Executive Summary

Solaris BioSciences has developed and patented a new, high sensitivity, rapid and compact, optically based technology for the characterization of bio-fluids and as an assay for the detection of proteins, RNA/DNA, antibodies, exosomes, and other biomolecular moieties using extremely low sample volumes (less than 10^{-12} liters). The technology has been demonstrated and uses nano-particle consumables (particles with sizes less than a micron) and an all solid state laser source to interrogate the ultra-small samples volumes. When used with precision nano-particles, the method is capable of determining the viscosity of pin-prick volumes of biological fluids such as blood plasma, which have been directly correlated with Covid-19 (SARS-2) associated hyper-viscosity, cardio-metabolic risk factors, proteinuria, and homeostasis in cardiac surgery patients in the early postoperative period.

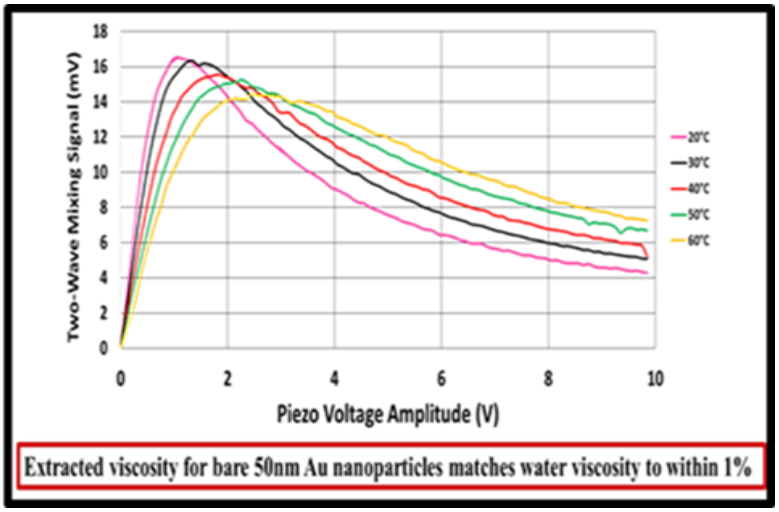
The Solaris BioSciences technology is based on a nonlinear optical interaction called Non-Degenerate Two Wave Mixing (NDTWM) and the use of customized nanoparticle consumables (gold, silver, polystyrene, and silica) which serve as particles with a precisely defined size and assay binding targets in the measurements. The underlying physics relies on the interaction of moving light intensity patterns to drag nano-particles through extremely small volumes of solutions, thereby determining their “size” through measurements with and without the various molecules of interest attached to their surfaces. The viscosity of a bio-fluid, such as blood plasma or urine, can be determined on the sub-pin-prick scale of fluid volume (~20microliters) by using highly size calibrated nano-particles which allow the measured drag to be directly converted to the viscosity of the fluid. Because the method is an exchange of energy between two light beams, rather than weak scattering of light, the signal to noise inherent in this method is millions of times larger than with some other optical methods.

Current shear based viscometers require several milliliters (1ml-4ml) of blood plasma while advances in microfluidics based approaches require extreme surface cleanliness of the capillaries and require time consuming calibrations involving liquid handling in the measurement setting to undertake viscosity measurements on very small samples. In the Solaris BioSciences technology,

the particles are moving *within* the fluid and the interaction of the fluid with the walls of a capillary play no part in the measurement. Other novel approaches to viscosity measurement in small samples using viscosity dependent fluorescence yield of molecular rotor dyes suffer from extreme sensitivity to dye concentration, sample turbidity, and temperature, which have kept this technology out of commercial use.

The figure below shows the sensitivity of Solaris BioSciences technology by measuring the viscosity or a pico-liter volume of water at different temperatures.

Water is a well-studied system and the results demonstrate the resolution of the system when compared to the highest precision results in the literature.



