Edge

Began with a period of preparation, around two to four weeks. According to a contemporary account:

“He was bled, to ascertain whether his blood was fine; was purged repeatedly, till he became emaciated and feeble; was kept on a very low diet; small in quantity, and dosed with a diet-drink to sweeten the blood”

After this he was removed to one of the inoculation stables and isolated with other pupils while the inoculated smallpox ran its course over the next 10 to 14 days. Fortunately for Jenner his disease was mild. It was still a very debilitating and memorable process.

Back to beginnings

Next school in Cirencester, said to be keener on fossil collecting and natural history than the classics.

Perhaps in recognition of his interests (but perhaps also because he was orphaned), unlike his brothers he did not continue to prepare for Oxford

Accepted as an apprentice surgeon by John Ludlow aged 12 in 1761

Six years learning the knowledge and skills of a country surgeon

First awareness that Cow Pox which was caught from the udders of infected cows prevented infection with smallpox

Moved on at 18 to St George's Hospital to further his medical education

Unclear why he went into medicine in the first place and why he moved on to London, his training was exceptionally long

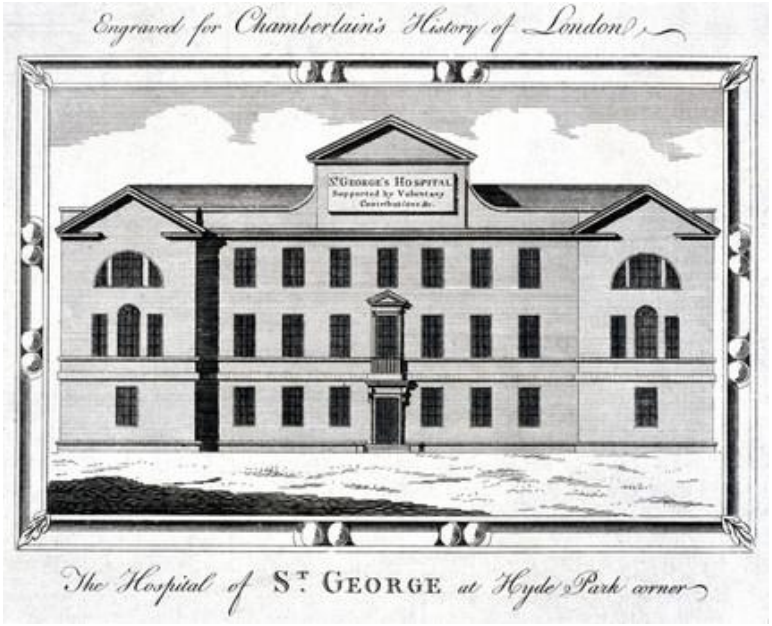
1770 – 1773 St George's Hospital

The key influence? John Hunter, "the dear man"

1770 became John Hunter's pupil and probably the first to lodge at his home.

This not only extended Jenner's education but started a life long friendship and collaboration with the greatest medical investigator of his era. They were close friends and collaborators until Hunter's death 25 years later

There is evidence that Jenner discussed the cow pox issue with Hunter



John Hunter (1728 - 1793)

Taught Jenner to be a scientist:

Observation – hypothesis - experiment

Primarily involved in anatomical study:
Human teeth
Digestion - fat absorption, role of lacteals
Lymphatic system
Foetal development
Separation of placental circulation
Body temperature

Forward thinking surgeon applying science to clinical problems:
Studies of inflammation
Gun shot wounds
Popliteal aneurysm
Venereal disease

FRS 1767 for studies on body temperature.

Appointed to staff of St. George's Hospital 1768

Jenner pupil 1770 - 1773

Joseph Banks (1743 – 1820) another significant influence

Botanist, naturalist, much involved in the advancement Of science and importantly friend of Jenner.

Most famous as naturalist on Cook's voyage on HM Bark Endeavour (1768 – 1771).

Jenner involved in cataloguing specimens after Banks return.

President Royal Society 1778 – 1820

Jenner FRS 1789, "Observations on the Natural History of the Cuckoo"

Between 1780 – 82 experiments on the use of human blood as a fertiliser at the request of Joseph Banks

BEFORE FAME (1773 – 1798)

Back to Berkeley (1773)

To live with his brother Stephen and practice as a surgeon, indulge his “hobbies” and find himself a wife.

As a country surgeon he was unusual and had many advantages:

- As a surgeon, unusually well qualified
- Status and steady income as a local landowner gave him time to pursue interests other than his job
- London contacts particularly John Hunter were a continuing influence

Bachelor for next 15 years, courted Catherine Kingscote for 10 yrs. Married 1788

The Cow Pox experiment was 23 years away

So what did Jenner get up to?

