Difference between antibody and antigen pdf

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The last update on July 8, 2020 is Sagar AryalDifferences between antigen and antibodyAntibodies produced by the immune system in response to antigens (the material is perceived as foreign). The antibody response to a particular antigen is extremely specific and often involves a physical connection between the two molecules. This association is governed by biochemical and molecular forces. The reaction between antigens (Ags) and antibodies (Abs) involves additional binding sites on Ab and on Ag molecules. Some differences between antigen and antibodies are these: Some differences: 1Molecule TypeUsually, proteins can also be polysaccharides, lipids or nucleic acids. Proteins2DefinitionThese are substances that provoke an immune response. It is a glycoprotein that is secreted by immune cells (plasma cells) in response to a non-agent substance (antigen).3 Effectcaus disease or allergic reactions. Protect the system by licking the antigenic material.4OriginWithin body or externally. Inside the body.5PartsThe high variable with different structural conformations and usually consists of different epitopes.Composed of three main parts:-Two light circuits-Two heavy chains-Four polypeptides6Reavalent investigators in all cell types; mainly in viruses, bacteria and fungi. It is present only in certain cell types.7SynonymsImmunogensImmunoglobulins8Specific binding siteEpitopeParatope9ComplexityMedium; exists because of random mutations in the cell gene. Very tall; A complex chemical that binds to a very specific antigen.10SourceUsually from a foreign source (viruses, and bacterial and fungal toxins). Naturally produced by the body (B lymphocytes or B-cells).11Kinds There are three main types of antigens (exogenous, endogenous and autoantigens)There are five main types of antibodies (IgG, IgM, IgA, IgE and IgD).12ExamplesExogenous antigens: bacteria, viruses, fungi, etc. Endogenous antigens: blood group antigens, HLA (antigens of histocompatibility of Lekeocytes) etc. Autoantigens: nucleoproteins, nuclein acids, etc. Differences between antigen and antibodies Any substance capable of triggering a specific immune response and react with the products of this responseAntibodispecific serum proteins produced in response to exposure to a foreign agent (i.e. diseases that cause agents, vaccines) The paramedic conducts a test COVID-19 in Friedley, Minnesota. Aaron Lavinsky/Star Tribune via Getty Images With new information released all the time, it can be difficult to track how doctors are testing for coronavirus. While identifying and treating infected patients is critical, some tests add to our deeper understanding of the size, impact and direction of the pandemic. Here's a breakdown of the differences between diagnostic, antibody, and antigen Diagnostic testing: frontline defenseA defenseA or polymerase chain reaction (PCR) test is used for those suspected of infection with coronavirus, usually obtained through a nasal or throat tampon. Due to the limited supply in the US, although usually only people with severe symptoms are checked. The results of diagnostic tests can usually take at least one or two days, although faster versions are in development. Genaro Molina / Los Angeles Times via Getty Images This test looks for the presence of viral genetic material indicating a person has a current infection and is probably infectious, epidemiologist Ista Ghosh, medical director of Grand Rounds, told Insider. Pathogens can be seen directly in samples from a patient, often using a microscope, or grown in a laboratory for days to several weeks, Steven Berger, founder of the Global Network of Infectious Diseases and Epidemiology, said. Tests of nucleic acid, which are more sensitive to early detection, have been widely used during the current pandemic. Results can usually take at least one to two days, although faster versions are in development. Although they can detect the virus in those who are imptomatic, diagnostic tests present a false negative in about 30% of cases. Thus, patients are tested twice before being confirmed as non-infectious. Antibody testing: Are you immune? People who may have been infected and recovered are tested for antibodies, the proteins the body creates to help fight a particular infection. Coronavirus antibodies are usually not detected until 14 days after the onset of symptoms. In most viral infections, specific antibodies can be detected within months up to several years after infection - and in many cases in old age, Berger says. A man undergoes a finger prick as part of a rapid serological test on COVID on May 6, 2020. TISIAN FABI/AFP via Getty Images After someone confirmed that the antibodies they are able to donate plasma to patients who are currently infected. But antibody testing is also used to get a better idea of the overall impact of the pandemic. Widespread antibody testing can help track where the virus has spread and its mortality rate, and determine whether it is appropriate to facilitate blockage. Unlike tampon for diagnosis, antibody tests require a blood sample, usually through a finger prick. The blood is then studied into two types of antibodies: IgM antibodies, which develop at an early stage during