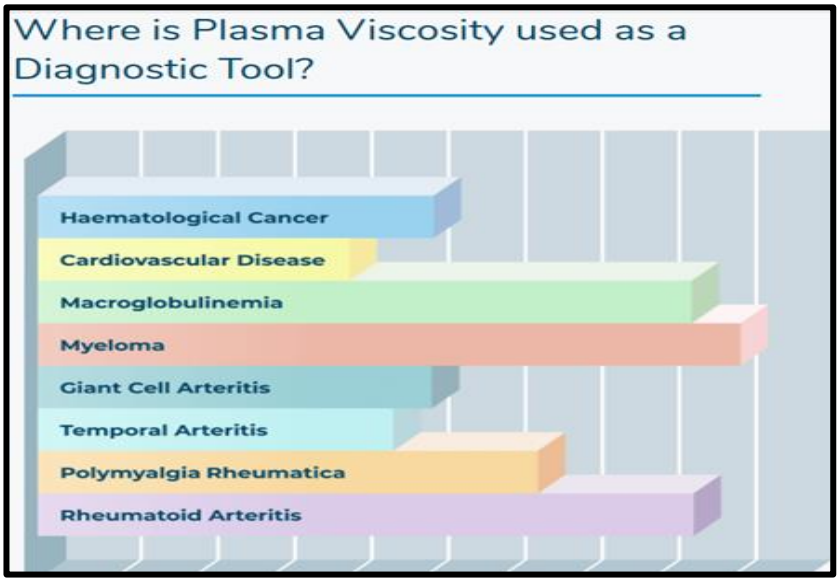
The data shown provides a resolution of dynamic viscosity which is more than sufficient to resolve the blood plasma changes associated with various disease states. Water has a viscosity of 1.00 mPas (millipascal-second) while blood plasma has a range of 1.3-1.8 mPas at body temperature of 98.6 F.

Ultra-small Volume, Rapid, Measurement of Blood Plasma Viscosity

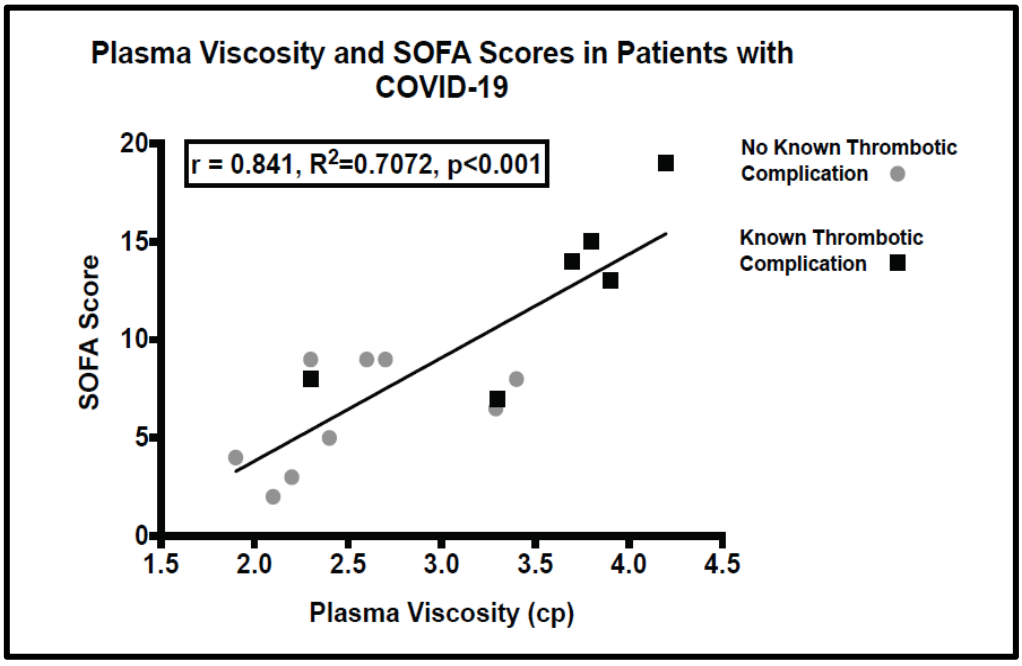
In recent studies from 2018 to the present, there has been a rapidly growing body of evidence that correlates the viscosity and refractive index of medically relevant bio-fluids such as blood plasma and urine to disease states. Blood plasma viscosity is linked to a number of chronic diseases, infections, and inflammations (ranging from myocardial infarction, venous thrombosis, venous thromboembolism, to a variety of blood cancers, and infectious diseases like malaria). The body produces paraproteins in response to infection or inflammation, and these responses consequently affect blood viscosity; measuring this viscosity may aid in diagnosing, detecting and monitoring a variety of illnesses.

