BBB COMPANY BRIEF 2019

BBB inc. creates affordable blood testing technologies with mobile enabled tools and data insights.
History

2019. 03  Completed a Joint “Cancer Diagnostic Performance Verification Clinical Trial” with Seoul National University Bundang Hospital
2018. 10  Raised 16.5 million in Series B
2018. 07  Presented MARK B Technology at American Association for Clinical Chemistry (AACC) in Chicago, USA
2018. 03  ‘MARK B cancer’ Clinical testing and joint research with Seoul National University Bundang Hospital
2017. 11  Launched etemark dual check in Korea
2017. 08  Signed OEM contract with GenBody Inc. for supply of rapid test readers for arboviruses and drugs of abuse
2017. 06  Signed MOU with Korea University Guro Hospital to develop next-generation immunodiagnostic kit for cancer, myocardial infarction, and chronic disease
2017. 06  Signed MOU with Busan University to commercialize medical research and infrastructure
2017. 04  Signed OEM contract with Philosys Inc. for supply of glucometers for hospital use
2016. 08  Signed agreement with KT for use of etemark
2016. 08  Raised $5 million in Series A round
2015. 10  Winner of Zhongguancun Innovay "2015 Demo The World" in Smart Hardware Sector
2015. 05  Tech-In-Asia Award Winner @beGlobal Seoul 2015
2015. 04  Signed OEM contract with GreenCross MS for supply of in-vitro diagnostic devices for hospitals
2015. 01  Joined HAX Batch 6 program [HAX, Hardware startup accelerator based in Silicon Valley and Shenzhen]
2014. 10  Founded headquarters in Korea
Company Structure

Bio Lab.
- Biochemistry
- BioMEMS
- Biosensors
- Neuroengineering

Hardware Dev.
- Electrical design
- Mechanical design
- Firmware
- SCM

Software Dev.
- System software
- Application
- Back-end

Quality
- QA
- QC
- RA

Business
- Business dev.
- Marketing
- CS

Management
- Accounting
- HR
- PR

Production
- Production
- Production tech
01 Lab-on-a-chip Technology
Development of mobile blood testing device for self and point-of-care (POC) diagnosis
- Blood cell and plasma separation
  Membrane and capillary flow-driven microfluidic blood plasma separation device
- Biological sample manipulation and immunological analysis
  Electro-kinetic and magnetic force-based electrochemical immunological analysis

02 Nano/Micro-Processing Technology
Development of nano/microstructure production technology for low-cost mass production.
Production of plastic microfluidic chips and carbon nanoelectrodes

03 Biosensor Technology
Development of high-performance nano-biosensor materials and elements,
highly sensitive electro-chemicals, and optical sensor technology

04 Brain Stimulation Treatment Technology
Personalized treatment combining AI and AR that treat depression, obesity, and addiction
**BBB Vision**

Healthcare data integration & personalization ➤ Forecasting, Prevention, Early Detection

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**Data generation**
Healthcare data from the hospital, MARK B™, non-invasive monitoring devices and other products

**Data consolidation**
Healthcare data consolidation and personalization within BBB healthcare platform

**Prediction & prevention**
Artificial intelligence for early-stage diagnosis and the prediction and prevention of the most prevalent diseases

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**STEP1**

**STEP2**

**STEP3**

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bbbtech.com
Designed to be used anywhere at anytime, by anyone.
Quantitative immunoassay biosensor for prognosis management, for telemedicine, for emergency room, for bed-side test in ICU, and for home-use.
### Specification

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
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<tbody>
<tr>
<td><strong>Assay method</strong></td>
<td>Magnetic Sandwich immunoassay</td>
</tr>
<tr>
<td><strong>Detection method</strong></td>
<td>Electrochemical measurement</td>
</tr>
<tr>
<td><strong>key features</strong></td>
<td>Membrane-based power-free plasma separation. No centrifugal, dyeing, cultivation required</td>
</tr>
<tr>
<td><strong>Turnaround time</strong></td>
<td>3~10 minutes</td>
</tr>
<tr>
<td><strong>Sample / Volume</strong></td>
<td>whole blood 35µL, serum and plasma 20µL <em>for PSA test</em></td>
</tr>
<tr>
<td><strong>Limit of detection</strong></td>
<td><strong>Tumor Markers</strong>&lt;br&gt;PSA : 0.1ng/mL  CEA : 1ng/mL  AFP : 1ng/mL  CA19-9 : 1U/mL  CA125 : 1U/mL</td>
</tr>
<tr>
<td><strong>Data management</strong></td>
<td>Communication with LIS, HIS, and other external system</td>
</tr>
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Key Features

