



Serology Testing for SARS-CoV-2

AN OVERVIEW OF FUNCTIONALITY AND UTILITY

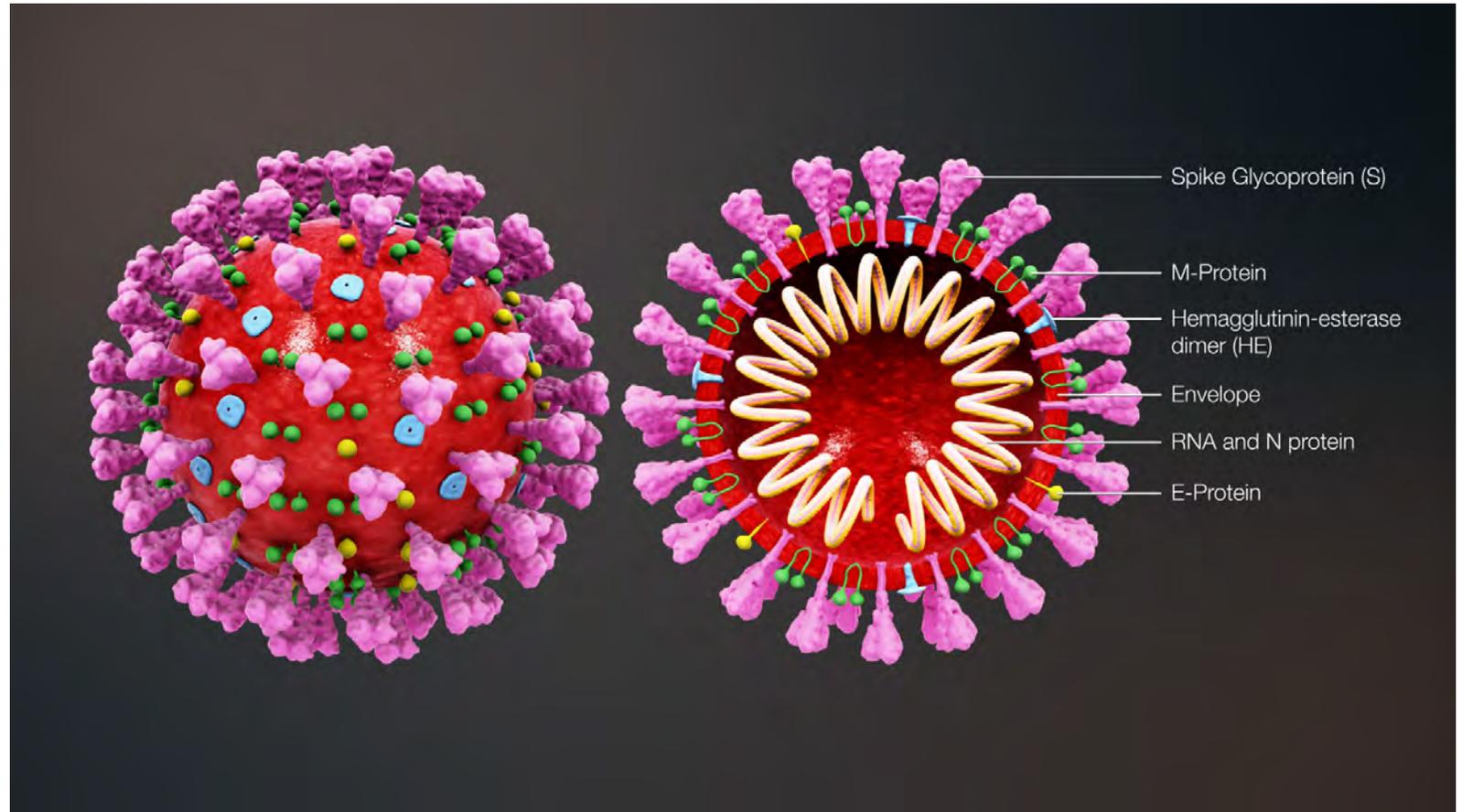
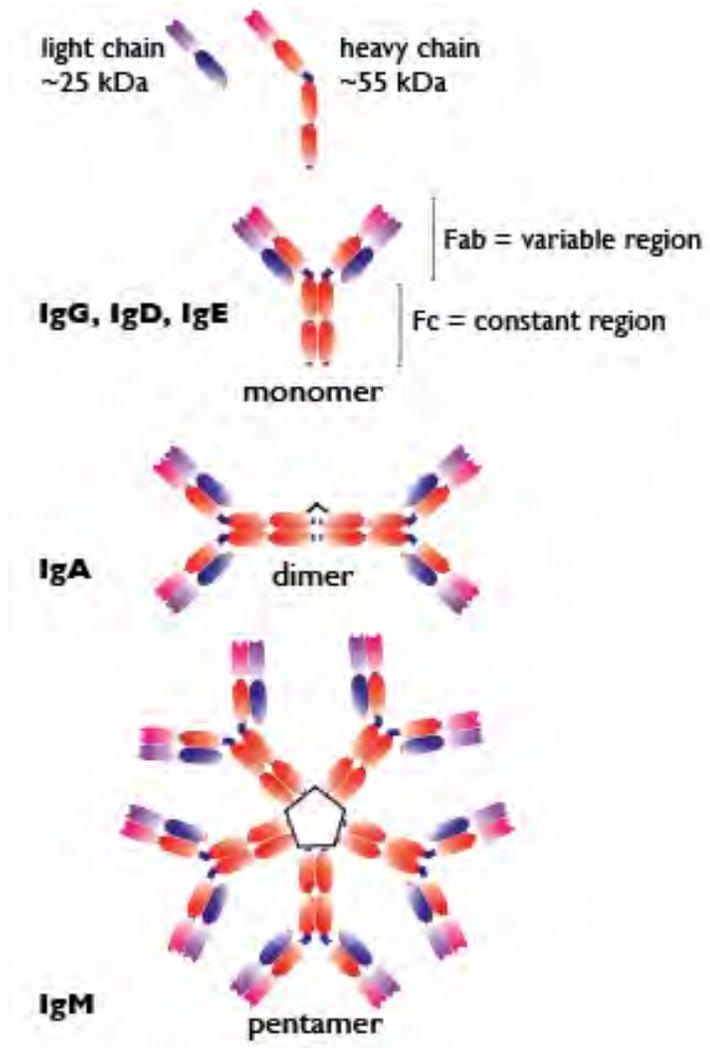
Types of testing for SARS-CoV-2