He practiced medicine across a large part of Gloucestershire bordered by Gloucester and Cheltenham in the North, the Severn, Wotton-under-Edge and the Cotswold escarpment and Thornbury to the South. (This remarkable in its own right considering transport was a horse).

He met regularly with medical colleagues to socialise and advance one another's practice through case presentation and discussion.

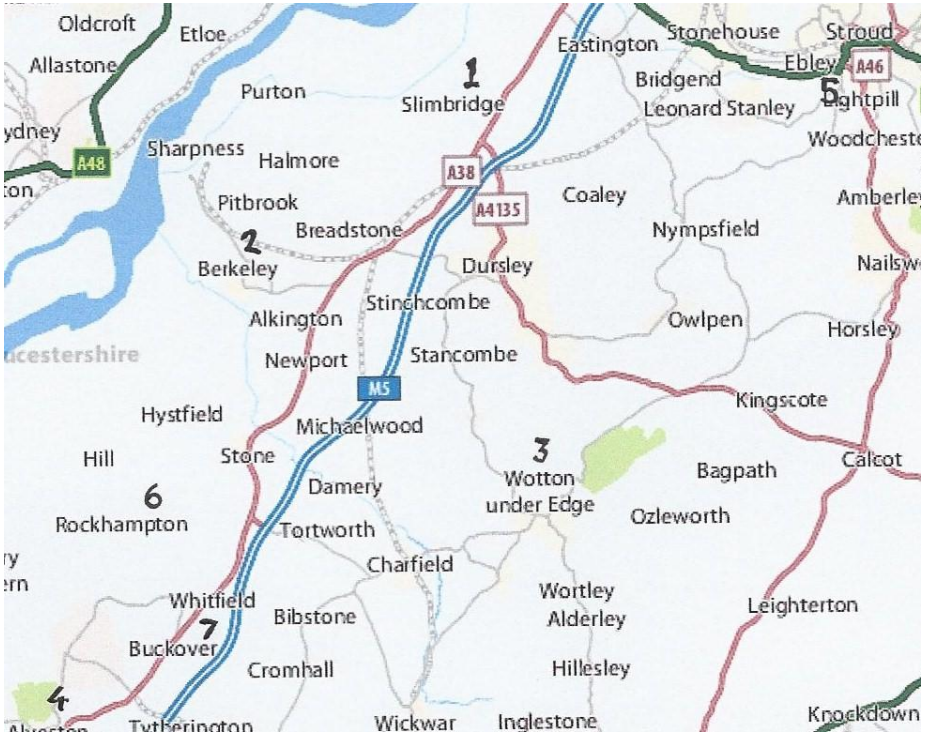
He was active in scientific research.

He wrote, prose, poetry and endless letters as well as a few scientific papers

Eventually he got married (1788) and started a family.

He was not always well, "melancholy" a problem and on at least one occasion severe infection (probably Typhoid)

A LITTLE GEOGRAPHY



1. Steven Jenner's birthplace
2. Berkeley
3. First school, description of coronary calcification
4. The Ship, Convivio-Medical Society
5. The Fleece, Medical Convivial Society
6. Brothers rector
7. Frewster's variolation house.

MEDICAL SOCIETIES

Convivio-Medical Society met at the Ship, Alveston

Founder, John Fewster, surgeon in Thornbury, paper to Medical Society of London, 1765

“Cow pox and its ability to prevent smallpox”

Medical Convivial Society, met at the Fleece, Rodborough,

Notable Jenner papers;

early and possible first description of coronary artery calcification

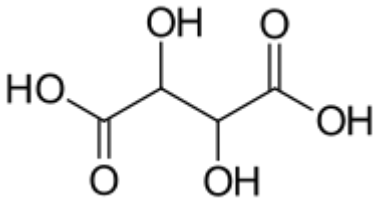
Studies of hydatid disease

Scientific Endeavour other than Cow Pox

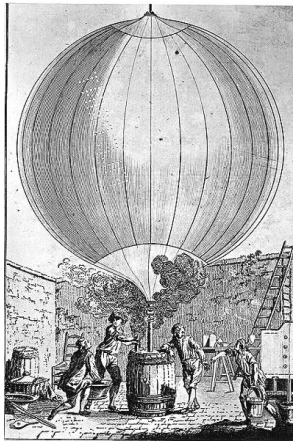
Hibernation with Hunter

Migration of Birds

Cuckoo in the nest



Tartar emetic



H2 Balloon, with Earl Berkeley

Blood as fertiliser with Banks

Jenner's Scientific Writings

Cursory Observations in Emetic Tartar. Wotton-under-Edge: J. Bence, 1780

Observations on the Natural History of the Cuckoo, Philosophical Transactions of the Royal Society. London 1788 78:219-237

A Process for preparing pure Emetic Tartar by Re-crystallisation…, Transactions of the Society for the Improvement of Medical and Chirurgical Knowledge, vol I 1793

An Inquiry into the Causes and Effects of the Variolae Vaccinae, known by the name of the Cow Pox. London: Sampson Low, 1798.