- A portable device that guarantees the accuracy of a laboratory equipment using magnetic fields and electrochemistry
- Works with whole blood drawn from a finger prick pioneering analyzer for home and emergency situation use (CLIA waiver)
- No pre-processing or reagents required power-free plasma separation
- Reduce test times, test fees, and equipment maintenance fees affordable, one-time-use chips
- A multi-parameter platform an antigen-antibody reaction that is compatible with all biomarkers
Lab-Quality results

**Accuracy Method comparison**  MARK B™ vs laboratory equipment (cobas e 801), High correlation with cobas e 801 ($r = 0.997$)
Electrochemical measurement system

MESIA: Magnetic Electrochemical Sandwich ImmunoAssay
MARK B™ utilizes MESIA, a patented technology of BBB inc.

1. Proteins in the plasma react with the magnetic nanoparticles
2. Magnetic field drives the nanoparticles toward the electrode to form immunocomplexes
3. Removal of unbound nanoparticles using magnetic fields
4. Measurement of electrochemical signal from the nanoparticles bound to the electrode
<table>
<thead>
<tr>
<th>Publication</th>
<th>Date</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Laboratory</td>
<td>August, 2019</td>
<td>&quot;Evaluation of MARK B™ for Quantitative Measurement of Three Tumor Markers: Prostate Specific Antigen, Alpha Fetoprotein, and Carcinoembryonic Antigen&quot;</td>
<td>Tumor marker assays have played a crucial role for screening cancers and monitoring cancer patients, as they reflect the status and prognosis of patients. Alpha fetoprotein (AFP), prostate specific antigen (PSA), and carcinoembryonic antigen (CEA) are the most commonly used tumor marker proteins. The MARK B™ immunoassay system is a novel platform based on magnetic nanoparticles and electrochemical immunoassay. <a href="#">read</a></td>
</tr>
<tr>
<td>Analytica Chimica Acta</td>
<td>March, 2019</td>
<td>&quot;MESIA: Magnetic force-assisted electrochemical immunoassays for quantification of prostate-specific antigen in human serum&quot;</td>
<td>We propose a new immunoassay technique, called magnetic-force assisted electrochemical sandwich immunoassay (MESIA), where serum biomarkers can be determined by magnetic actuation and electrochemical detection of gold-coated iron oxide nanoparticles as probes for immunocomplex formation. In MESIA, neither washing buffer nor fluidic parts are necessary, because the formation of immunocomplexes and the removal of unbound probes are controlled by magnetic forces. <a href="#">read</a></td>
</tr>
<tr>
<td>Biosensors and Bioelectronics</td>
<td>July, 2018</td>
<td>&quot;Magnetic force assisted electrochemical sensor for the detection of thrombin with aptamer-antibody sandwich formation&quot;</td>
<td>A magnetic force assisted electrochemical aptamer-antibody sandwich assay (MESA) was developed for the detection of thrombin as a model protein in serum samples. The MESA using the formation of sandwich complexes on the electrochemical sensor probe for reaction and the removal of unbound bioconjugates from the sensor surface without washing are controlled by a magnetic field. <a href="#">read</a></td>
</tr>
</tbody>
</table>
**Test Process**

1. **Insert Blood Sample**
2. **Plasma auto-separation**
3. **Analyzing**
4. **Test Result**

![Test Process Diagram]
**Roadmap**

**STEP 1  Cancer diagnostics and after-care**  
Point-of-care testing in the convenience of one’s home  
Share real-time results with personal health care providers for personalized after-care and treatment  
*Cancer markers : AFP, CEA, PSA, CA-125, CA-19-9*

**STEP 2  Convenient & affordable cardiovascular diagnostics**  
Convenient as a rapid test  
Affordable as diabetes monitoring  
*Cardiovascular markers : cTnl, Myoglobin, CK-MB, NT-proBNP, D-dimer, hsCRP, ST2, Galectin-3*

**STEP 3  Screening infectious diseases with high accuracy**  
High accuracy with low detection limits in Point-of-care testing  
*Infectious diseases marker : Dengue, Influenza A&B*

