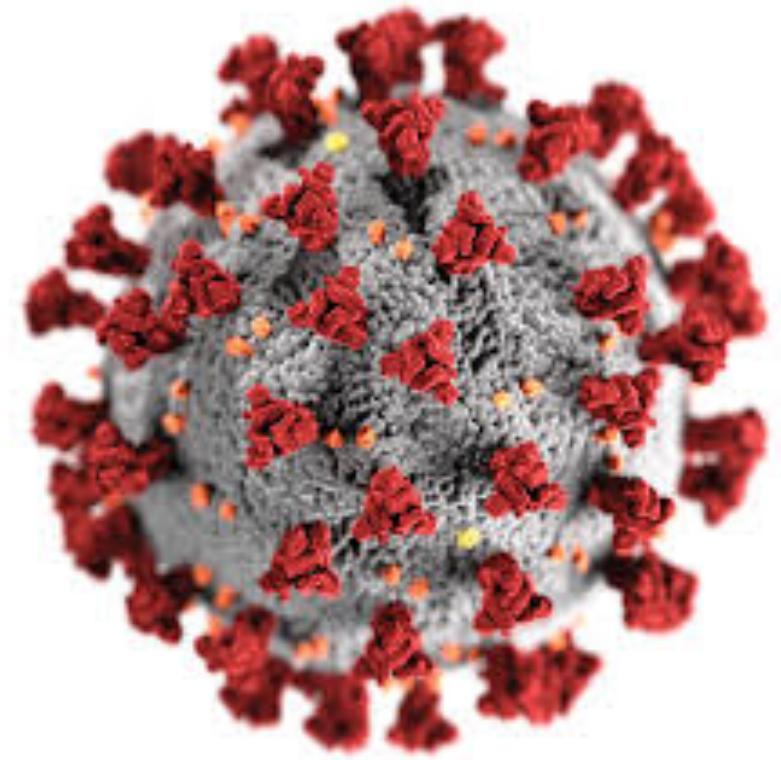
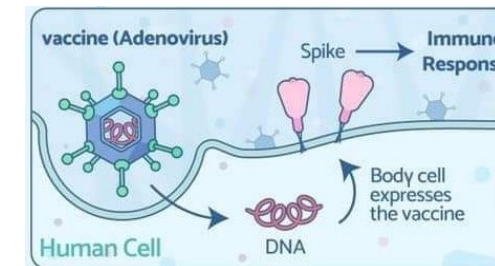
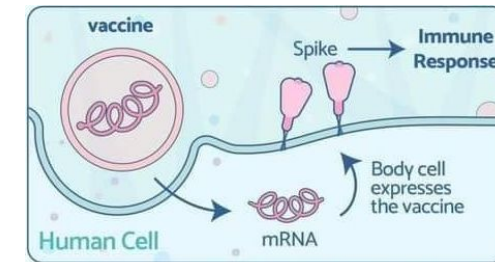
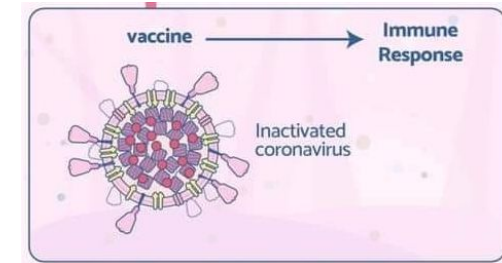


# Brief excursus on Virus, COVID-19 and Vaccines



# Coronavirus - vaccines

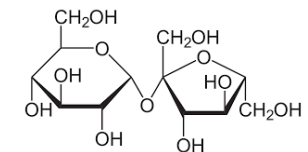
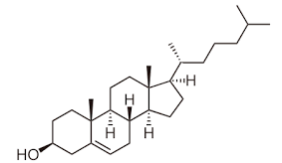
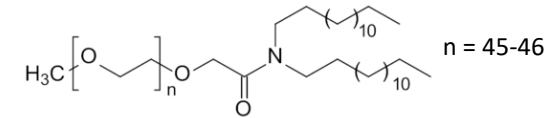
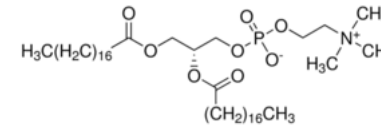
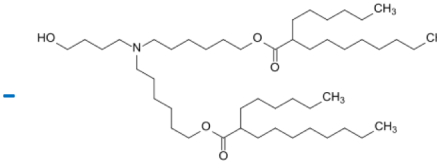
- A **vaccine** is a biological preparation that provides **active acquired immunity** (**antibodies**) to a particular **exogenous antigen** (**viral protein**) via recognition and attack
- *Traditional vaccines*: based on the inoculation of de-activated infectious agents (Sinopharm e Sinovac - China)
- *Innovative vaccines – type 1*: human cells are transfected with liposomes (lipid vesicles) loaded with mRNA that codifies for the viral spike protein (Moderna and Pfizer-BioNTech)
  - Our ribosomes translates this mRNA into the viral protein
  - Our immune recognize the viral protein as foreign and produce the antibody for neutralization
- *Innovative vaccines – type 2*: the gene (DNA) for the coronavirus spike protein is loaded into another virus (**Adenovirus**) that has can enter cell but it itself is not able to replicate (AstraZeneca and Sputnik)
  - Adenoviruses are common viruses that typically cause colds or flu-like symptoms
  - The Oxford-AstraZeneca team used a modified version of a chimpanzee adenovirus, known as ChAdOx1
  - Russian researchers used the same technology but based on a human adenovirus