infection, and IgG antibodies, which are more likely to be detected after recovery and are the best indicator of at least partial immunity. The igM test results can be accessed in as little as 15 minutes as IgG tests are sent to the lab, and it can take up to a week to get results. But some clinics will only perform IgG blood tests because they are more reliable. Does the presence of antibodies to coronavirus coronavirus Immune? It's not clear. Theoretically, the presence of these antibodies indicates a low probability of human infection, Ghosh said. But we don't yet know the degree of immunity and how long this immunity lasts. It is also not clear if the antibody tests a cross-reaction with antibodies of other, more common coronaviruses or if the immunity provided by antibodies from one strain of coronavirus extends to another strain. And a negative result doesn't necessarily mean you didn't have COVID-19. This can mean that you have an active infection and just haven't created any antibodies. Even without symptoms, you will still be at risk of spreading the virus. The FDA has issued emergency use permits to increase antibody testing for. There are currently more than 120 different tests on the market, but not all of them are effective. Early results indicate that many of the serological tests on the market today are inaccurate and unreliable, and may have high levels of false positives, Ghosh said. Therefore, employers will need to thoroughly check the quality of this serological test before choosing a supplier, and will need to check employees several times to reduce the rate of false readings. On Monday, the FDA announced that companies have 10 days to prove the accuracy of their antibody tests or remove risks from the market. Antigen testing: The way to resume tests AmericaWhile PCR picks up the genetic material of the coronavirus, antigenic tests register surface proteins on the virus. They are easier to detect, making testing faster and cheaper, and potentially available for home use. The presence of COVID-19 and many other viruses in patient samples can be confirmed through these antigenic tests, usually within a few minutes to several hours, Berger said. In COVID-19, the viral antigen will already be detected at the first signs of the disease. In fact, many patients already secrete viral RNA for a few days before there are any symptoms what it may be. Antigen can indicate if you are currently infected, not if you are recovering from the virus. Dr. Deborah Birks, White House Coronavirus Response Coordinator, speaks at a coronavirus task force briefing at the White House on Saturday, April 4, 2020, in Washington. Associated Press/Patrick Semansky Co-ordinator at the White House Deborah Birx said at a recent briefing that robust antigen testing could help re-open America, ABC News reported. There will never be an opportunity for a nucleic acid test to do 300 million tests a day or test everyone before they go to work or school, Birx said. But maybe with an antigen test. There are currently no antigenic antigenics on the market but several companies are working on them. OraSure Technologies is developing a home kit that will allow users to test themselves with a saliva sample. E25Bio, backed by MIT scientists, seeks FDA approval for rapid response kit can produce results within 15 minutes. E25bio test strips. The E25bio E25Bio test resembles an over-the-counter pregnancy test: a nasal swab is taken, a sample is added to the solution and placed on a paper strip treated with artificial antibodies. If the test is positive for coronavirus, a color indicator is formed on the strip. While antigen lightness tests and speed make them attractive, their lack of sensitivity is not: They have been found to miss about 15% to 20% of infections. If you use this test to test people to make sure they're not infected, and that they're coming back to work or the like, then you'd give people the message that they're not infected when in fact they are - and therefore the transmission of a new coronavirus, Jesse Papenburg, an infectious disease expert at McGill University, told NPR. In order for the antigen test for coronavirus to really work, scientists need to understand the biology and structure of the coronavirus that they are just starting to do. More: Coronavirus Coronavirus Freelance Original Reporting Antibody Testing 1. What are antibodies? (above) Antibodies, a Y-shaped protein complex belonging to the immunoglobulin super-family (Ig), exist in many types of organisms, especially higher animals. Specific antibodies can bind specifically to a particular exogenous pathogen such as a virus or bacteria or directly neutralize pathogens by blocking its active sites or facilitating the exclusion of pathogens by other immune cells, such as macrophages. Antibodies are produced by B lymphocytes (plasma cells). B-cells initially express antibodies on the cell membrane as B-cell receptors (BCR). When BCRs are connected with desired pathogens, B cells are differentiated into plasma cells, producing a myriad of antibodies. Part of plasma cells is transformed into memory cells that react relatively quickly to the same substance in a later infection. Most antibodies are Y-shaped and consist of four divisions, two heavy chains and two light circuits. Each light chain and moiety each heavy chain pairs together through a single disulfide bond to form the upper branch of 'Y', also named as Fab (antigen-binding fragment). The rest of the two heavy chains form the root 'Y' through two disulfide bonds, also called Fc. Collectively, one antibody has two Fabs and one Fc. The top (N termini) Fab are variable light chain domains (VL) and heavy chain (VH) with an antigen-binding site at the tip, and the rest, including some of the Fab and the whole part of the Fab, is more permanent. Accordingly, Fab determines the specificity and affinity of antibodies to the antigen, while Fc determines the location of antibodies. 