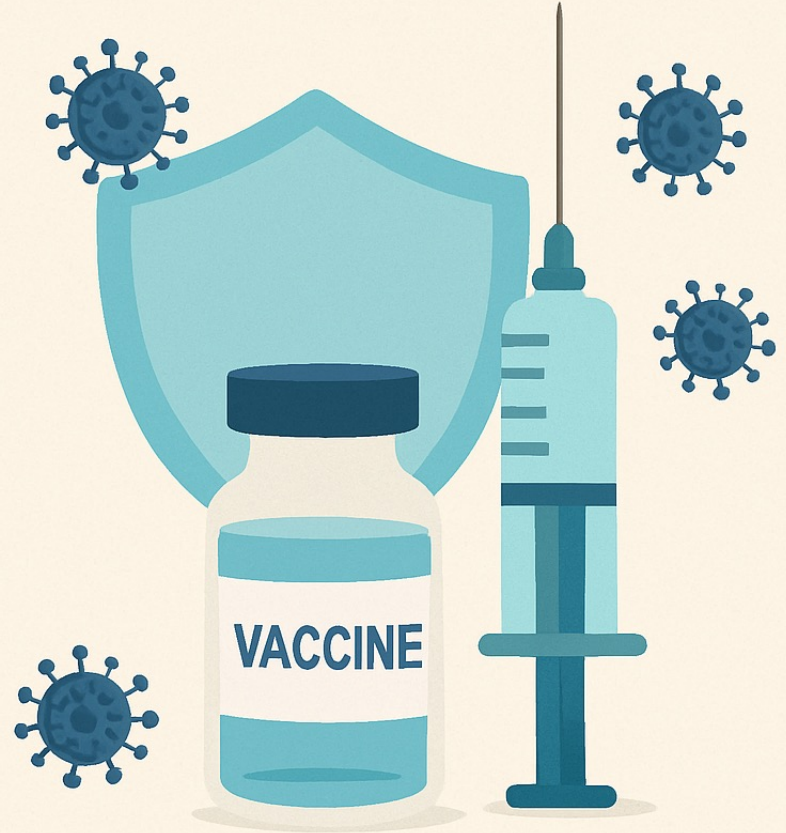


The History, Importance and Recent Advances in Vaccines

The long and winding
road of vaccines and
where we're at now.

Eugenio Gentile



What I'll Cover

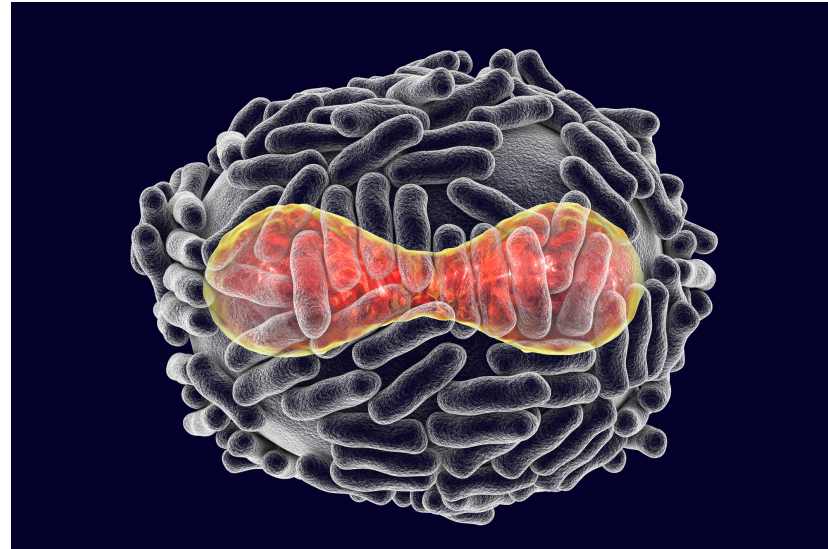
- Historical perspective – Edward Jenner's story
- Current methods and techniques in vaccination
- Recent advances and future outlook

Who was Edward Jenner?