Blood plasma viscosity testing is “non-specific,” as it does not determine the reason why hyperviscosity is occurring, nor locate where it's happening in the body, but can serve as a powerful early stage diagnostic which leads to more biologically specific laboratory testing. Senior Cambridge University biomedical scientist, Dr. Daniel Gleghorn stated:” “It is a cost-effective test compared with other expensive biochemical methods…. There is also the benefit of a less complicated and reliant supply chain for consumables and reagents. This has been significantly

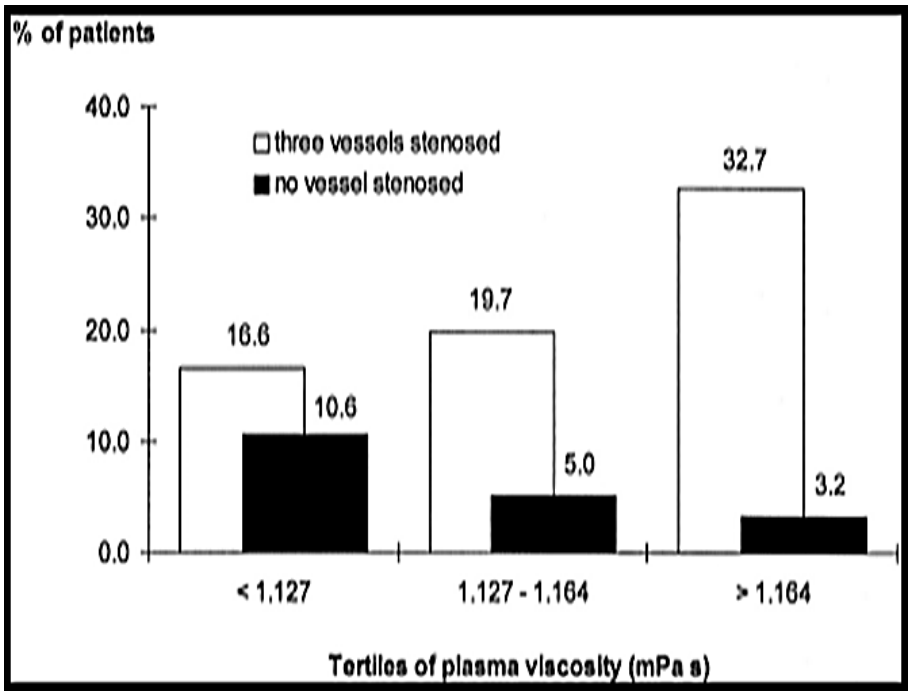
affected for other tests (CRP, procalcitonin and Interleukin-6) where this is not the case due to a worldwide increase in demand and the effects of lockdowns on distribution networks." The figure below illustrates some of the more traditional disease states where blood plasma viscosity is used as a diagnostic tool.



Since the SARS-2 pandemic, a number of medical researchers have reported on thrombic complications in patients with coronavirus disease, including ones receiving anticoagulation drugs. Researchers at Emory University School of Medicine have established a link between Covid-19-associated hyperviscosity of blood plasma with potentially severe medical consequences in patients with SARS-2 infections ("Covid-19-associated hyperviscosity: a link between inflammation and thrombophilia", The Lancet, Volume 395, 2020). These measurements were performed using standard capillary viscometers and found that all studied patients had plasma viscosity levels >95% of normal. The figure below is from the Emory University work and shows how the Sequential Organ Failure Assessment (SOFA) score correlates with blood plasma viscosity in Covid-19 patients.



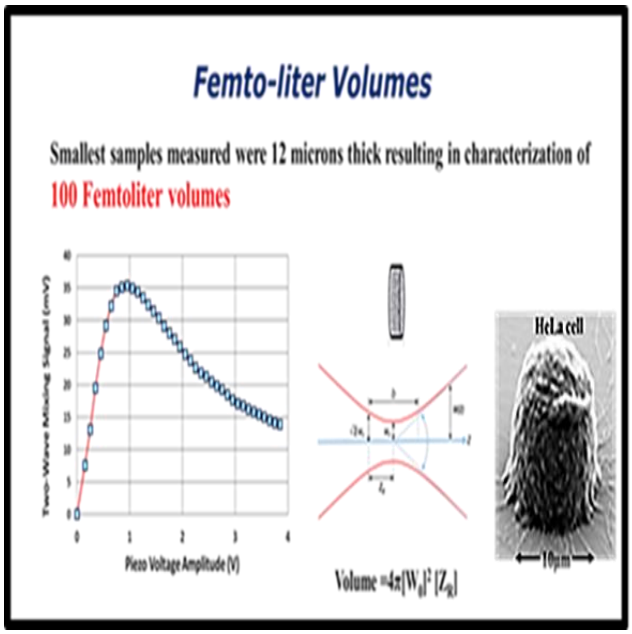
The viscosity of whole blood depends on hematocrit, erythrocytes deformability and plasma viscosity, which in turn depends primarily on the protein profile. The rapid, pin-prick sample, simultaneous measurement of blood plasma viscosity and refractive index can provide a useful picture of what the levels of fibrinogen are in a patient, respective of blood thinner medication which do not address this type of clotting risks Based on full rheological studies of blood, it has been suggested that plasma viscosity may be a more sensitive than whole blood viscosity to changes in the plasma proteins associated with cardiovascular disease risk and mortality and a valid clinical marker for these situations. The figure below shows data which correlates the population of patients with stenosed vessels with their blood plasma viscosity (Junker, et. al. "Relationship Between Plasma Viscosity and the Severity of Coronary Heart Disease", Arteriosclerosis, Thrombosis, and Vascular Biology, Vol. 18, No. 6, 19880).

