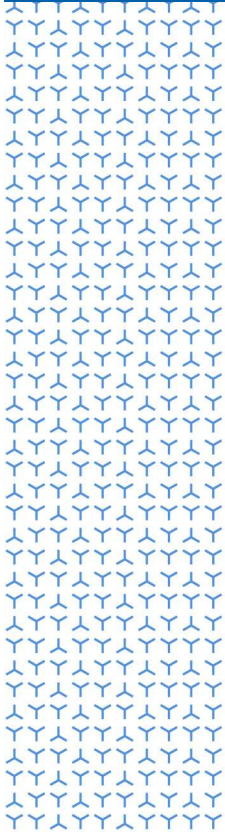


NIBR Translational Medicine



# **TM Digital Biomarker Themes**

## **Innovation Challenge for Novartis Country Organizations**

TW2010158384

# Background

- Novartis is scaling its digital transformation and aiming to build and grow our partnerships with the health tech ecosystem in Taiwan.
- We have defined high-impact research themes and needs related to Digital Biomarkers/Digital Endpoints
- We want to collaborate with the our local innovation ecosystems (e.g. Start-up companies, Universities) to create novel ways to collect and measure objective, quantifiable physiological and behavioral data by means of digital devices such as portables or wearables.
- Our goals are to strengthen Novartis' long-term partnership with the advanced innovation networks in Taiwan, create new collaboration opportunities, and accelerate the identification and integration of novel digital biomarkers into our early portfolio.

# **The technology we are looking for are:**

- Patient-centric, user-friendly, and easy to use at home (or in a clinical setting for selected categories)
- Able to gather data in a "passive" (i.e. no actions are needed from the subject) versus "active" way
- Able to quantify different aspects of our research themes in a short and simple way
- Accessible to patients in multiple locations (e.g. delivery via smart phone/iPad, or a wearable device)
- Already been substantiated through some peer-reviewed publications (preferred but not required)
- Compliant with globally-accepted Data Privacy regulation e.g. GDPR in Europe or HIPPA in US

**The potential partner should be open and willing to work with Novartis researchers in a confidential setting to share raw data, algorithms and analytics for mutual benefit.**

# Our Research Themes

- Cognition & attention
- Fatigue
- Sleep
- Depression & mood
- Pain
- Mobility
- Digital imaging of skin

# Our Research Themes

Category	Need Description
<b>Cognition &amp; Attention</b>	<ul style="list-style-type: none"> <li>• Measure Cognition via various physiological/ behavioral parameters and signals, e.g.               <ul style="list-style-type: none"> <li>– Eye movements</li> <li>– Voice</li> <li>– Measuring of interaction between a patient and a device</li> <li>– Game-ification of a physiological/ behavioral assessment</li> </ul> </li> </ul>
<b>Fatigue</b>	<ul style="list-style-type: none"> <li>• Measure different aspects of fatigue, e.g.               <ul style="list-style-type: none"> <li>– Continuous monitoring of physical activity, sleep and vital signs</li> <li>– Frequent measurements of mood and general cognitive status</li> </ul> </li> </ul>
<b>Sleep</b>	<ul style="list-style-type: none"> <li>• Multiple sensors to measure sleep, (e.g. sleep diaries)</li> <li>• Clinically-valid/objectively-derived sleep metrics, e.g.               <ul style="list-style-type: none"> <li>– Breathing rate during Sleep Apnea</li> <li>– Blood oxygen saturation via Photoplethysmography (PPG).</li> </ul> </li> <li>• Non-invasive (or minimally invasive)</li> </ul>
<b>Depression &amp; mood</b>	<ul style="list-style-type: none"> <li>• Measure multiple symptom domains of depression and changes in mood in patients' habitual/natural environment</li> </ul>

# Our Research Themes

Category	Need Description
<b>Pain</b>	<ul style="list-style-type: none"> <li>• Multiple sensors to measure pain directly or indirectly. e.g.               <ul style="list-style-type: none"> <li>– Behavioral and mood changes induced by pain</li> <li>– Physiological signals (e.g. heart rate, respiratory rate, body temperature or blood pressure)</li> <li>– Activity, fatigue, sleep or concentration</li> </ul> </li> <li>• Non-invasive</li> </ul>
<b>Mobility</b>	<ul style="list-style-type: none"> <li>• Quantitative measurements of mobility. e.g.               <ul style="list-style-type: none"> <li>– General mobility and gait</li> <li>– Gait asymmetry, knee and feet angle, Moments (of force)</li> </ul> </li> <li>• Two different types               <ul style="list-style-type: none"> <li>– Instrumented tests (in the clinic or at home)</li> <li>– Continuous monitoring of mobility (in the patients' habitual environment). Expected to be used by the patient over an extended period of time (eg. days, weeks or months).</li> </ul> </li> </ul>
<b>Digital imaging of skin</b>	<ul style="list-style-type: none"> <li>• Measure and evaluate specific aspects of skin conditions</li> <li>• Follow the progression of skin lesions over time.</li> <li>• e.g. skin lesion size, pigmentation.</li> </ul>