DIAGNOSTIC

- Molecular test that detects the genetic material of the virus
 - Targets specific gene/s for SARS-CoV-2 virus
- Utilizes polymerase chain reaction (PCR)
- Samples collected nasal or throat swabs or from saliva
- Considered very accurate overall
 - Variance in methodologies (rapid antigen vs PCR)
- Most effective with symptomatic patients due to increased viral load

SEROLOGY

- Immunoassays that test for the measurable and specific immune response to SARS-CoV-2 infection
 - Targets antibodies
 - 5 types of human antibodies: IgG, IgM, IgA, IgD, IgE
- Testing run on serum samples
- Accuracy varied when tests first came to market
- Results are useful to determine past exposure, vaccine studies, epidemiological surveillance

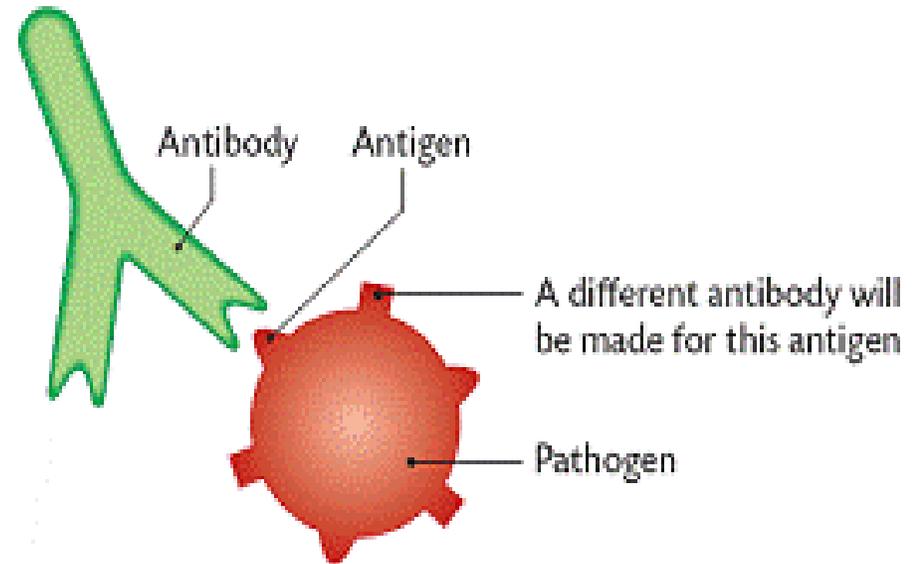


Source: <https://www.scientificanimations.com/wp-content/uploads/2020/01/3D-medical-animation-coronavirus-structure.jpg>