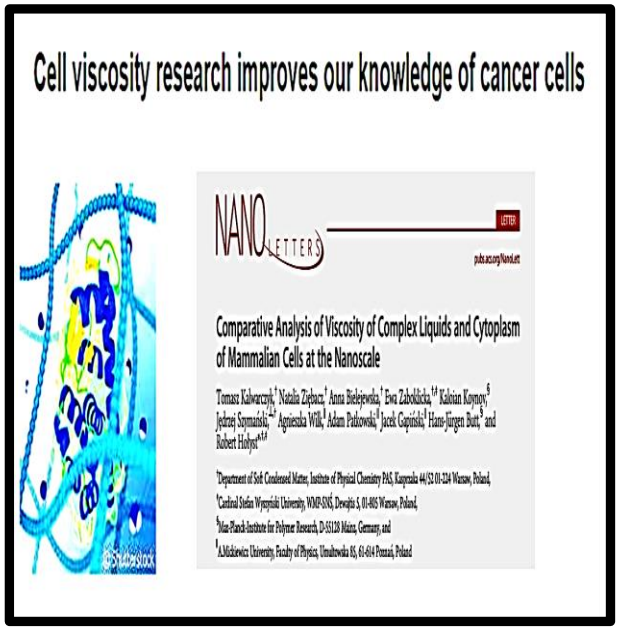


Potential for Viscosity Measurement Inside a Single Cell

The mobility of proteins and other intracellular moieties is one of the main regulating factors in processes taking place in living cells. Work on the rotational diffusion of molecular dyes probes has demonstrated a connection between the viscosity of the cytoplasmic environment and the disease state of the cells. Rotational diffusion measurements are plagued by complex molecular interactions with the probes themselves and provide extremely site specific information which is not representative of the average hydrodynamic cell fluid viscosity. This latter finding is potentially the key to another early stage diagnostic that can indicate early signs of disease and the transition to malignant states.

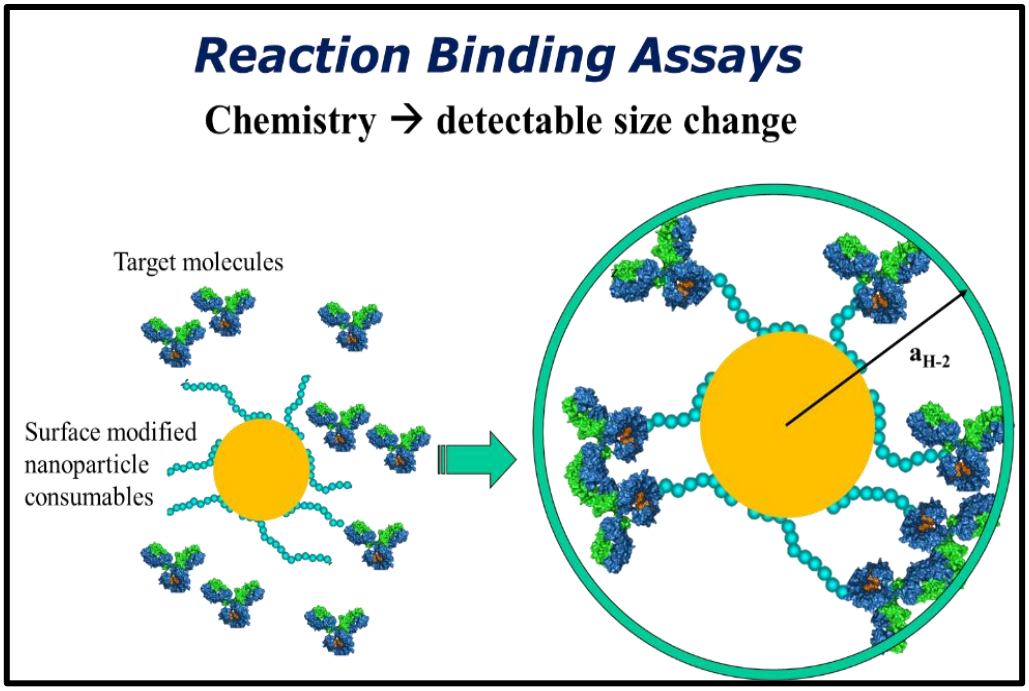
Work at several labs around the globe has shown that up to 10^4 nanoparticles of inert, nonreactive, gold can be rapidly taken up by healthy mammalian cells. The use of these cells as “ultra-small sample holders” can determine the effective macroscopic fluid viscosity within the cells. Measurements using the two wave mixing process dragging these particles through the intercellular volume have the potential to be used as indicators of important cellular changes when correlated with disease changes from diabetes to cancer and precancerous conditions.
The realization of this version of the technology could open the door to standard cell screening of intracellular viscosity as part of pathology testing, creating another very large market for Solaris.