Further Observations on the Variolae Vaccinae or Cow Pox. London: Sampson Low, 1799.

A Continuation of Facts and Observations Relative to the Variolae Vaccinae. London: Sampson Low, 1800.

The Origin of the Vaccine Inoculation. London: D. N. Shury, 1801

Instructions for Vaccine Inoculation. London: D.N. Shury, 1801

On the Varieties & Modifications of the Vaccine Pustule, occasioned by an Herpetic State of the Skin. Cheltenham: H Ruff, 1806

Two Cases of Small-Pox Infection, Communicated to the Foetus in Utero. Medico-Chirurgical Transactions, London, 1815, 3rd edn, Vol I, pp 270-7

Observations on the Distemper in Dogs, Medico-Chirurgical Transactions, London, 1815 3rd edn, Vol I, pp 265-70

Some Observations on the Migration of Birds. Proceedings of the Royal Society, London, 1824 2:204

An aside on the Chantry, Edward Jenner's house from 1785 to his death in 1823. Now "Dr Jenner's House" a beautiful, quiet corner of Gloucestershire where vaccination was born.

PIONEERING VACCINATION

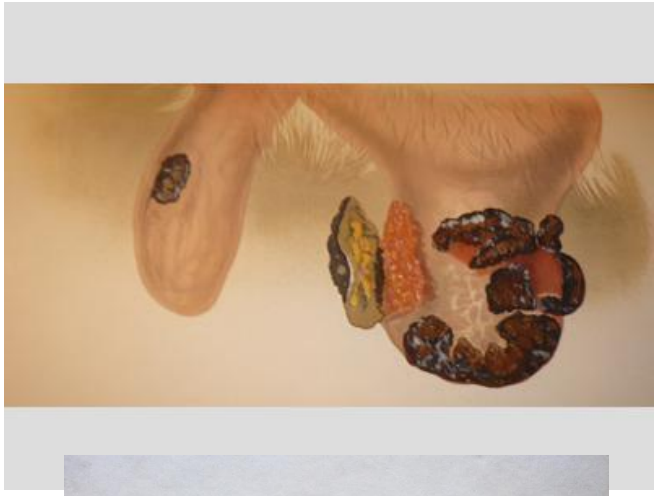
COW POX

(The term “vaccination” coined in1803 by a Plymouth surgeon, Richard Dunning)

Blossom, a “Gloucester” cow from a farm at Breadstone.

Her horns have mysteriously multiplied

Her hide is at St George’s Hospital Medical school



Her udder infected Sarah Nelmes hand

The time was right for the widespread introduction of vaccination. Jenner's crucial contribution was his "evidence based" approach and persistence.

John Fewster, surgeon in Thornbury, paper to Medical Society of London, 1765 "Cow pox and its ability to prevent smallpox"

Benjamin Jesty, farmer in Yetminster Dorset, inoculated family members with cow pox in 1774

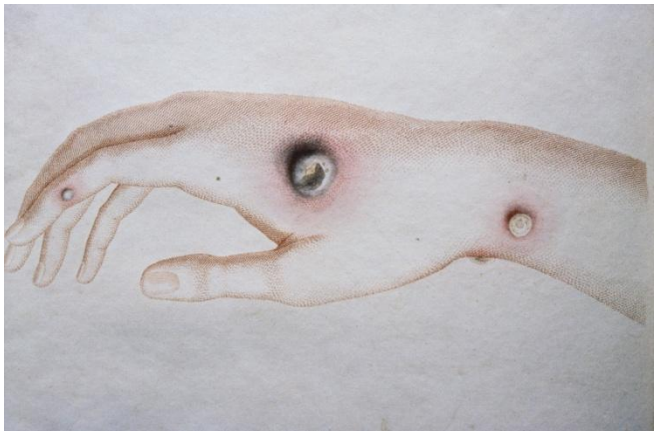
The Scientific Method

- OBJECTIVE; to answer a question of the natural world
- Basis OBSERVATION
- HYPOTHESIS; a proposal or possible solution developed by observation
- EXPERIMENT; tests the hypothesis
- RESULTS must be reproducible
- Jenner's Hypothesis, "that infection with cowpox virus would give immunity to infection with smallpox virus.

