Demystifying Diagnostics: The Agdia ImmunoStrip®

Part One: Introduction

Robert Emmitt

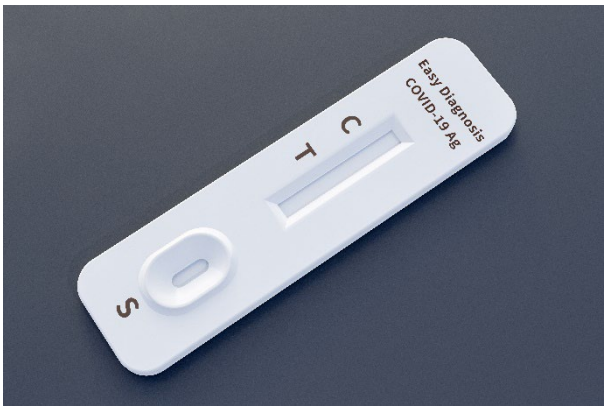

Figure 1. Commercially available lateral flow assay for detection of COVID-19

Over the previous three years, we collectively learned the importance of fast, accurate and easy-to-use disease diagnostic products in the absence of laboratory resources and expert personnel. The SARS-CoV-2 pandemic ushered in the era of the ubiquitous DIY lateral flow test, developed to detect the presence of a human pathogen, COVID-19 (**Figure 1.**). The lateral flow device (LFD) has been used in clinical settings for six decades. And as the technology has advanced, applications have come to include cancer and diabetes research, drug screening, environmental testing, food safety and veterinary diagnostics. Moreover, LFD home pregnancy tests have been a staple on U.S. pharmacy shelves since the late 1970's. Nevertheless, it is a recent development that the LFD has become a societal norm, widely available for in-home testing for confirmation of viral infection. The utilitarian elegance of the LFD combined with the specific complexity of the underlying immunochemistry provide users with little to no experience in diagnostics a powerful tool in disease management efforts.

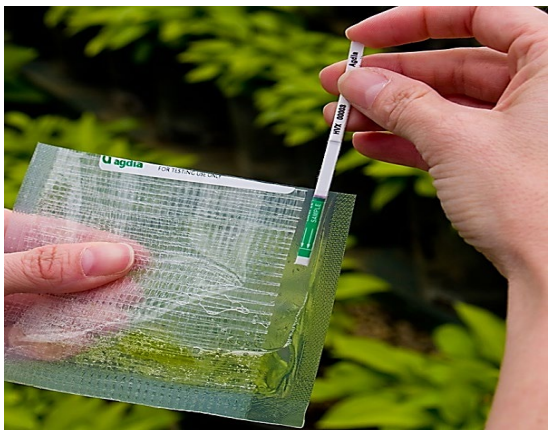

Figure 2. Agdia ImmunoStrip®

Plants get sick too, and indeed plant pathogens affect considerable and sometimes catastrophic crop damage globally, thereby profoundly affecting human civilization. As with the epidemiology of human pathogens, accurate and timely diagnosis of plant disease is paramount to managing local and widespread outbreaks. The plant diagnostic community realized this and embraced the LFD several decades ago for use in industry and university plant clinics throughout the U.S. Moreover, Agdia ownership recognized the value of the LFD and its utility across diverse markets in plant protection. This led to the development of the ImmunoStrip®, Agdia's flagship LFD product (**Figure 2.**). Since then, ImmunoStrip® products have become available for detection of many of the most important plant pathogens and are used around the world in every market sector of plant production.

As mentioned above, LFDs are utilized across numerous applications and reach consumers in multiple configurations. Nevertheless, all LFD products have one thing in common: antibodies. Antibodies, also known as immunoglobulin (Ig), are relatively large glycoprotein complexes produced by specialized white blood cells in animal immune systems, B cells, in response to the

presence of a foreign molecule within the body. This foreign molecule, known as the antigen, is not recognized by the immune system as a typical molecular constituent and triggers a defensive response, initializing antigen-specific antibody production. Antigens come in many forms, including allergens, bacteria, environmental toxins, fungi, hormones, incorporated gene products, tumor cells, viruses and even venom. More specifically, antigens are unique molecules that constitute these larger foreign bodies, such as lipids, nucleic acids and proteins.