- In 1757 an 8-year-old was inoculated with smallpox and survived.
- He was 1 of thousands just that year.
- He survived and became immune.
- He was...
- EJ became a medical doctor and surgeon. A very good one at that.
- He was a true interdisciplinary scientist (medicine, bird migratory schedules, species classification, hydrogen balloon building)

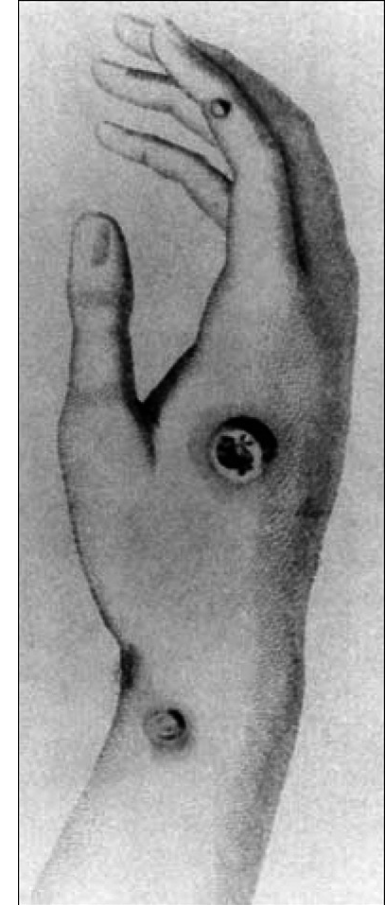


- Has been the scourge of humanity since as long as 10,000 BC.
- Signs of smallpox were found on the face of Ramses V, Egyptian pharaoh who died in 1156 BC.
- The decline of the Roman Empire was concomitant with a smallpox epidemic. 7M deaths.
- Smallpox was also the disease that decimated the Aztecs and Inca populations.



Edward Jenner vs. Smallpox

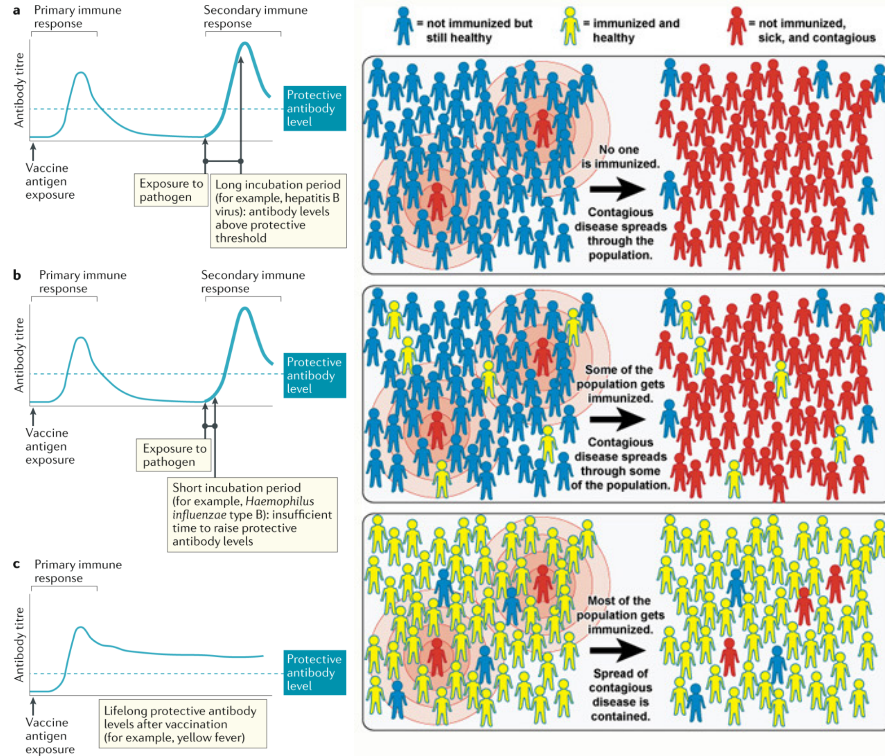
- Jenner was 13 when he learned about the link between cowpox and smallpox.
- He heard dairymaids didn't get smallpox because they had had the cow variant.
- Cowpox however is very mild and not deadly.
- In 1796 using cowpox lesions Jenner inoculated a 8-year-old boy, James Phlipps. James had some symptoms but recovered fully after 10 days.
- Jenner then inoculated the boy with material from a fresh smallpox lesion, no disease developed.
- Vaccination was born, it took a long time and campaigning to ensure it is globally accepted but the results spoke for themselves.