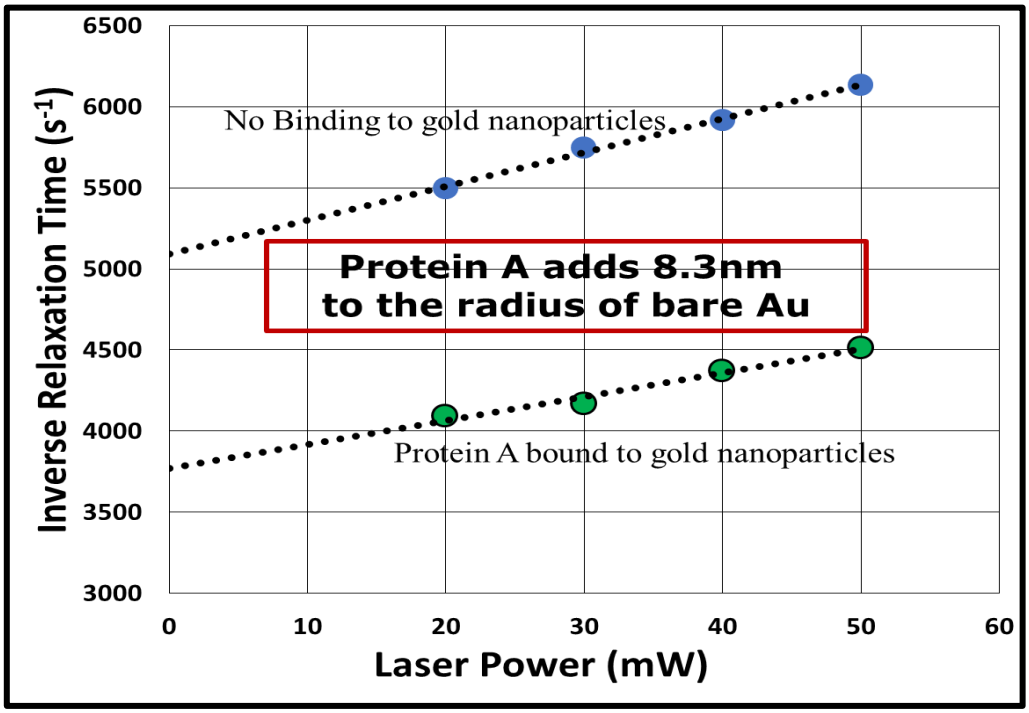


Ultra-sensitive Biomolecule Detection for Drug discovery and Assays

The NDTWM technology has been shown to be a very sensitive method of detecting extremely small (10^{-15} moles) numbers of molecules in very small volumes of solution. This has applications in detection of a large palette of biomolecules for a number of applications ranging from drug discovery to assays for viruses and other pathogens. This application utilizes surface modified nanoparticles as consumables to which target molecules of interest selectively bind, resulting in a change in the effective radius of the particles being dragged through the solution (water) by the moving laser light pattern. This results in an easily measured shift relative to the case of no specific target binding and indicates that reaction has occurred at the smallest concentrations of the target species.



Experiments performed to date have resolved the binding of protein A onto gold nanoparticles showing the technology is capable of resolving femtomoles (10^{-15}) of the protein on as few as 1000 nanoparticles and in volumes of 10^{-13} liters.



Commercial Opportunities:

The Solaris BioSciences technology has a number of applications spanning the medical and biotech and drug discovery fields, ranging from assays for specific targets such as viral and bacterial pathogens, target proteins and RNA, to viscosity measurements for medically relevant samples such as blood plasma, urine, and cerebrospinal fluids. The entire spectrum of applications requires the use of a consumable disposable cartridge which contains specific nanoparticles along with a hardware system. These nanoparticle consumables may be passive for viscosity measurements, or have surfaces which are activated with specific molecules which react and bind with target RNA, proteins or antibodies to change their effective "size" and hence the drag forces when being acted upon by the moving light pattern.