ASTUTE OBSERVATION and HYPOTHESIS

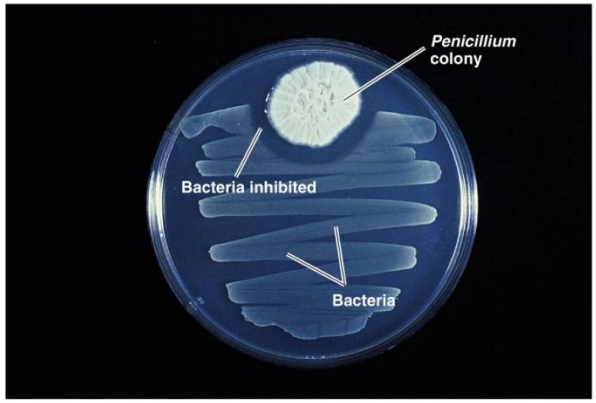
Edward Jenner

Inoculation with Cow Pox will prevent infection with Smallpox.



Alexander Fleming

A product of the mould is killing the bacteria

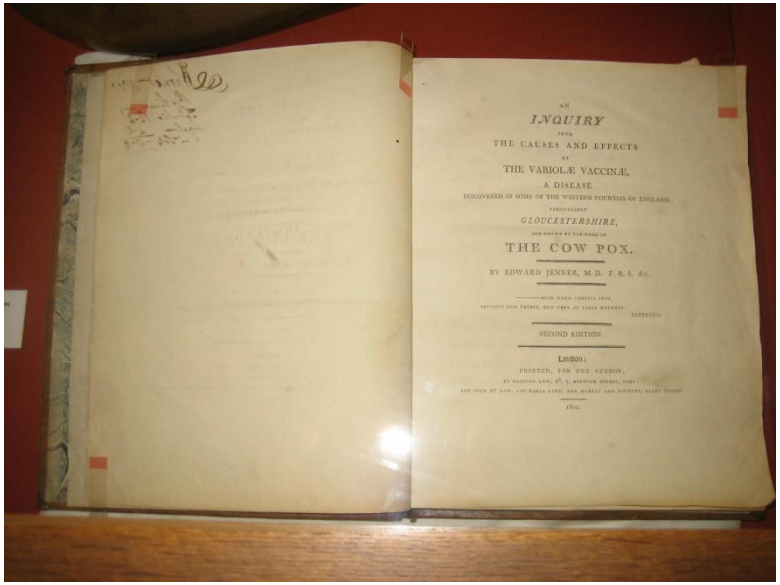


EXPERIMENTATION

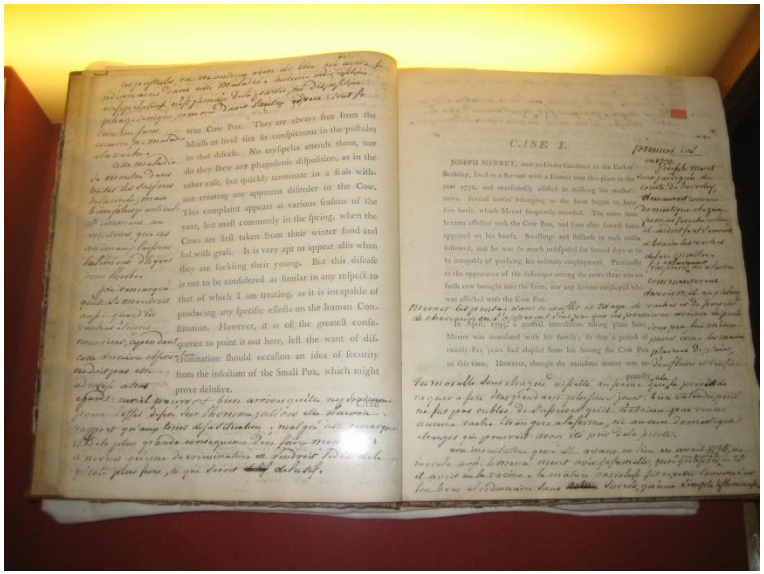
14th May 1796, inoculation of James Phipps with lymph from a cow pox ulcer on the hand of Sarah Nelmes.

1st July James variolated (i.e. infected with smallpox) with no “take”

Publication: “An Inquiry into the Causes and Effects of the Variolae Vaccinae, known by the name of the Cow Pox”. London: Sampson Low, 1798.



AN
INQUIRY
INTO THE
CAUSES AND EFFECTS
OF
THE VARIOLÆ VACCINÆ,
A DISEASE
DISCOVERED IN SOME OF THE WESTERN COUNTIES OF ENGLAND,
PARTICULARLY
GLOUCESTERSHIRE,
AND KNOWN BY THE NAME OF
THE COW POX.
BY EDWARD JENNER, M.D. F.R.S. &c.
SECOND EDITION.
LONDON:
PRINTED, FOR THE AUTHOR,



CASE I.