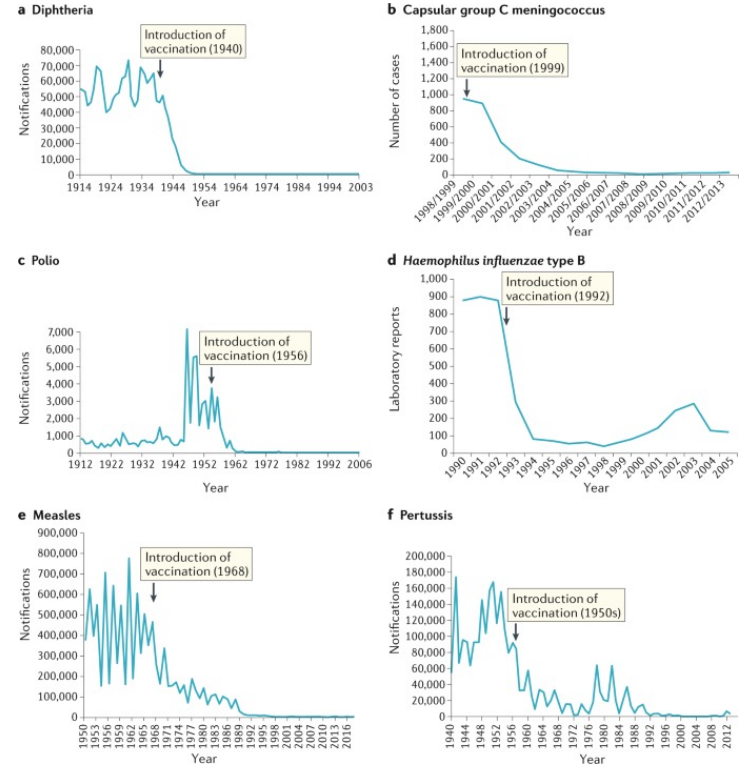
Current State of Vaccines - Importance

Concept:

3 different types of vaccine responses exist














Outcome:



Current State of Vaccines - Types

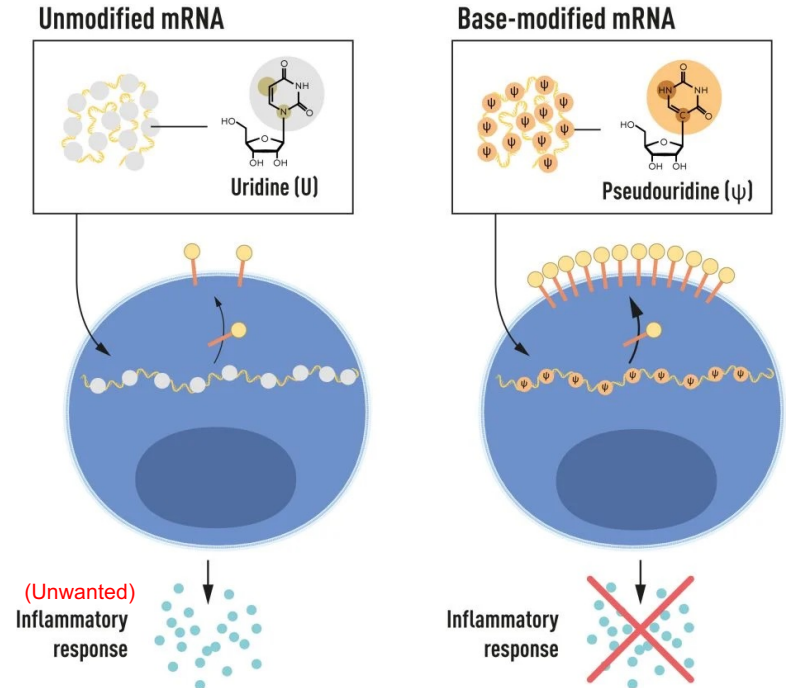
- Each vaccine type has its specific applications.
- For example: live viruses can be problematic when given to immune-compromised patients.
- Non-live vaccines are often combined with an adjuvant.
- Adjuvants are substances that aim to upscale the immune response to a vaccine.

Type of vaccine		Licensed vaccines using this technology	First introduced
Live attenuated (weakened or inactivated)		Measles, mumps, rubella, yellow fever, influenza, oral polio, typhoid, Japanese encephalitis, rotavirus, BCG, varicella zoster	1798 (smallpox)
Killed whole organism		Whole-cell pertussis, polio, influenza, Japanese encephalitis, hepatitis A, rabies	1896 (typhoid)
Toxoid		Diphtheria, tetanus	1923 (diphtheria)
Subunit (purified protein, recombinant protein, polysaccharide, peptide)		Pertussis, influenza, hepatitis B, meningococcal, pneumococcal, typhoid, hepatitis A	1970 (anthrax)
Virus-like particle		Human papillomavirus	1986 (hepatitis B)
Outer membrane vesicle		Group B meningococcal	1987 (group B meningococcal)
Protein-polysaccharide conjugate		Haemophilus influenzae type B, pneumococcal, meningococcal, typhoid	1987 (H. influenzae type b)
Viral vectored		Ebola	2019 (Ebola)
Nucleic acid vaccine		SARS-CoV-2	2020 (SARS-CoV-2)
Bacterial vectored		Experimental	-
Antigen-presenting cell		Experimental	-