The consumables are the key profit driver for the business model whereby both sophisticated as well as portable hardware instrumentation systems are used as the installed equipment base driving consumable sales. The sophisticated instrumentation system will be required for the biotech/pharma research applications while point of care viscosity or viral testing will require smaller, highly focused, much lower cost versions of the hardware.

- **Blood Plasma Viscosity Market**

The adoption of the technology at various points in the healthcare system will require compelling evidence that such rapid pin-prick viscosity tests, which can be performed in situ in primary care physicians and cardiologist's offices or hospital recovery rooms, without blood drawing and subsequent laboratory analysis and delays, have real time treatment and prophylactic value. Once established, the success of the business will require that these tests provide downstream savings in total treatment costs to allow for private insurance or government funded healthcare to support their ubiquitous use for target conditions. Another avenue for commercialization is to have the test cost be comparable to or less than the co-pay of insurance and that the sale is made directly by the medical provider. This latter model circumvents insurance authorizations for routine medical appointments and allows the medical practitioners to increase their revenue directly by offering the option of a simple point of care pin-prick test.

Currently, blood plasma analysis is performed using shear or capillary viscometers supplied by companies such as Anton Paar, Benson, BioFluid Technology, Harkness, and RheoSense which utilize typical sample volumes of 1ml-4ml as compared to pin-prick volumes which are typically 20-50 microliters of blood volume. These devices have selling prices which range from $4000 - $40,000 depending on the range of shear rates and automation. The blood plasma viscosity measurements are performed by laboratories within hospitals or outsourced to major diagnostics

companies such as Quest Diagnostics and Labcorp which provide turnaround times of 2-4 days and currently cost $108/test in the USA.

Solaris BioSciences technology has the capability to performed such test with pin-prick blood volumes, provide a result within five minutes or less, and with hardware which will cost under $12,000. The consumables we will provide for each test are similar in design to the diabetes capillary strips with a separation membrane and calibrated nanoparticles within the module. Based on the anticipated cost of manufacturing, we believe that a cost of $25/test is a compelling alternative to the current $108/test pricing from diagnostic labs.

At a price of $10 per disposable test module, adoption of viscosity testing at the primary care level, particularly for older adults could provide the largest single market worldwide. According to a survey from the Kaiser Family Foundation, 92% of U.S. residents say it is important to get an annual physical, and 62% report actually getting the exam. Overall about ~50 million Americans get the exam every year. If in-office viscosity testing becomes part of the weight, height, blood pressure, heart rate and blood oxygenation palette being currently performed in the office, the potential revenues are $500 million in the USA alone and well in excess of $2 billion worldwide. In the pay out of pocket model, the primary care physicians as a whole would net an additional $1 billion in revenue at a test cost of $20 which is in line or less than current USA co-pay fees structures. With over 200,000 primary care physicians in the USA alone, a table top NDTWM Solaris BioSciences viscometer at $10,000/unit would project hardware sales of $1-$3 billion depending on the degree of sharing of the instrument by more than one physician in the practice. Worldwide, the hardware opportunity is over $10 billion.

The emergence of an increasing number of studies linking hyperviscosity and refractive index of blood plasma to Covid-19, cardiology, and post-surgical outcomes present the fastest route to market and will be the focus of the first product development efforts. With the current world SAR-2 infection of 34 million people, 27 million recoveries and over a million deaths (9/2020), we believe that this may provide one of the fastest routes to market with follow-on adoption in cardiology with the final target being the Primary Care Physician office. The Covid-19 opportunity lies in the treatment of hospitalized patients as well as the possible uses of the rapid viscosity testing for older adults that have overcome the infection. Regrettably, it is likely that Covid-19 will remain in play for several years and, that new pandemics which result in blood plasma viscosity changes will arrive in the future, the way we have gone from SARS-1, to MERS, to Ebola to SARS-2.

A Covid-19-driven market of >$30 million annually is possible if testing is adopted for patients under treatment or who have recovered and have follow on care. Similarly, if such tests were performed in the cardiology arena, with annual surgeries of 500,000 for angioplasty (percutaneous coronary intervention), 450,000 stents inserted, and 400,000 coronary artery bypass grafts, and at

least five measurements taken during the hospital stay or follow-up visits per patient, the potential consumable revenues in the USA alone are $60 million. Worldwide the cardiac surgery consumables opportunity is potentially as large as $100 MM.

- **Biotechnology/Pharmaceutical Research Market**

Currently, sensitive detection assays are performed using methods such as electrophoresis and blotting, dynamic light scattering (DLS), nanoparticle tracking analysis (NTA), colour change reactions, and microfluidic methods which all have limitations such as the required sample volumes, requirements of low scattering, molecular charge, and processing times.