# What is inside Pfizer-BioNTech and Moderna vaccines?

Besides the purified viral mRNA codifying for the viral spike protein, the Pfizer/Moderna vaccines are made of:

- ALC-0315 = (4-hydroxybutyl) azanediyl)bis (hexane-6,1-diyl)bis(2-hexyldecanoate)
- ALC-0159 = 2-[(polyethylene glycol)-2000]-N,N-ditetradecylacetamide
- 1,2-Distearoyl-sn-glycero-3-phosphocholine
- Cholesterol
- Potassium chloride (KCl)
- Potassium dihydrogen phosphate ( $\text{KH}_2\text{PO}_4$ )
- Sodium chloride (NaCl)
- Disodium hydrogen phosphate, dihydrate ( $\text{Na}_2\text{HPO}_4 \cdot 2 \text{H}_2\text{O}$ )
- Sucrose
- sterile water for injection (WFI)

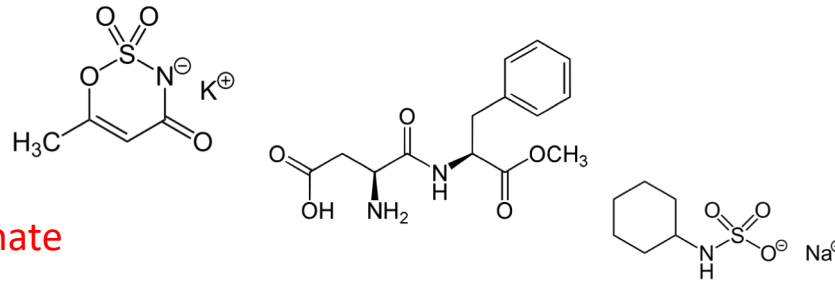


# Pfizer-BioNTech and Moderna vaccines vs. Coke Zero

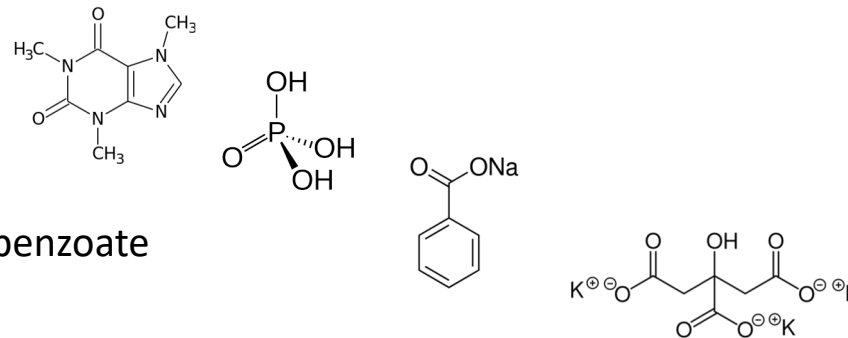
Coke Zero contains:

- Water
- Carbon dioxide
- E150d (caramel color, a brownish materials resulting from the carefully controlled heat treatment of food grade carbohydrates in the presence of small amounts of food grade acids, alkalis or salts)

- **Acesulfame K**
- **Aspartame**
- **Sodium cyclamate**



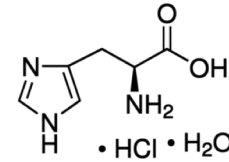
- Caffeine
- Phosphoric acid
- Potassium/sodium benzoate
- Potassium citrate
- **Natural flavors (???)**



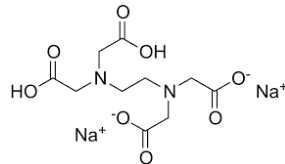
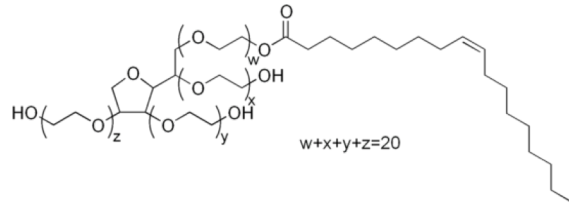
# What is inside AstraZeneca vaccine?

Besides the purified viral DNA codifying for the viral spike protein within the associated Adenovirus, the AstraZeneca vaccines are made of:

- L-histidine and L-histidine hydrochloride monohydrate
- Magnesium chloride hexahydrate ( $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ )



- Polysorbate 80
- Ethanol (EtOH)
- Sucrose
- Sodium chloride
- Edetate disodium



**AZ vaccine does not contain any preservative or ingredients of animal origin**

# SARS-CoV-2/host cell interaction

The SARS-CoV-2 attacks human cells via interaction between the capsid spike proteins (S) and their human receptors, the transmembrane angiotensin-converting enzyme 2 (ACE2)