**STEP 4  Screening Thyroid, Metabolism disorders with high accuracy**  
Screening Thyroid, Metabolism disorders with high accuracy  
*Thyroid markers : TSH, T3, T4  *Metabolism markers : Ferritin, Vitamin D*

**STEP 5  Market for demand-based markers using blood testing platform**  
Development of Alzheimer’s biomarker  
Collaboration with pharma, biosensor companies  
*Alzheimer’s diseases : β Amyloid, τ protein*
Schedule for **CE. FDA. MFDS**

- **2020**
  - CANCER: PSA, AFP, CEA, CA125, CA19-9
  - CVD: Troponin I, Myoglobin, CK-MB, NT-proBNP, D-dimer, ST2, Galectin-3
  - INFECTIOUS: Dengue, Influenza A/B
  - SEPSIS: PCT, Interleukin 6, CRP
- **2021**
  - THYROID: TSH, T3, T4
  - METABOLISM: Vitamin D, Ferritin
  - ALZHEIMER’S: β amyloid, τ Protein

- **2022**

- **2023**

**Veterinary**
- cNT-proBNP, cTNI, cTnI, D-dimer
- cPL, fPL
- TSH, T4
- SAA, SDMA
- Heartworm, Parvo, Distemper, Corona
BBB Product 02.
elemark is

a smart medical device that empowers users to read and track their own blood biomarkers. With elemark, users can directly monitor major blood biomarkers (blood glucose, ketone-bodies, full lipid profile, etc.) to manage diabetes and chronic diseases. It also features elemark care, a data-sharing function that enables your family members to manage your health together, and your doctor to provide a more accurate diagnosis through deeper and enhanced insights.

* elemark dual check: Measures blood glucose and ketone bodies for diabetic patients [Released in Korea, Nov. 2017]
* elemark lipid check: Measures full lipid profile (including triglycerides and LDL) [Coming soon, H2 2018]
Multi-Platform elemark

elemark dual check
elemark + dual check module
Diabetes Care

elemark lipid check
elemark + lipid check module
Cardiovascular Disease Care
elemark dual check

Manage diabetes in a more systematic manner with the medical device, elemark dual check, an attachable module exclusive to elemark, that monitors glucose and ketone levels in the blood.

- Measure blood glucose and ketones
- Test time: Glucose 5 sec / Ketones 7 sec
- Automatically upload results to the cloud
- Creates data analysis charts
- Share your data with family and doctors
Manage chronic diseases, such as high blood pressure, hyperlipidemia, and arteriosclerosis at all times by measuring your lipid profile using the medical device, elemark lipid check, an attachable module exclusive to elemark.

Monitor full lipid profile
TC, TG, HDL, LDL
Reflectance Photometry
Results in 3 mins
Automatically save results
Health monitoring platform for long-distance family and elderly parents. Transmit data to the doctor for accurate diagnosis.
neurogear

No sounds . No vibrations . No side effects
A non-invasive medical device for the treatment of brain disorder

A non-invasive medical device for the treatment of brain disorder neurogear™ is a medical device intended to treat depression, OCD, ADHD, cognitive disorders, dementia, etc. Caregivers can use expert mode to customize treatments necessary for each patient. No audible or physical stimuli can be detected during its operation, allowing the patient to be entirely comfortable.
For treatment-resistant depression
Depression, anxiety, and emotional instability occur when balance of brain activity is offset. neurogear™ activated to restore the balance of the brain.

A non-surgical core brain stimulation
Present new possibilities for the treatment of Parkinson's disease
Brings significant improvement to patients
**Quadrupole electromagnetic structure:**

The neurogear™ has implemented a technique that can safely stimulate deep brain in a non-invasive way rather than a surgical procedure. The round headgear has eight electromagnetics in total, two in four directions. Through continuously changing the magnetism of each electromagnet to N and S pole, it builds up magnetic field stimuli on the specific region.

The result is activated nerve cells on the target. Stimulating deep brain is possible by operating eight electromagnetics at the same time so that meaningful stimuli are loaded on the deep brain.

**Clinical trials on effects on depression in progress**

- California Institute of Technology
- Chapman University
- The Catholic University of Korea
- Seoul St. Mary’s Hospital
No sounds
No vibrations
No side effects

A comfortable & safe treatment for the patients

No consumables
No side effects
Financially attractive business model

New option for healthcare professionals
Headset and Cradle. That’s all.