To C H Parry, M.D. at Bath

In the present age of scientific investigation it is remarkable that a disease of so peculiar nature as the cow-pox, which has appeared in this and some of the neighbouring counties for such a series of years, should so long have escaped particular attention. Finding the prevailing notions on the subject, both among men of our profession and others, extremely vague and indeterminate, and conceiving the facts might appear at once both curious and useful, I have instituted as strict an inquiry into the causes and effects of this singular malady as local circumstances would admit.

The following pages are the result, which from motives of most affectionate regard, are dedicated to you, by

Your sincere friend,

Edward Jenner
Berkeley, Gloucestershire, June 21st, 1978

CONTENT OF THE INQUIRY

23 Case reports recording immunity to smallpox either due to
-natural infection with cow pox

-or inoculation with material from a cow pox pustule

Case 1 Joseph Merret, cow pox 1770, 1795 variolated in Berkeley along with his family, several attempts but Jenner could not make the smallpox material “take”

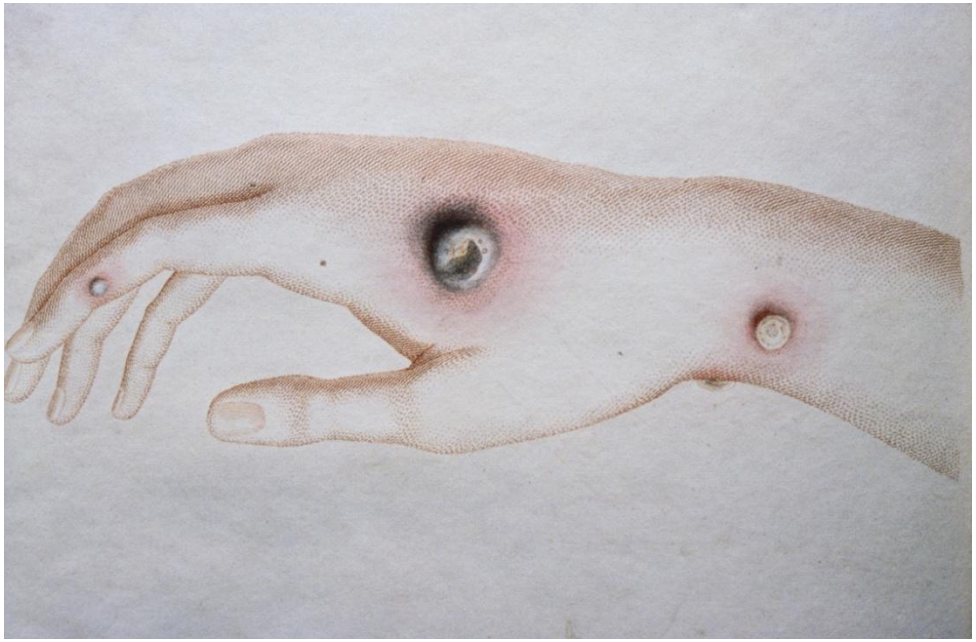
CASE 17.

James Phipps, a healthy boy, about eight years old

CASE 16

Sarah Nelmes, a dairymaid at a farmer’s near this place, was infected with the cow-pox from her master’s cows in May, 1796

CASE 16 – Sarah Nelmes, a dairymaid at a farmer's near this place, was infected with the cow-pox from her master's cows in May, 1796. She received the infection on a part of her hand which had previously in a slight degree injured by a scratch from a thorn, a large pustulous sore and the usual symptoms accompanying the disease were produced in consequence. The pustule was so expressive of the true character of the cow-pox, as it commonly appears upon the hand, that I have given representation to it in the annexed plate.



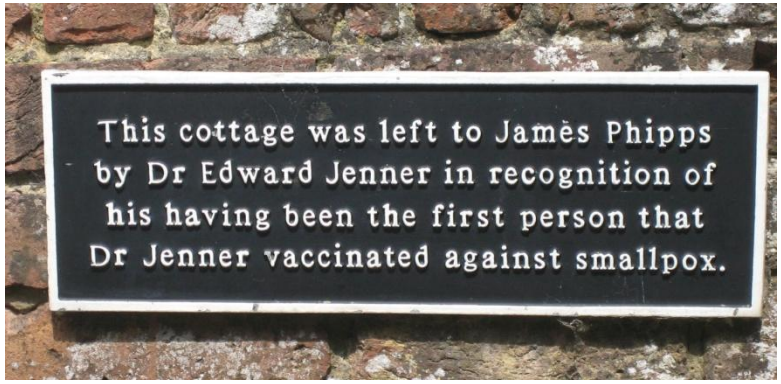
CASE 17.