2. How many species of local antibodies exist in vivo? (above) In placental mammals, five different heavy chain (α, δ, ϵ, γ and μ) divide antibodies into five isotypes, including IgA, IgD, IgE, IgG IgG Igm. Isotypes Podisotypes Structure Location Function IgA1 IgA2 monomer tetramer Most abundant Ig, spread in mucous areas, also in saliva, tears, and milk Preventing pathogens invading tissue from epiderm IgD N/A monomer on the naive B-cell membrane Activation of basophilium and mast cells to produce antimicrobials Preventing infections of worms IgG IgG1,IgG2a, IgG2b IgG3, IgG4 monomer serum and only antibodies found in the fruit Basic antibodies fight against pathogens IgM N / monomeric Pentamer Monomer on B cell membrane and pentamer secreted in serum to provide early elimination of pathogens before the beginning Of (Above) It is surprising that almost all pathogens or microbials can trigger an immuno-reaction in humans/mammals, indicating the ability of organisms to generate a pool with multiple antibodies. Indeed, it has been estimated that the human body is capable of producing 10 billion different types of antibodies. Complex mechanisms are used by humans/mammals to achieve diversification of antibodies with limited genomic sizes. The locus gene responsible for coding a heavy chain or light chain includes the gene area for variable domains and permanent domains. The gene area of the variable region consists of variables (V), diversity (D) and joining (J) segments for the heavy chain, and only the V and J segments for the light chain gene. The V, D or J segments consist of multiple copies of tandem-located V, D or J genes surrounded by preserved recombination signal sequences (RSS), which can be recognized as V(D)J recombinase and subsequently processed by other recombinant factors to accidentally remove spare V, D and J genes. Thus, randomly selected one V, one D and one J (only V and J for the light chain) genes are linked together to form an area of the variable gene for transcription. Given that a person has 44 V copies of genes, 27 D copies of genes and 6 J copies of genes, antibodies pool with conceivable variety can be produced. This process is called recombination V(D)J. After recombination V(D)J, when B-cells expressing naive antibodies on the cell membrane collide with an antigen, variable-area genes undergo a process called somatic hypermutation (SHM), which also requires T-cell assistants. SHM is performed by the AID enzyme and the DNA Inconsistency Repair Mechanism (MMR), which recruits error-prone DNA polymerase to re-synthesize a certain part of the variable genes. It has been estimated that one nucleotide mutation will be injected into one alternating gene at one round of cell division. Thus, naive antibodies acquire new functions to be slightly different in the antigen Affinity. B-cells with new antibodies that acquire a higher affinity for a specific antigen antigen have the advantage of survival over B cells with naive antibodies and antibodies, acquiring a lower affinity. This process is also called affinity for maturation, by which B-cells express specific antibodies with high affinity to a certain pathogen are supported and amplified. When B-cells are activated and mature when confronted with antigens, the constant area of antibody genes is rebuilt to produce isotypes, except for the original IgM and IgD on the naive B cells, to orient antibodies to perform several functions in immunoweb. This reshuffle is done by recombining the switching of classes (CSR). Randomly selected two nucleotide motifs (switch regions) located between genes of permanent regions are recognized and processed by several enzymes to generate two double DNA ruptures in the regions of the switch. The gene area between the two regions of the switch is then removed, and the rest is re-connected by a process called Nonhomologous end joining. Thus, different isotypes are produced. 