

SARS-CoV-2 Vaccination

Goals

Safety : Avoid side effects

Efficacy: ability to produce the desired results such as

.1 to prevent disease

.2 to prevent infection

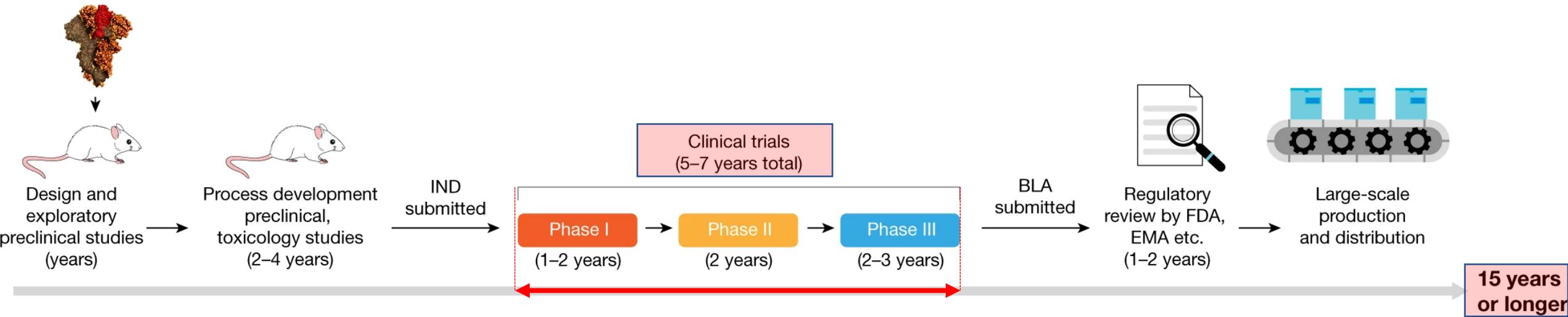
Development timeline: ≤ 1 year

Production and distribution capacity: > 1 Bn units per year

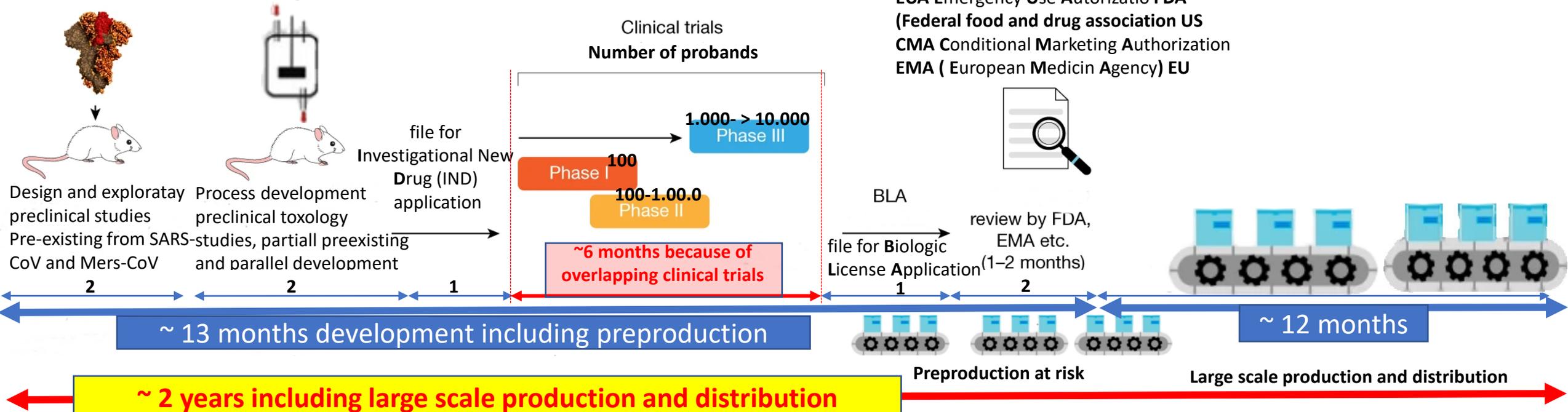
Product price per dose: $\leq \$ 40$

I SARS-CoV-2 Vaccines accelerated development

Traditional development



SARS-CoV-2 vaccine development



II MODERNA – PHIZER – BIONTECH mRNA based SARS-CoV-2 vaccine – how it works

Each dose contains the following ingredients:

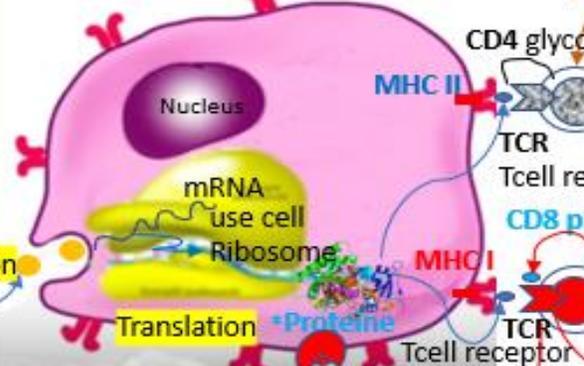
- a total lipid content of 1.93 mg
- polyethylene glycol [PEG] 2000,
- dimyristoyl glycerol [DMG],
- 1,2-distearoyl-sn-glycero-3-phosphocholine [DSPC],
- cholesterol,
- SM-102 (proprietary of Moderna),
- Saltes: 0.31 mg tromethamin, 1.18 mg, tromethamine hydrochloride, 0.043 mg acetic acid, 0.12 mg sodium acetate, and 43.5 mg sucrose.



Lipid nano Particle is a phospholipid bilayer, acting as a vaccine virus transport vehicle into the host cell



Rybosome - mRNA made *Proteins are moved to the cell membrane as MHC II and MHC I (are found in all human body cells)

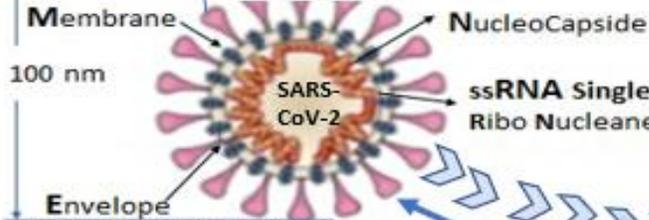
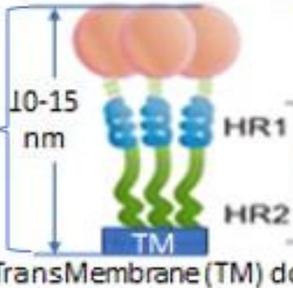


a)...It releases very dangerous molecules causing destruction of this cell if infeted with SARS-Cov-2

S1 N – C terminal domains, RBD Receptor Binding Domain; Mediator for cell membrane fusion
S2 contains internal Fusion Peptides FP; HR1, HR2 Heptad Peptide Repeat Sequence
 TransMembrane (TM) domain anchored in the viral membrane

Back translation procedure from DNA to mRNA

Spike S-protein



The structure of the SARS-CoV-2 trimeric S protein has been determined by TM cryo-electro microscopy at atomic level (resolution 1,5Å = 0,15 nm)

b) also stimulates Th cells

Th release cytokines lik:

MHC Maor Histocompatibility Complex (MCH II only found in APC's and those are

Interleucin 2
 Interleucin 4
 Interleucin 5

- B-cells
- macrophages
- Dendritic cells)

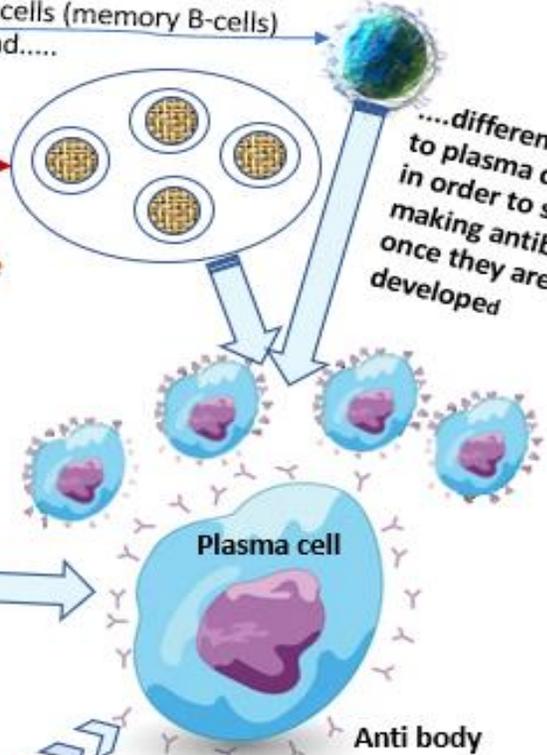
a) cause proliferation of B-cells (memory B-cells) and.....

b)... causing them to proliferate and making lot of memory T- and effector T-cells.. helping to generate imune rspnose

When CD8 interacts with MHC I....a) and b)...

