ANTIBODIES FOR HUMAN DISEASES

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1 PRINCIPLE OF MONOCLONAL ANTIBODY THERAPY

The immune system is our defense system that prevents us from illness and also works to help our recovery from many illnesses. The immune system plays a central role in protecting the body against various diseases such as infectious diseases, inflammation, and cancer. It is also the major force in the body in combating diseases that have already developed. The body's ability to develop an immune reaction to tumors may help determine which patients are cured of cancer using conventional therapies, including surgery, radiation, and drugs. The concept of immunotherapy is based on the body's natural defense system, which protects us against a variety of diseases [1].

Many years of research have resulted in the successful examples of immunotherapies for many diseases including cancers and inflammatory diseases. These new treatments referred to as biological therapies—such as monoclonal antibodies and vaccine therapies. The recent technological advances in monoclonal antibody (mAb) development caused significant investment and interest in the pharmaceutical and biotech industry. It is estimated that nearly half of all clinical trials are conducted on monoclonal antibodies [2]. Antibodies are complex protein molecules that are a component of the immune system. These molecules belong to the immunoglobulin (Ig) class of proteins. They are a major component of the body's adaptive immune system, which is involved in mounting a specific attack against "foreign" molecules, cells, and organisms by recognizing and binding to antigens. The cells that produce antibodies are known as B cells.

There are several classes of antibodies in humans including the IgG class (IgG1, IgG2, IgG3, and IgG4), IgM, IgA class, IgD, and IgE. IgG is most abundant class of antibodies with serum concentration of 10%. All therapeutic antibodies are IgG molecules, typically IgG1 or IgG2. The structure of antibodies is Y-shaped, consisting of two light chains and two heavy chains, which are linked by disulfide bonds (Fig. 1). The light and heavy chains contain a variable region, also known as the Fab (fragment antigen binding) region, and a constant region, which is also known as the Fc (fragment crystallizable) region. The Fab region is the main part of the molecule involved in antigen recognition. This region is encoded by genes that can be rearranged to achieve the extensive diversity of antigen recognition. The constant region, on the other hand, is involved in inducing the effector functions of antibodies and mediating an immune response [3].

High specificity, high affinity to a disease target and relatively low or no effect on other substance except the target antigen make mAb ideal molecules for therapeutic agents. Monoclonal antibodies are suited to target different target molecules and may offer different action mechanisms. In addition, it is possible to modify and improve an antibody drug candidate by genetic engineering methods and establish large-scale production using recombinant protein technology.

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