4. Are there any artificial antibodies and what are their uses? (Above) With the development of biomedical technologies, in addition to in vivo naturally occurred antibodies, a number of artificial antibodies were introduced and applied in scientific studies and clinics. The characteristics of the antibody structure and the application of the Single Domain Antibody (sdAb) (single VH or VL domain) Small, highly accessible to hard-reaching epitopes; effective tissue penetration and the crossing of the brain's gemo-refalic barrier; High resistance to changes in temperature and chemical environment; more selective than other small molecular medicines. Good candidates for brain medications and discovery for oral drug delivery. Bisspecificic antibodies (BsAb) (trifunctional antibodies, two different Fabs references, Bisspeciphic T-cell role) Containing two or three paratopes; Delivery of cytotoxic T cells or macrophages to target cells; Applied to treat cancer, bacteria or viral infection single-chain variable fragment (scFv) (associated VH and VL) is easily produced and expressed on the cell membrane, so good candidates for surface display systems; Also used in immunohistochemism and chimeric antigenic T cells (CART) for cancer, bacteria or viral infection therapy Fab-scFv Fusion (Tribody) (associated with VH and VL) Two different scFv are jointly expressed with each Fab Domain chain respectively; The average size between IgG and bisspecific antibodies; balanced tissue penetration efficiency and retention time, so high accumulation of tissues. Single chain antigen-binding fragment without cysteine (scFab-C) Associated Fab without disulfide communication High stability and proximity compared to scFv; The soluble shape can be easily E.coli; Phages are allowed to be displayed and detected by conventional antisera reagents. 5. What are the applications of antibodies in studies? (above) Because of their binding specificity with pathogens/antigens, microorganisms/antigens, widely used in biochemical research. Applications Details Western blotting Detection of the existence of a specific protein/peptide in the tissues of lycate. Immunocytochemistry Detection of a specific protein/peptide in cells, on the cell membrane or in the extracellular matrix, detection of protein-protein interactions by analyzing the egastia of proximity or joint localization of immunohystochemistry analyses Detection of a specific protein/peptide in tissue sections. Immunoprecipitation study protein-protein or protein-chromatin interactions in cells/tissues, including chromatin immunoprecipitation and RNA immunoprecipitation. ELISA ELISA (enzyme-associated immunosorbent analysis) to quantify the concentration of a particular antigen in solutions, or to qualify the affinity of antibodies to this antigenic cytometry by calculating or sorting the cell population with specific protein/DNA EMSA (electrophoretic change of mobility) to detect DNA interactions between the protein. Proteomic antibodies microarray 6. What are the antibodies in the clinic? (above) At present, with the development of precision/personalized medicine, the requirements of antibodies in the diagnosis and treatment of diseases continue to grow. In the field of disease diagnosis, antibodies help doctors determine the presence of specific biomarkers in tissues or blood through in vivo or in vitro examinations. In the treatment of diseases, especially cancer and autoimmune diseases (e.g. coeliac disease), antibodies use their ability to block bio-activity targets or label tumor cells. For example, some tumor cells are good at avoiding detection by the immune system, and specific antibodies can label these cells for the immune system. In addition, antibodies can influence the survival and growth of cancer cells by blocking growth factor receptors that are for cancer growth or blood vessel growth (angiogenesis). In addition, artificial bisspecific antibodies and chemical receptors of antigen T (CAR-T) cells can direct cytotoxic T cells to specific cancer cells. In addition, antibodies hidden with radioactive substances or chemicals have also proven to be a useful tool for accurate cancer treatment. In tissue transplantation, antibodies are successfully used to facilitate rejection. Compared to conventional chemotherapy, antibody-based treatment has obvious advantages in minimizing side effects and improving efficacy. However, antibody therapy inevitably has some limitations. Two major drawbacks 1) cancer cells can develop to harbor resistance to antibodies by mutationing antibody target receptors or exploring alternative pathways for blood vessel formation or uncontrolled growth; 2) it is, sometimes, a challenge in practical for appropriate antibodies for a specific purpose. 7. What is the difference use of polyclonal antibodies and monoclonal antibodies? (above) In short, polyclonal antibodies (PAb) indicate that antibodies are heterogeneous in the collection, thus recognizing the various epitopes of the antigen. In contrast, monoclonal antibodies (MAb) mean that all antibodies are identical to each other in the collection, thus binding to one specific antigen epitope. Manufacturing Manipulation Affinity to target modification of Cross Reactivity PAb quickly and cheaply easy to store, tolerant to PH and ion changes in the buffer Total high affinity to antigen, resistant to conformation changes of target protein Easy to be labeled unchanged in binding functions of high MAb slowly , MAb easier to reproduce with already obtained hybrids from the process of initial production, while immunization required by producing PAb. Because MAb recognizes only one antigen epitope, so it is always used to quantify the concentration of the antigen. It should be noted that due to low cross-activity, MAb is much more popular in clinical applications than PAb. 8. What is an antigen? (above) Basically, the antigen is a group of substances that can be recognized by the host's immune system (B-cells, T cells or antibodies). It should be noted that not all antigens can trigger the host's immune response, which means that antigens do not necessarily have to be immunogens. One of the important criteria of immunogenicity of antigenicity is its molecular weight should be more than 10,000 da. Typically, antigens can be classified into exogenous antigens, endogenous antigens, autongues and tumor antigens based on its sources, as well as in proteins, polysaccharides and lipids based on its chemical properties. 