b)...It releases also other cytokines that amplify this imune respons

....differentiate to plasma cells in order to start making antibodies once they are developed

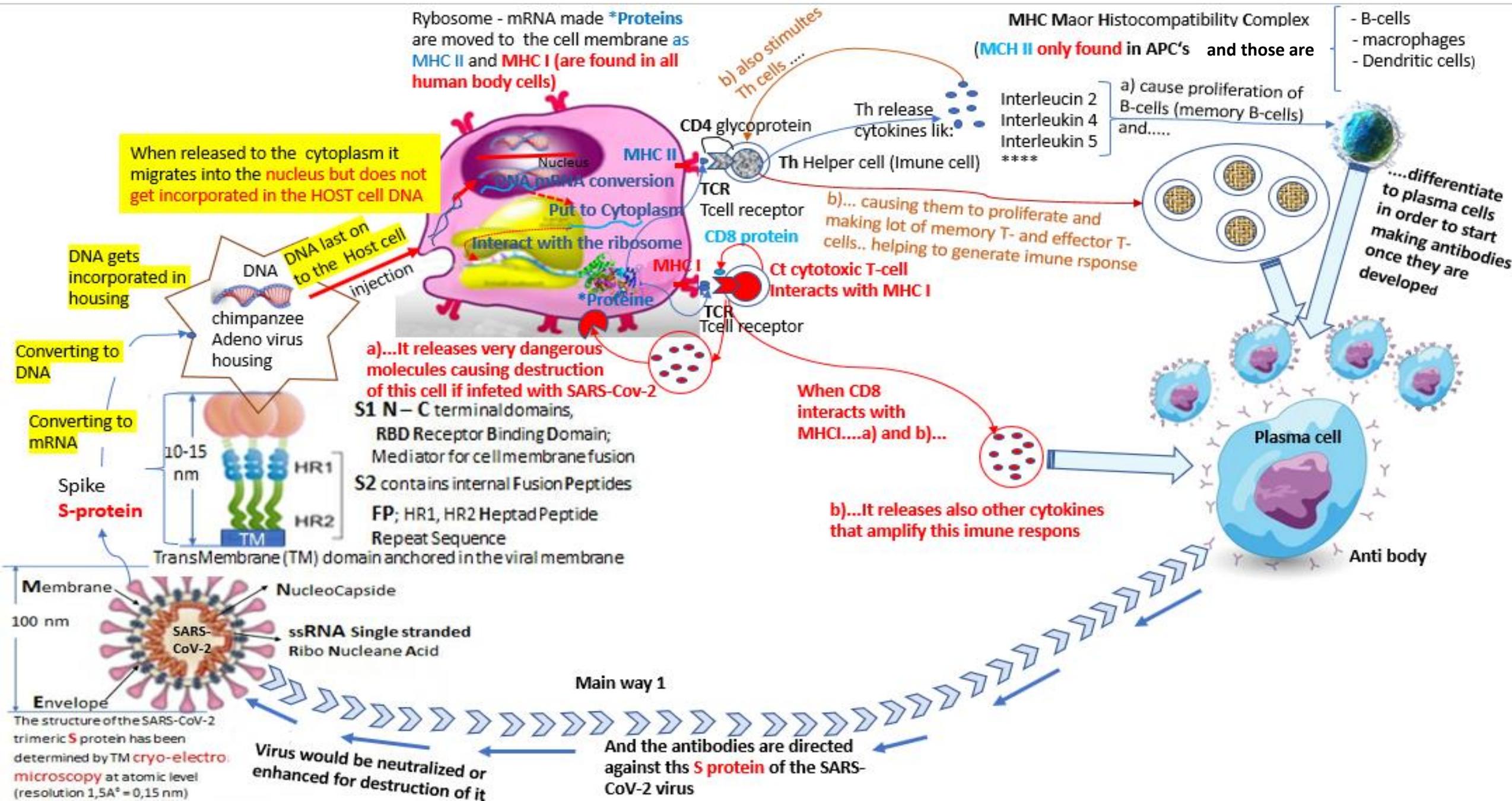


Main way 1

Virus would be neutralized or enhanced for destruction of it

And the antibodies are directed against ths S protein of the SARS-CoV-2 virus

III ASTRZENICA – OXFORD Adeno virus DNA based SARS-CoV-2 vaccine – how it works



IV SARS-CoV-2 Suppliers key data

I MODERNA

Technology: mRNA

Dosage and checking: 1st dose day 0; 2nd dose day 28; 14 days later symptom check

