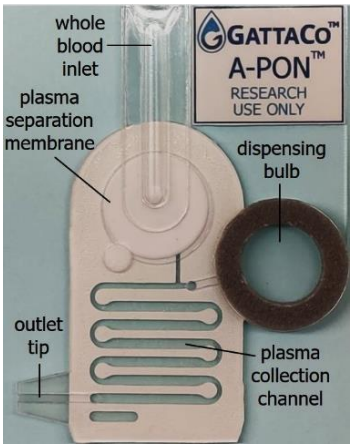
The A-PON™ and its Use for Accelerated COVID-19 Serological Testing



The A-PON™ is a disposable blood sample collection and preparation tool used to replace centrifugation to separate plasma from whole blood. It is a combination of a size-exclusion filtration membrane, proprietary technology, and microfluidics that enable the collection of capillary whole blood from a finger-stick, passive separation of plasma, and dispensing of a metered amount of plasma. The plasma can be tested immediately, or shipped to a clinical lab. The A-PON™ has been optimized to recover a high-yield of antibodies, comparable to centrifuge derived plasma, for use in COVID-19 serological testing and other applications. Antibodies in liquid plasma separated by the A-PON™ have been shown to be stable and readily available for detection after environmental conditioning for 72 hours at 37° C, exceeding standard regulatory imposed biomarker stability requirements.

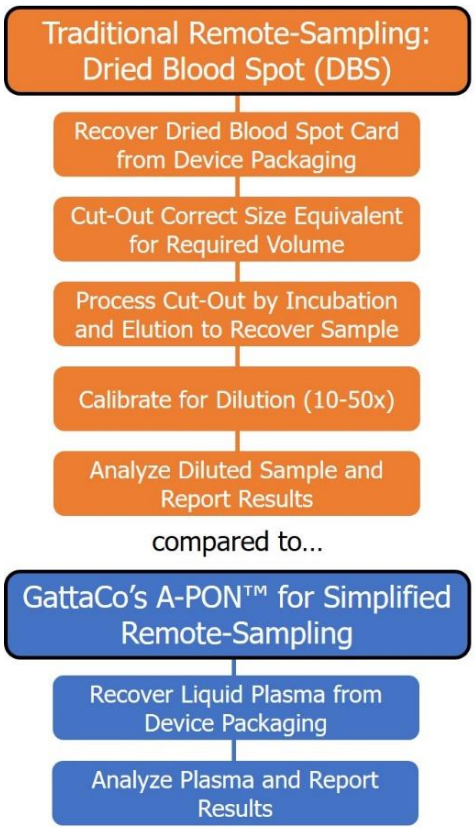
In traditional settings when antibody testing is needed an individual, after consultation with their physician, receives a blood collection order. The individual is required to visit a blood collection center where a phlebotomist draws one or multiple tubes of blood from a vein in the individual's arm. These centrifuge tubes are placed in bulk in cooled blood transport containers and shipped to a clinical lab for processing. The fresh blood must be kept under 'cold chain' to minimize degradation of the blood sample which includes denaturation of critical biomarkers, such as antibodies, and rupturing of delicate red blood cells or hemolysis, which contaminates the sample and interferes with eventual downstream biomarker detection. For almost all biomarker detection applications the blood tube, once it reaches the clinical lab, is spun in a centrifuge to separate cells from plasma. A Complete Blood Count test (CBC) uses the cellular components as biomarkers, but almost all of the other diagnostic tests use soluble biomarkers in the plasma. Based on current regulations, centrifugation and sample preparation procedures are intended to be performed by trained and certified clinical laboratory technicians.

Despite this careful process, even with the blood kept under cold chain and in the presence of preservation reagents in the blood tubes, important biomarkers immediately begin to degrade once removed from the blood stream. Whole blood cannot be frozen without inducing substantial hemolysis making the sample worthless for almost all testing applications. In the case where biomarkers are extremely sensitive to degradation, the blood tube can be centrifuged immediately after the blood is drawn as separating cells from plasma eliminates or greatly slows the degradation and interference effects. Plasma can also be frozen to preserve the biomarkers further, if needed. However, requiring centrifugation immediately after sample collection would necessitate the blood collection site to meet laboratory best practices, adding cost, complexity and skill on the part of the phlebotomist or technician, which most centers are unwilling to accept.

Considering the current call for mass testing to assess seroprevalence, or the presence of anti-SARS-CoV-2 antibodies in the general population, it has been suggested that millions of COVID-19 antibody tests should be performed. This level of testing is necessary and justified as the demand for high quality epidemiological data is essential to making informed decisions to allow re-opening of the U.S. economy, currently costing hundreds of billions of dollars in GDP each week that lock-down orders are in place, for understanding the endurance of immunity, especially for vaccine development and implementation, and for screening for high risk activities where exposure is difficult to avoid. Clearly, this volume of testing would completely overwhelm existing capability and infrastructure and is simply impractical. New technologies, products and services must be developed to bridge the infrastructure gap between centralized laboratories and the public sample pool.