Electrophoresis is recognized as one of the most widely used identification and analysis technologies in pharmaceutical, life science and biotechnology laboratories. Electrophoresis can determine certain physical properties of biomolecules but is limited in application to charged biomolecules and requires relatively large amounts of material to perform the measurements.

The global market for electrophoresis equipment and supplies is currently $2.0 billion. The US represents the largest market for electrophoresis equipment and supplies worldwide while the Asia-Pacific market is expected to experience the fastest growth at a compounded annual rate of 5.3%.

Dynamic light scattering (DLS) systems supplied by a number of companies such as Horiba and Malvern are based on intensity correlations of scattered light. This instrumentation is limited to samples typically of the order of microliters and is plagued by large errors arising from low signals, multiple scattering effects, and samples which fluoresce. This market is currently a $200M dollar market with growth being driven by a multitude of applications, including the biosciences. Both the electrophoresis and dynamic light scattering (DLS) markets are experiencing growth due to:

- Proteomics research;
- Patent expiries of several drugs forcing pharmaceutical manufacturers to discover and develop new drugs;
- Increasing global demand for innovative drugs and therapies triggering drug discovery research; and
- Greater focus on research projects involving proteins, genes and associated biomolecules.
- Motivated by the potential for significant profits from the growth of this market, a number of companies (Hoefer, Bio-Rad Laboratories, Cleaver Scientific, Agilent, Thermo Fisher Scientific, Invitrogen and others) are introducing innovative systems with improved capabilities to meet the demands of scientists working in these growing areas.

The Solaris BiosSiences approach has the potential to shorten the entire process of identifying biomolecules and the determination of binding reactions critical to drug discovery by at least one order of magnitude with a million-fold reduction in required sample volumes and with extremely high sensitivities. The same basic approach with compact and directed purpose hardware and specific consumable nanoparticle kits can be implemented for point of care testing for viruses and other targets, potentially without the need for PCR.

This market is currently dominated by testing for glucose monitoring, cardio-metabolic markers, coagulation, pregnancy and fertility with a growing segment driven by the pandemic awareness now and in the future. The latter has the potential of rapid adoption by a large company partner if we can demonstrate that the platform is versatile and can be focused on specific targets by simply a change in the surface modified nanoparticles consumables. The current Point of Care market is $23 billion and is expected to reach >$36 billion by 2025 with largest growth in the USA and India with an average CAGR of >7%.

- **Licensing Model**

Validation of the technology for bio-fluid viscosity, assays, or drug discovery has the potential for significant licensing transactions with large established healthcare and diagnostics companies. The licensing approach for all or part of the product possibilities could lead to significant, multimillion dollar up-front payments for exclusive ownership of the patents which have a long remaining life of over 16 years, with additional intellectual property being filed for the consumables required.

Intellectual Property Protection:

Solaris BioSciences technology is protected by two issued USPTO patents and foreign fillings (USPTO 9,970,854 and 10,379,114, "Nondegenerate two-wave mixing for identifying and separating macromolecules). A report on the technology for use in assays using gold nanoparticle consumables was commissioned and prepared by Dr. Hadi Shafiee, at the Division of Engineering in Medicine, Brigham and Women's Hospital of the Harvard Medical School.
Dr. Shafiee is a recognized expert in assay technology and particularly as it relates to virus detection. In the report, he commented on the original nature of the technology:
"After surveying the academic and clinical literature, this technology represents a technique that has not seen use previously. In the current medical diagnostic market, there are not diagnostic systems or assays that utilize nondegenerate two-wave mixing approach with gold nanoparticles……."Successful application of nondegenerate two-wave mixing with gold nanoparticles for rapid particle size measurement, especially applied to a medical diagnostic device, may be considered non obvious"

Two additional complimentary patents are also part of the Solaris BioSciences IP portfolio (USPTO 7,355,704 and 7,684,035, "Chemical and biological sensing using metallic particles in and amplifying and absorbing media") and new patents are pending on the simultaneous rapid

measurement of viscosity and refractive index as well as integrated blood from plasma separation consumables for use with this aspect of the technology.