Methods: 30,000 participants split in two groups then it was checked how many people tested positive

placebo group: received a fake vaccine like a saline → 185 people were tested positive → 30 developed severe symptoms

vaccine group: received the real vaccine..... → 11 people were tested positive → 0 developed severe symptoms

Efficacy Results: against the disease itself (infected or not) → $185 - 11 = 174$ no disease / $185 = 0,941 = 94,1\%$ vaccine efficacy

against the severeness of the disease → sample: 100% → severeness 0% → severeness efficacy = 100%

Storage temperature: guaranteed viability when stored at $-3^{\circ}\text{F} = -20^{\circ}\text{C}$ ($-4^{\circ}\text{F} - 32$) $\times 5/9 = -20^{\circ}\text{C}$)

Vaccine availability: by end of 2020: 20 million; by end of 2021: 1,5 billion

Price: \$25-\$37 per dose

II PFIZER – BIONTECH

Technology: mRNA

Dosage and checking: 1st dose day 0; 2nd dose day 21; 7 days later symptom check then get a PCR (Polymerase Chain Reaction) test

Methods: 43,000 participants split in two groups then it was checked how many people tested positive

placebo group: received a fake vaccine like a saline → 162 people were tested positive → 30 developed severe symptoms

vaccine group: received the real vaccine..... → 8 people were tested positive → 1 developed severe symptoms

Efficacy Results: against the disease itself (infected or not) $162 - 8 = 154$ no disease / $162 = 0,951 = 95,1\%$ vaccine efficacy

against the severeness of the disease → sample: 100% → severeness $1/8 = 12,5\%$ $100\% - 12,5\%$ severeness efficacy = 87,5%

Storage temperature: guaranteed viability when stored at $-94^{\circ}\text{F} = -70^{\circ}\text{C}$ ($-94^{\circ}\text{F} - 32$) $\times 5/9 = -70^{\circ}\text{C}$)

Vaccine availability: by end of 2020: 50 million; by end of 2021: 1,3 bn

Price: \$19.50 per dose for first 100 million doses

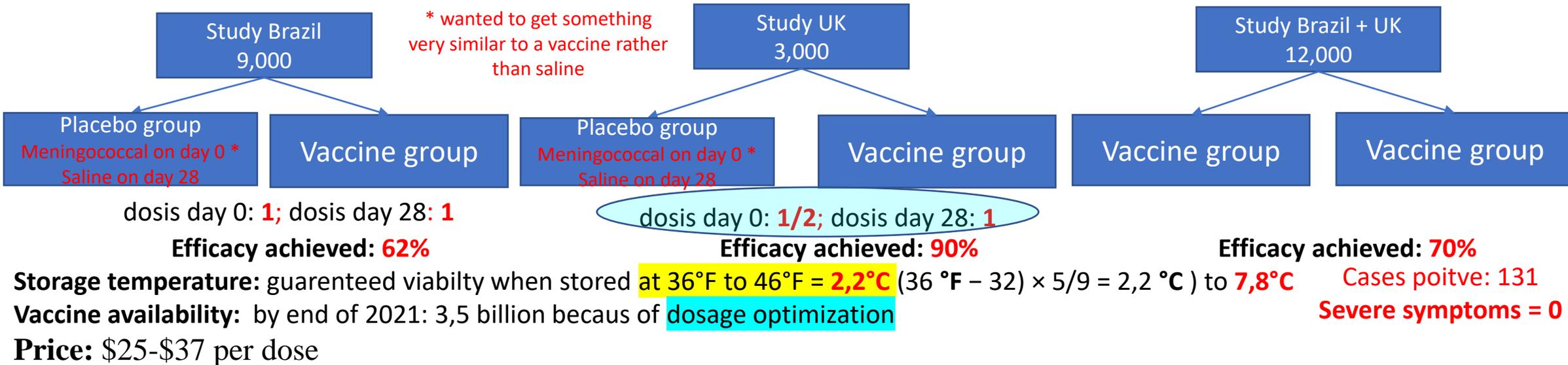
IV SARS-CoV-2 Suppliers key data

III ASTRAZENICA – OXFORD

Technology: Adeno virus - DNA

Dosage and checking: 1st dose day 0; 2nd dose day 28; 14 days later symptome check, PCR (Polymerase Chain Reaction) testing was done

Methods: 12,000 participants split in two groups then it was checked how many people tested positive



IV SPUTNIK

Technology: Adeno virus - DNA

Dosage and checking:

Methods:

Efficacy: 91.4%

Vaccine availability:

Price: \$10 per dose