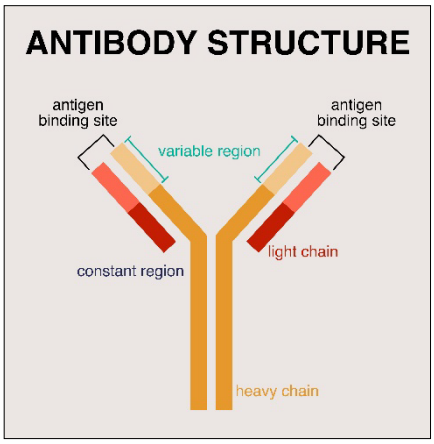

Figure 3. Typical antibody structure

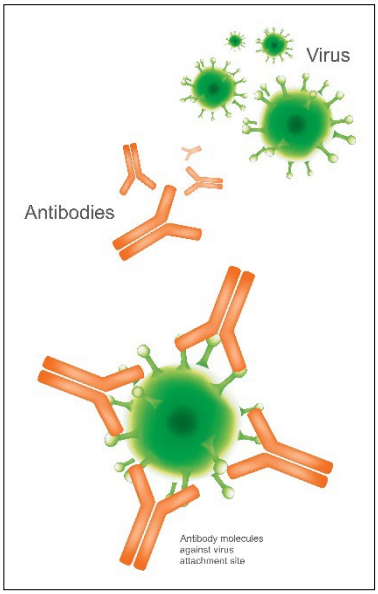

Figure 4. Antibody-antigen binding activity

Inherently, B cells are produced in the bone marrow and flood the blood stream and lymphatic system. When B cells contact an antigen a focused biochemical interaction occurs, and they begin producing antibodies. These antibodies have a conformation similar to that of the letter Y (**Figure 3.**). The extended terminal ends of this Y are known as paratopes and bind specifically to sites on the antigen known as epitopes. This binding is unique and analogous to that of a lock-and-key mechanism, with paratopes functioning as the lock and epitopes as the key (**Figure 4.**) Through binding, antibodies do not always fully destroy or deactivate the antigen themselves but flag the antigen for destruction by additional immune system components, such as T cells. Collectively, the immune system components now work to neutralize the antigen and ideally prevent severe deleterious physiological effects from occurring. Moreover, the adaptive immune system now has specific antibodies in its arsenal, allowing for earlier antigen detection and neutralization in subsequent exposures and infections (**Figure 5.**).

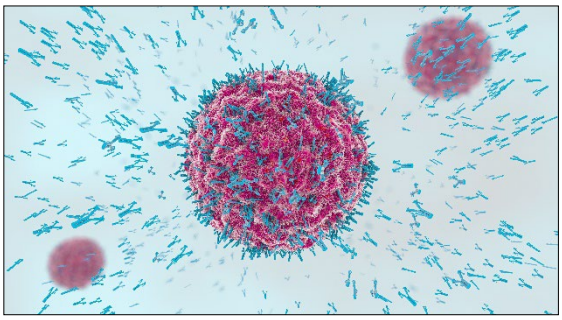

Figure 5. Existing antibodies swarming viral particle.

At this point, you might be waiting anxiously to read what I will write next. Nevertheless, I suspect you are asking yourself what all of this has to do with the ImmunoStrip® you are using to test your plant. As I mentioned, it is all about antibodies, which I will discuss in greater detail in the next installment.

About the author

Robert Emmitt serves as the Domestic Account Manager of Plant Pathogen Diagnostics at Agdia, Inc., where he has been for six years. Robert earned his B.S. in Crop and Soil Science from the University of Kentucky and his M.S. in Plant Pathology from the University of Georgia. Before joining Agdia, Robert spent 18 years in the landscape management industry, culminating as a Plant Health Manager on private estates in Cincinnati and Northern Kentucky, which is where he grew up and became interested in plant health. Moreover, he holds associate degrees in Horticulture and Turfgrass Management and has several years of professional experience in landscape design. Robert can be reached at robert.emmitt@agdia or 574-327-6065.