9. Which antigen is suitable for immunization for antibody production? (Above) Basically, all antigens that can trigger an immune response can be used to create antibodies. To generate antibodies for clinical or research uses, antigens must meet two basic requirements 1) the molecular size must be more than 10,000 Da; 2) Cleanliness is offered by more than 90%. Various types of substances have been used in the generation of antibodies, including hatpens (12-25 amino acids of small peptides) associated with large assistant peptides, recombinant proteins, local proteins, bacteria, viruses and even naked plasmids that can directly express antigen proteins in vivo. Native Protein Recombinant Protein Haptens Cost High Medium Low Carrier No Need Immunogenicity Very High High Fair Antibody Generation Success 80%-95% 60%-80% 30%-60% Suitable for Ligand Best Good Fair Reproducibility Best Good Good Brief Comparison of Native Proteins, Recombinant Proteins and Haptens 10 antigens. How do antibodies bind to its targeted antigen? (above) The antibody binds to the antigen through the interaction between the antigen-binding site on the antibody and the epitope on the antigen. The antigen binding site, also called paratop, is a small region (usually 15 to 22 amino acids) in a variable area of a light chain or heavy chain. The antigen binding site includes a set of complementarity that defines regions (CDRs), also called the hypervariant region. Each light chain and heavy chain has three CDRs (CDR1, CDR2 and CDR3, of which CDR3 is the most variable) surrounded and sterileally supported by four framework regions. The proximity of antibodies to a particular antigen is determined by the level of supplementation (e.g. lock and key) and the strength of the uncelent bonds between paratop and epitope. Thus, the interaction between the antibody and the antigen is relatively weak compared to the covalent force between atoms in a single molecule. Thus, this interaction is reversible in most cases. 11. How to determine the affinity of certain antibodies to the antigen? (Above) The interaction between antigens and antibodies is largely reversible, so the reaction can be simplified as well: Abe Ag Ab-Ag (Ab), Ag and Ab-Ag describe the concentration of antibodies, antigens and antibody-antigenic complexes in this reaction, respectively. When the reaction reaches equilibrium or stable condition, the rate of antibody antigen association is equal to the rate of dissociation of antibody-antigens. Thus, at this stage, the relationship between Ab-Ag and Abe Ag (Ka) may indirectly reflect the affinity of antibodies to a particular antigen. As a rule, high-affinity antibodies have several methods used to calculate Ka. The first is called equilibrium dialysis. Briefly, the antibody solution filling in the dialysis bag dialyzed against the solution of radioactive designated antigen. The principle is that the antibodies in the dialysis bag cannot travel, but the antigen can travel between both sides of the bag. When the dialysis reaction reaches balance, the radioactive level in the bag reflects antibody-binding antigens and free antigens, while the level outside the sac reflects free antigens. Given that the concentrations of free antigens inside and outside the sac should be the same, it is possible to calculate the concentration of antibodies-antigenic complex. This method is commonly used when the antigen is haptens or small molecules. An alternative approach to measuring ancffinity of antibodies is fluorescence hardening. Briefly, proteins/antibodies may contain tyrosine and tryptophan emitting fluorescence excited by ultraviolet. When non-fluorescent queers/antigens bind to fluorescent antibodies, they can form a complex with less fluorescence. So measuring the change in fluorescence signal, the affinity of antibodies to the antigen can be measured. Measured. both of the above methods have limitations in the property of antibodies. In equilibrium dialysis, the antigen should be small for diffusion through the bag, and when tempering fluorescence antigens should have unique fluorescent functions. An alternative technology called surface plasma resonance (SPR) has been developed to remove these limitations. Briefly, antibodies/antigens are immortalized on the dextran layer and antigens/antibodies are allowed to flow on the layer. The SPR detector is so sensitive that any change in the amount of substances per layer can be recorded, so the binding of antibody antigens is measured in real time. Thus, antibody-antigen binding kinetics can be calculated. All of these individual services and products are intended only for research use, are not intended for pharmaceutical, diagnostic, therapeutic or any human use in vivo. 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