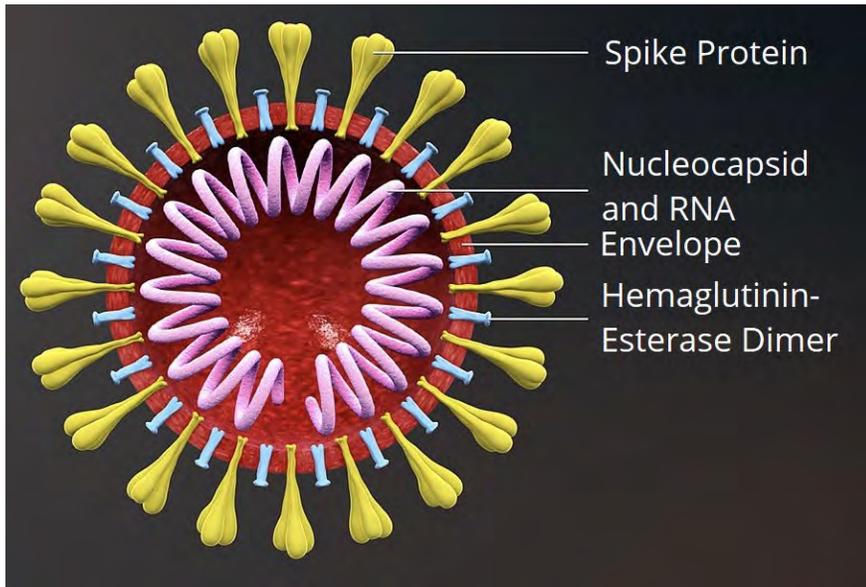
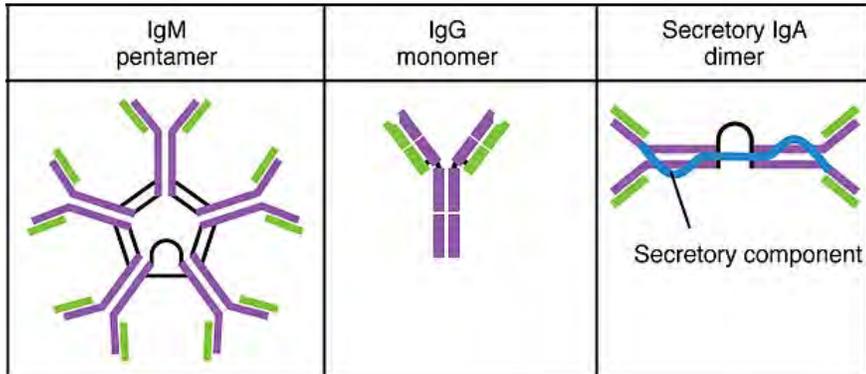
Source: https://www.invivogen.com/sites/default/files/invivogen/resources/img-reviews/invivogen-antibody_isotypes.png

Overview of serology testing

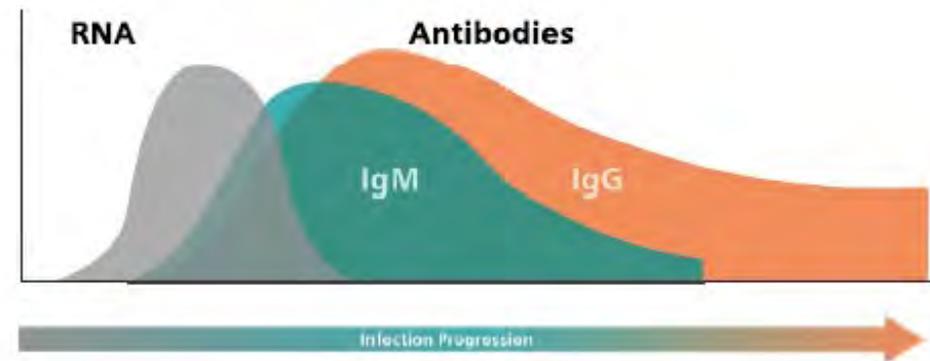
- Basic function of the immune system is to identify and protect the body from pathogens (foreign invaders)
- Two major branches of the immune system, innate and adaptive immunity
 - Innate immune system – **non specific**, guards against all infections
 - Adaptive immune system – acquired immunity to **specific** pathogen, focus of **serology** testing
- Immune cells identify pathogens by unique structures on their surface called **antigens**
- Immune system produces specific proteins called **antibodies**, which either “tag” the pathogen for attack by immune cells or neutralize the pathogen directly
- Serology tests measure **antigen-antibody complex**
 - Used to identify unknown antigen (direct serology) or antibodies specific to a pathogen