Current State of Vaccines

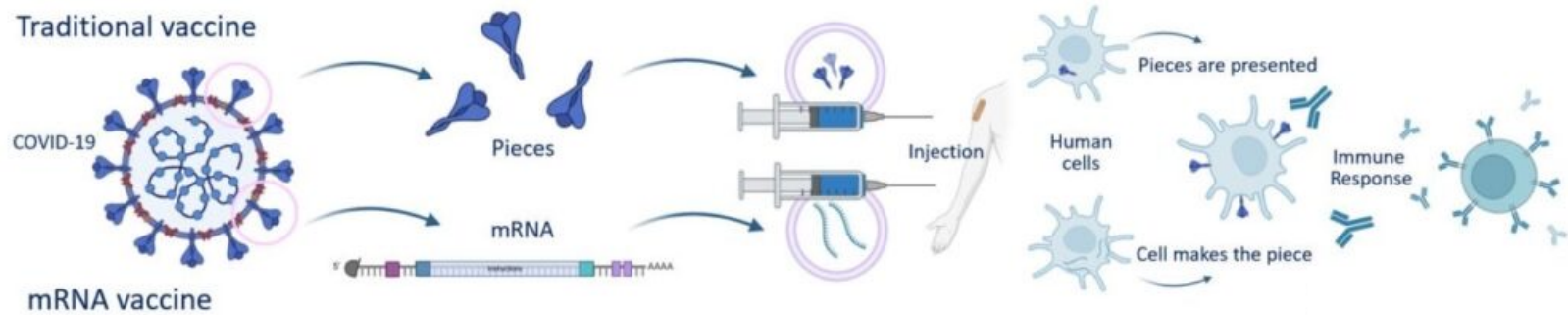
– the Covid mRNA Vaccine

- mRNA vaccines are very useful since their development is easy—much more simple than handling live virus or purifying viral proteins.
- mRNA vaccines are a (relatively) novel technology allowed for by the invention of *in vitro* transcription.
- Katalin Karikó and Drew Weissman made the breakthrough that allows mRNA vaccines to exist.



Current State of Vaccines – the Covid mRNA Vaccine

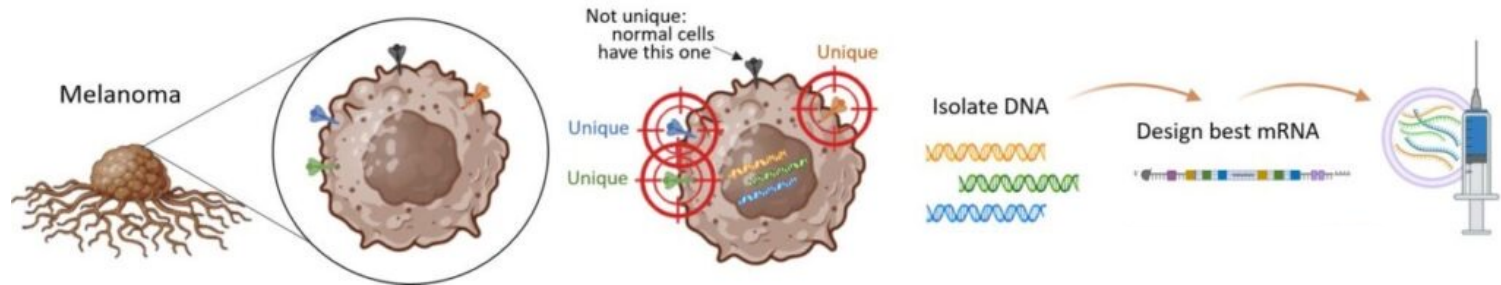
- The Covid vaccine specifically:



Current State of Vaccines

– mRNA Cancer Vaccines

- These vaccines rely on the use of the body's own protein-production machinery to produce tumour-specific antigens.
- If these are recognised by the immune system a response may be mounted against them and by extension the cancer itself.
- There is a current Phase 2B trial ongoing for a melanoma mRNA vaccine.



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- Melanoma mRNA vaccine: <https://www.aimatmelanoma.org/update-on-the-state-of-vaccines-for-melanoma/>