Alternatives to the traditional blood drawing and shipping process have been developed. They include the use of small, portable centrifuges that are used in a de-centralized manner. However, as mentioned this pushes the skill and cost outward from the lab, which may be done in high-value applications such as clinical trials but is not compatible with mass-testing needs. Another method is to use dried blood spots or other dried sample collection methods. While studies have shown many biomarkers are preserved when the blood is in a dried state, this method significantly increases the workload of the clinical lab, as illustrated in the workflow diagram to the right, and exposes the sample to contamination due to the open nature of the system to facilitate air drying. Many labs are unwilling to invest in the equipment and develop the capability to process large numbers of dried blood samples. Saliva or urine samples are also proposed as alternatives, but studies show important biomarkers are not present in these samples or may be present at greatly reduced concentrations than in plasma. These samples must also be processed by centrifugation once they reach the lab, due to the presence of interfering macroparticles. In some cases, however, these sample types are very valuable in situations when the biomarker is specifically associated with their related systems, such as urinary tract infections, but this association is only weakly present in the case of COVID-19 antibodies. The most common testing currently performed is a diagnostic PCR test. It is based on direct detection of the molecular biomarker of the virus (RNA). This test is valuable for taking a snapshot of the immediate state of the patient but cannot provide the dynamic information of the disease behavior that is available through antibody testing. The detection of IgM can provide information about active infection in the patient body, even if they are not symptomatic, and the detection of IgG gives evidence of previous exposure or infection even if the patient did not show any symptoms. This information is usually derived through blood plasma testing.

Conversely, the A-PON™ can be used to provide mass sample availability. The A-PON™ can be



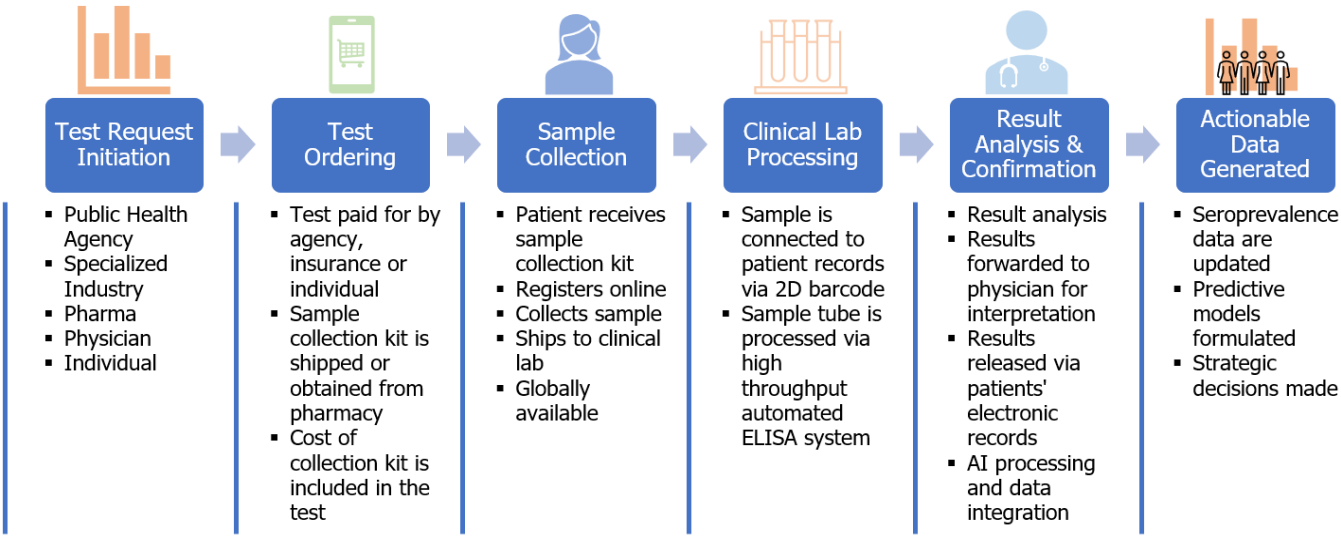
distributed widely, through the mail or by in-store purchase. The individual collects the sample in the comfort and safety of their own home, and the lab receives purified, antibody rich, liquid plasma ready to be analyzed on high-throughput analysis systems, without the imposition of any additional workflow burden. No cold chain or special handling is needed. The A-PON™ facilitates easier sample collection, processing, transport and generation of critical serology data for an individual's personal information, or to drive information rich analysis to support population seroprevalence studies, employee health, soldier readiness, immunization or vaccine efficacy, re-infection, or other applications requiring informed decision making for improved crisis management.

A-PON™ technology is compatible with several use models that benefit from scale up of COVID-19 serological testing, such as:

1. Seroprevalence studies to support data-driven opening of the economy.
2. Sample pooling for expedited testing and reduced cost.

A-PON™ Collection Kit for Clinical Lab COVID-19 Serological Testing

PROCESS WORKFLOW



3. High-risk activity screening, such as for travel to high impact areas.
4. Pre- and Post-Vaccination clinical studies.

With any of the above use models, the proposed workflow is illustrated in the figure above and consists of the following steps:

1. The initiation of the test request by an individual, physician, public health agency, or other party.
2. The ordering and purchasing of the test either online or from a pharmacy. The cost of the test includes the cost of the sample collection kit and can be paid for in a variety of ways depending on the case.
3. Upon receipt, the A-PON™ kit is registered online or via the phone. A few drops of capillary blood are collected, and, within 3 minutes, antibody-rich plasma is dispensed into the storage tube. The tube is mailed or delivered to a clinical lab.
4. The clinical lab receives and registers the sample via its integrated 2D barcode and adds it to its automated analysis workflow.
5. Results are reported to the physician, added to the individual's electronic health records, and to public health databases for processing.
6. Seroprevalence models or clinical trials are updated. Informed decision making is possible based on accurate data resulting from tens of thousands to millions of samples being analyzed by high-sensitivity, high-throughput, accurate and cost-effective processing.

Shown below is an image of the current A-PON™ package. It includes lancets, an alcohol wipe, a sample collection tube designed to fit in 96-well plate-based laboratory automation systems and a bandage. A return mailer and instructions for use will also be included. The A-PON™ product line is expected to be commercially available late 2020, but is available now through a limited Early Access Program. Please email info@gattaco.com or visit www.gattaco.com for more details.