The more accurately to observe the progress of the infection I selected a healthy boy, about eight years old, for the purpose of the inoculation of the cow-pox. The matter was taken from a sore on the hand of a dairymaid, who was infected by her master's cows, on 14th May, 1796, into the arm of the boy by means of two superficial incisions, barely penetrating the cutis, each about half an inch long.

On the seventh day he complained of uneasiness in the axilla, and on the ninth became a little chilly, lost his appetite and had a slight headache. During the whole of this day he was perceptibly indisposed, and spent the night with some degree of restlessness, but on the following day he was perfectly well. The appearance of the incisions in their progress to a state of maturation were much the same as when produced in a similar manner by variolous matter.

In order to ascertain whether the boy, after feeling so slight an affection of the system from the cow-pox virus, was secure from contagion of the smallpox, he was inoculated on the 1st of July following with various matter immediately taken from a pustule. Several slight punctures and incisions were made on both his arms, and the matter was carefully inserted, but no disease followed. Several months afterwards he was again inoculated with variolous matter, but no sensible effect was produced on the constitution.

James Phipp's Singular Role in Medical History was recognised.



A NOTE ON SMALLPOX (Variola major)

Deserved Jenner's nickname for it "the speckled monster"

"there is no disease which presents a more melancholy scene than the natural smallpox as it frequently occurs.

Where endemic up to 40% of the population caught it, usually in childhood

Extremely ill for around three weeks

Around 1 in 6 died

Many who survived were blinded

Pocks heal with scarring so disfigure

No respect for social rank

Smallpox: no respecter of rank or privilege!

Elizabeth I survived (1562) but the heavy makeup is famous

Her half brother Edward VI died at the age of 16 with the consequence that both Mary (who also survived smallpox but died of influenza) and Elizabeth reigned in succession

Edward Jenner, “Vaccine Clerk to the World” (1798 – 1823)

The Inquiry appeared in two further editions by 1800.

From the second dedicated to George III, Jenner was received by the king on 7th March 1799 and subsequently by the Prince of Wales.

Jenner published four further pamphlets attempting to standardise vaccination by 1806 and was involved in correspondence across the globe until his death

The efficacy of vaccination was quickly demonstrated by others (and it was realised that it did not afford life long protection) and

It as being used across Europe and North America by 1799

Adopted by the Navy in 1800

Reached India by 1802

The Organisation of Vaccination

June 1799, London Vaccine-Pock Institution founded by George Pearson.

January 1802, Royal Jennerian Society:-

Jenner President of Medical Council

Both offered free vaccination.

1809 National Vaccine Establishment:-

Jenner Director

Main source of vaccine lymph to 1861

Jenner was effectively in retirement from 1809. He died at the Chantry on 25th January 1823. He is buried in the church next door to his home.

LEGACY

"It is owing to your discovery that in the future the peoples of the World will learn about this disgusting smallpox disease only from ancient traditions." Thomas Jefferson in a letter to Dr. Edward Jenner, 1806

"the world and all its peoples have won freedom from Smallpox a most devastating disease since earliest time, leaving death, blindness and disfigurement in its wake and which only a decade ago was rampant in Africa, Asia and South America." Resolution of the 33rd World Health Assembly, Geneva, May 8th 1980.