Solaris BioSciences Board of Directors:

Founder, Chairman, and Inventor of the Technology:

Dr. Nabil Lawandy received a PhD in Chemical Physics from the Johns Hopkins University in 1980. In From 1981 to 1997, Dr. Lawandy was a professor at Brown University in the Division of Engineering and Department of Physics. Professor Lawandy has published over 180 papers in peer reviewed journals holds over 100 published US and international patents in a number of applications spanning optical materials, processes, and devices. Dr. Lawandy is an Alfred P. Sloan Fellow, a recipient of a Cottrell Award, and a recipient of the Presidential Young Investigator Award, the Slater Foundation Innovation Award, and the Rolex Prize for his work on using Random Lasers for Photo-medicine. He is the founder and CEO of Spectra Systems Corporation, SpectraDisc Corporation and Solaris Nanosciences. In July of 2011, Dr. Lawandy and the Spectra management team successfully floated Spectra Systems on the AIM segment of the London Stock Exchange.

Non-executive Directors:

Dr. Mark Selker

Dr. Selker is currently CTO and Co-Founder of Jovea Labs, LLC. Before founding Jovea Labs, Mark was Vice President of R&D in the Bioprocessing equipment division of Thermo Fisher Scientific. Finesse Solutions, a company he helped co-found in 2005 was purchased by Thermo Fisher in 2018. Mark and his team developed the world's only viable phase fluorimetric single-use pH and dissolved oxygen sensors for large scale bioprocessing, including all the mechanical hardware, as well as the electronic boards, and associated firmware. Before co-founding Finesse, Dr. Selker was a visiting scholar at Stanford working on nano-scale plasmonic waveguides. Mark has worked in many other aspects of the optics industry including laser design, 40 Gb/s optical telecommunications, HFC networks, and nonlinear optics. Dr. Selker holds a BS in engineering from Brown University, an MS from University of Southern California and a PhD in engineering from Brown University.

Mr. Joshua Mandel

Joshua Mandel is a Healthcare Business Development and Product Marketing Executive who has worked at several leading pharmaceutical companies, including Novartis Oncology, Allergan, and Eisai. Joshua is currently Director of Business Development at MyTomorrows, a Dutch company helping patients with unmet medical needs discover and access treatments around the world. Joshua holds a BA with honors from Brown University, and received his MBA as an Austin Scholar from the Kellogg School of Management at Northwestern University

Solaris BioSciences Scientific Advisors:

Professor Anubhav Tripathi, PhD

Professor Tripathi's research group at Brown University develops new pathogen diagnostic platforms by integrating biological and engineering principles. This work has a broad impact on scientists, engineers, physicians, and entrepreneurs. He holds many patents, has over 120 peer-reviewed publications, and delivered more than 90 invited talks. He is a Fellow of the American Institute of Medical and Biological Engineering. Prior to Brown, Tripathi led the development of microfluidics chips for protein and DNA sizing at Caliper LifeSciences (now Perkin Elmer). This technology is sold in over one million chips a year. Tripathi earned a Ph.D. in Chemical Engineering from the City University of New York and was a Post-doctoral Fellow at Massachusetts Institute of Technology.

Professor and Chief or Cardiothoracic Surgery, Frank Selke, MD

Dr Sellke is the Karl Karlson & Gloria Karlson Professor and Chief of Cardiothoracic Surgery and Director of the Cardiovascular Institute at the Alpert Medical School of Brown University and Lifespan Hospitals. He previously served as the Johnson & Johnson Professor of Surgery at Harvard Medical School and Chief of Cardiothoracic Surgery at the Beth Israel Deaconess Medical Center, having been a successful clinician, educator and researcher in the cardiovascular field. His basic research focuses on microcirculation of the heart, brain and other organs as it relates to vasomotor regulation, permeability and collateral development. Dr Sellke has been continuously funded by the National Institutes of Health for the past 28 years. His clinical interests involve neurocognitive decline and other outcomes, quality improvement and reduction of inflammation, bleeding and transfusion after cardiac surgery. He has published over 540 papers and has an H-index of 92 with over 124,000 citations. He is the Associate Editor of the Journal of Thoracic and Cardiovascular Surgery and the Circulation Journal, and serves as a member of several other editorial boards. Dr Sellke is the Editor in Chief of the last 3 editions of Sabiston and Spencers' Textbook "*Surgery of the Chest*" and the Editor of the 1st and 2nd editions of "*Atlas of Cardiac Surgical Techniques*". He chaired the study section for the National Institutes of Health sponsored Cardiac Surgery Network and has served as the Chairman of its DSMB for the past 13 years, in addition to serving many other duties for the NIH. He has served as a full time member of the Surgery, Anesthesia and Trauma study section and the Bioengineering, Technology and Surgical Science Study section of the NIH. Dr. Selke received his B.A. from Wabash College and his M.D. from Indiana University Medical School. Dr. Selke also holds honorary degrees from Harvard University and Brown University.