COVID-19 Serology Testing



- Two major antigen targets for SARS-CoV-2 virus
 - Spike glycoprotein (S)
 - Nucleocapsid phosphoprotein (N)
- Four major antibody targets for SARS-CoV-2 virus
 - IgM – first antibody to develop during an infection
 - IgG – develops after IgM, but lasts longer in the body
 - IgA – detected in mucous secretions, but significance unclear in COVID-19
 - Total antibody

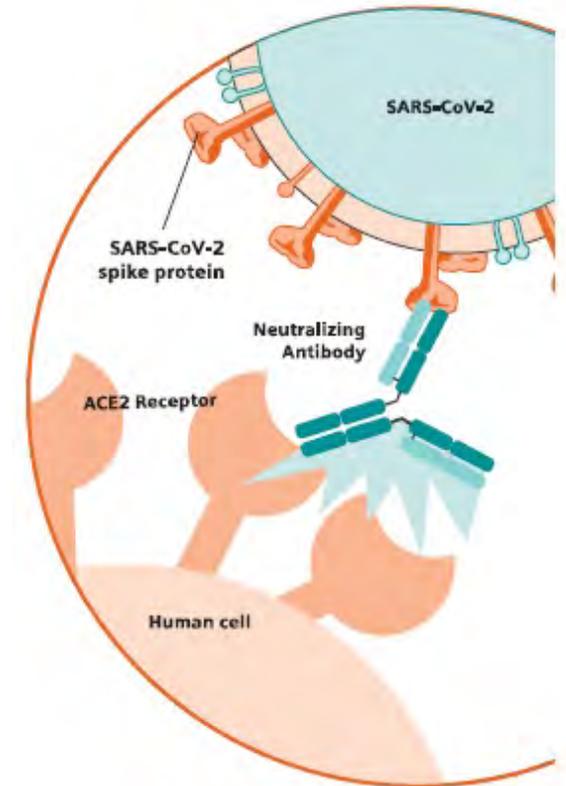


Controversy and revised FDA regulations

- In mid March the FDA posted a policy that allowed for serology testing to be marketed without receiving Emergency Use Authorization (EUA)
 - Done to necessitate “flexibility” in bringing antibody testing to the market
- After widespread reports of unreliable testing and false/misleading claims by the certain manufactures the FDA revised it’s regulations on May 4th
 - New regulations required all commercial manufactures to file for an EUA, including tests already being used
 - Submit validations studies that included cross-reactivity to other major viral pathogens
 - Provide specific information and instructions for use including the EUA status, interpretations guidelines, and possible cross reactivity with other coronaviruses

Siemens SARS-CoV-2 Total Assay

- Immunoassay intended for the qualitative detections of **total antibodies (IgG and IgM)** to SARS-CoV-2 infection in **serum** samples using the **Atellica** analyzer
- Antigen target is **spike glycoprotein (S)**
 - Some studies suggest antibodies to spike could neutralize the virus by interfering with the virus's ability to bind human cells
 - Possible future use of antibody testing
- Sensitivity: **100%** clinical performance in identifying detectable levels of SARS-CoV-2 antibodies (≥ 14 days post COVID-positive PCR test).
- Specificity: **99.8%**
- In house validations showed 100% correlation with samples tested at another lab



General Uses and Limitations of all SARS-CoV-2 serology testing

COVID-19 SEROLOGY TESTING SHOULD BE USED

- Identification of individuals who have been previously exposed to SARS-CoV-2
- Very limited uses to support diagnosis of COVID-19 when the patient presents late in the disease process
- Epidemiological or seroprevalence studies
- Identification of potential convalescent plasma donors using quantitative testing (research or hospital use only)
- Evaluate immune response for vaccine studies

COVID-19 SEROLOGY TESTING **SHOULD NOT** BE USED

- Diagnosis or exclusion of a SARS-CoV-2 infection
- Determining if a patient has immunity
 - May be a future use of serology testing
- Guide PPE, social distancing, or return to work policies