The essence of Edward Jenner's historic discovery

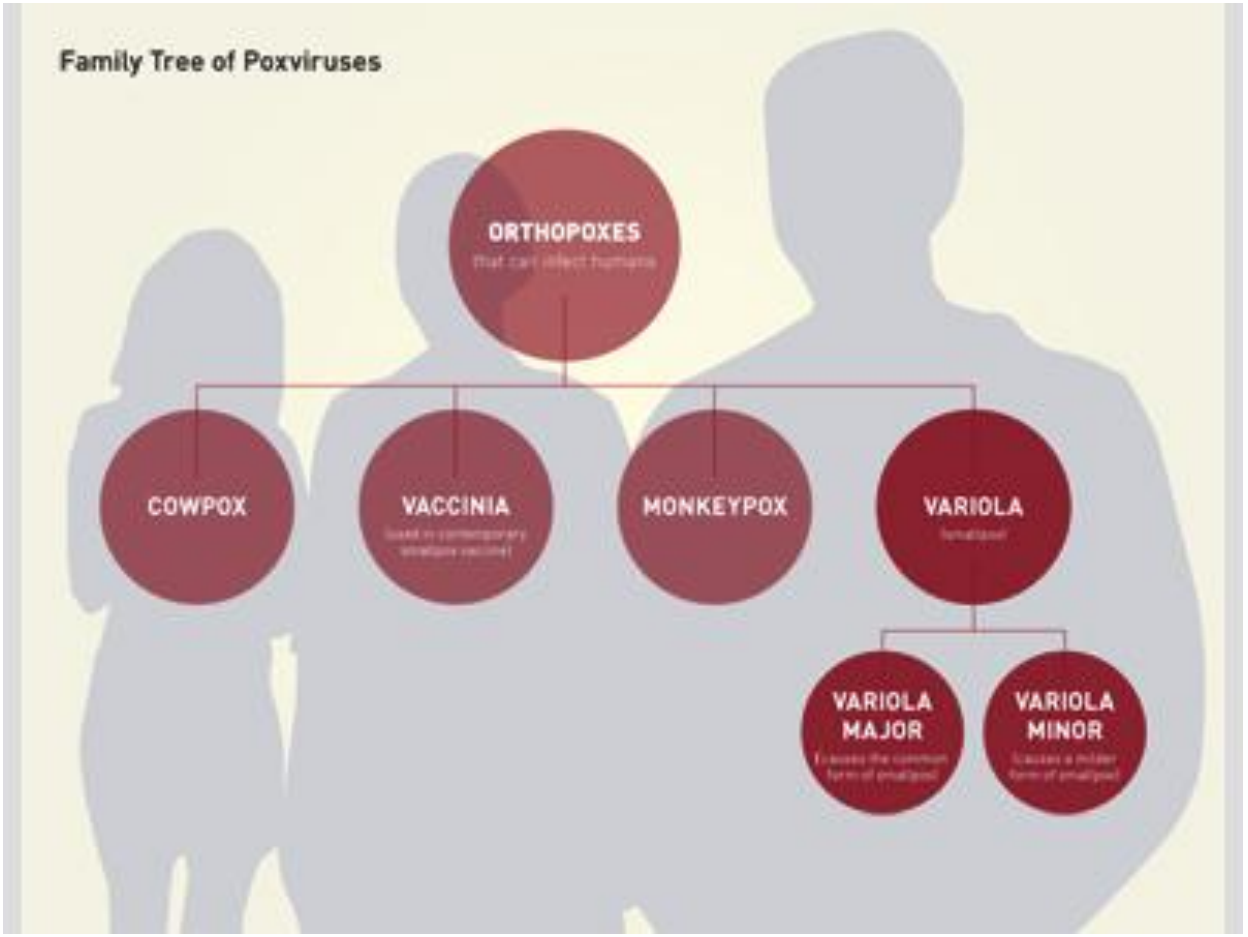
In Edward Jenner's own words

"but what renders the cow-pox virus so extremely singular is that the person who has been thus affected is forever after secure from the infection of the small-pox; neither exposure to the variolous effluvia, nor the insertion of the matter into the skin, producing this distemper".

What had Jenner demonstrated?

- That inoculation with one disease –cow pox- could protect against another.
- Cow pox produced only mild illness and recovery was full (in otherwise healthy individuals)
- Individuals were protected from a life threatening disease through recovery from a mild one.

Intrinsic to the success of Vaccination; the Family Tree of Poxviruses



Louis Pasteur, 1822 - 1895

Along with Robert Koch demonstrated bacteria as a cause of infectious disease.

Vaccine to chicken cholera 1880, attenuated by ageing culture

Similar vaccine to anthrax 1881

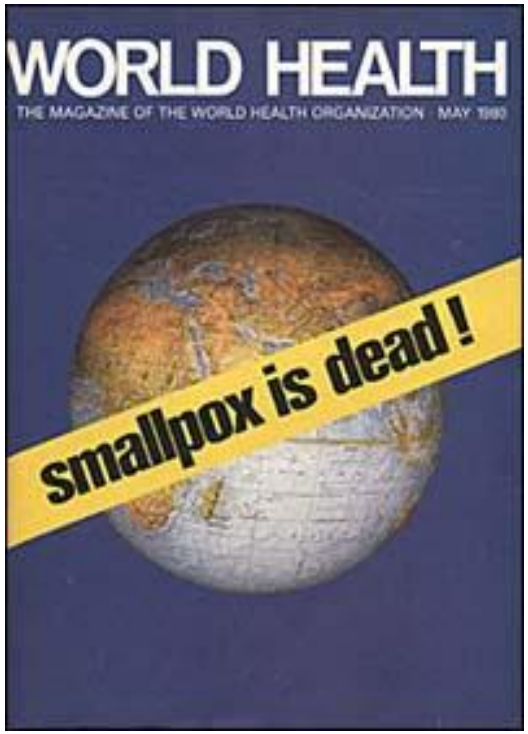
1884 rabies vaccine based on dried infected spinal cord

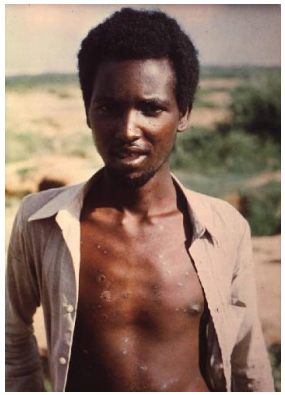
INFECTION COULD BE ATTENUATED

PROCESS WAS DISEASE SPECIFIC

Process called “Vaccination” in honour of Edward Jenner

5th August 1980 WHO Assembly declares the World free from Smallpox





Last case 1977, Ali Maow Maalin, hospital cook in Somalia – Variola minor.

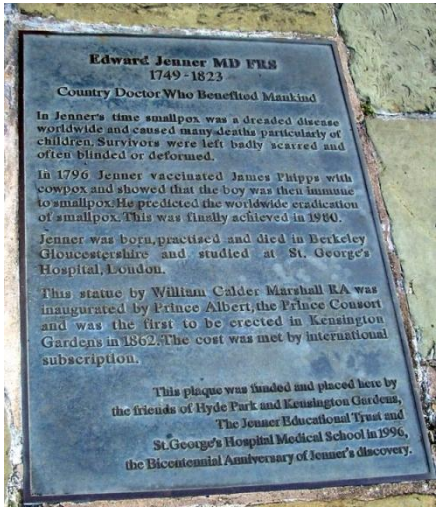
Overall, the number of lives saved is incalculable

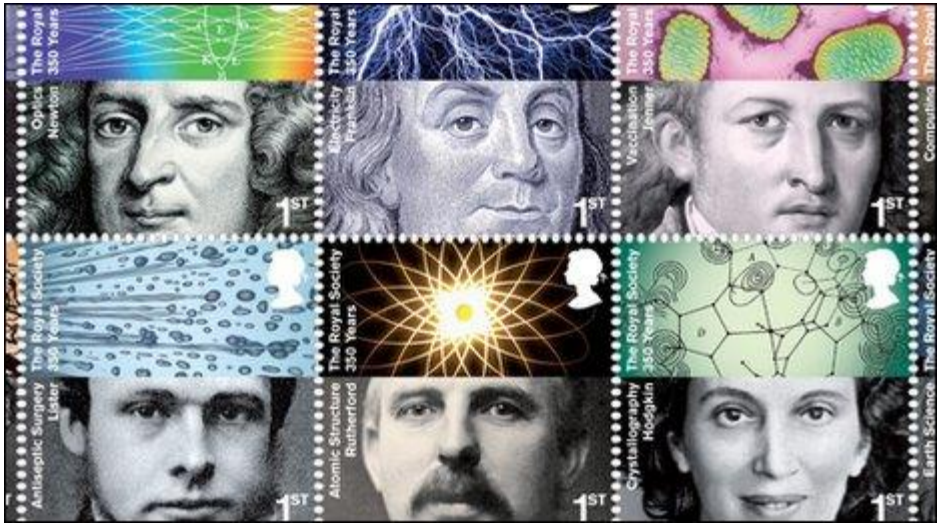
Vaccines in use in human medical practice

Anthrax	Japanese encephalitis	Rubella
Cholera	Measles	Smallpox
Diphtheria	Mumps	Tetanus
Haemophillus influenzae b	Pertussis	Tick borne encephalitis
Hepatitis A	Pneumococcus	Tuberculosis
Hepatitis B	Polio	Typhoid
Human polyoma virus	Rabies	Varicella
Influenza	Rotavirus	Yellow fever

Still many challenges, HIV, Malaria ------

Celebrating Jenner





The Temple of Vaccinia

Located at the bottom of the Chantry garden

Gift of Robert Ferryman,

Designed and constructed at some time between 1796 and 1804.

Named by Jenner

Used by Jenner once a week as a vaccination station for the local poor

From Jenner to Wakefield: The long shadow of the anti-vaccination movement.

Gareth Williams

Dr Jenner's House

Birthplace of Vaccination

Please visit us, a good start, our website;
www.jennermuseum.com

Humoral Immunity, a time line

1714, Emanuele Timoni, Variolation, report to Royal Society

1721, Hans Sloane, Trial of Variolation, reported Royal Society

1798, Jenner's Inquiry

1880, Pasteur, Chicken Cholera trial

1888, Roux and Yersin isolation of Diphtheria Toxin

1890, Von Behring and Kitatsato, antitoxic "antibodies" passive transfer