

# EEGlewave

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EEGlewave aims to provide a biomarker data management platform for concussion assessment and other sports health/performance metrics for sports organizations, athletes, and parents.

## Team members

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## 1. Executive Summary

EEGlewave was established with the objective to provide a total wellness management platform by integrating concussion assessment with other health and sports performance-related aspects. Despite clear evidence that brain injury can harm cognitive and social development, there currently is no clinical tool based on objective biomarker data that can accurately and reliably diagnose concussion and evaluate recovery, resulting in the unrecovered athletes who return-to-play with increased vulnerability to repeated concussions and potential damage to short-term and long-term brain health. EEGlewave's proprietary algorithm for converting EEG into concussion biomarker data will be core to this platform. Our mission is to build a database of concussion EEG and other wellness biomarker data that can be used by athletes and interested parties to take ownership of their own well-being, while also fostering awareness, education, and transparent understanding of risks.

Our products, services, and educational programming are distributed through a tier-based subscription model. Revenues are generated from premium plans, programming fees, and advertisement revenue. Growth will be driven by a franchising and JV model with companies in the sports social media and wearable technology space and by embedding our platform into their offering to gain access to their existing and projected subscriber base. We anticipate first revenue in Year 3 and a target of acquiring 1.5mm subscribers by the end of Year 5, with a 10% penetration rate of the subscriber base into our paid services. We expect breakeven to occur at the end of Year 5 with net income of 4.7mm on revenues of 9.6mm. Based on 10 years of projected cash flow and an investor IRR hurdle of 35% we see a potential enterprise value of USD 95mm with an exit after Year 5. We see the critical factors in implementation as sourcing of funding and human capital. Our ability to rollout the franchising and JV strategy with potential partners will be key to our success.

## 2. Market Analysis

### 2.1. Problem

Sports-related concussions in youth have potentially serious long-term negative impact on their developing brains, including increased risk of cognitive decline in later life. Consequently, there is an urgent need for objective, brain-based measures of concussion and severity within the spectrum of brain health. By high school, half of all student athletes have had sustained a concussion with estimates higher due to underreporting [1]. There is currently no accurate, objective concussion management database which allows biomarker data to be collected, stored, distributed, analyzed, and compared, while also providing athletes with the platform to monitor their own health and performance.

### 2.2. Market Need

There is a growing demand from sports fans and parents to hold sports organizations, coaches, and athletes themselves responsible for the athletes' well-being [2], with participation in high contact sports decreasing due to parental concerns and massive lawsuit payouts [3]. Through observations of the target market, we identified the following key needs: Schools and sports organizations need concussion management protocols which show parents and students that health and safety are prioritized; coaches and athletes need methods of assessing and monitoring the athletes' sports health, to optimize performance during gameplay and to ensure safety; parents want an objective method of monitoring and assessing the health and safety of their children.

### 2.3. Market Size

High schools in Canada and the USA are the target market. In the USA legislation involving concussion management is mandated not simply for athletes, but the entire student body. The number of public high school students in the United States alone is 15.0mm [4], with approximately 3.0mm students participating in high concussion risk sports [5] (see Table 1). Typical concussion assessments are priced at \$100 per patient [6], providing evidence of a potential market ranging from \$300mm to \$1.5b. The existing Brain Monitoring market is approximated to be 7.5b USD (2015) with significant growth [7], with an estimate of over 900 concussion clinics in the USA and Canadian market [6]. The Wearable Technology market is expected to reach 51.6b USD by 2022, with an AGR of 15.5% [8].

### 3. Competition

#### 3.1. How are Customer Needs Addressed Today

Existing needs for concussion assessment by sports organizations and physicians are met through baseline-based neurocognitive testing, such as SCAT3 and ImPACT, which have an unknown relationship to brain function and recovery. The use of these assessment methods may lead to athletes who have not fully recovered returning-to-play, subjecting them to higher risk of repeated concussions. This may lengthen recovery time and increase the severity of symptoms, resulting in detrimental consequences to their health and liability to schools and sports organizations.

#### 3.2. Environmental Scan

The product is currently overlapping 3 industry segments: Concussion Care, Sports Coaching and Performance, and Wearable Technology (see Figure 2). Key players in each of these industries and their overlap are shown in Table 2, with expected competition from players in the Concussion Care segment.

Traditional players in this segment include neurocognitive assessments such as SCAT3 and ImPACT. Upcoming players include concussion prevention technology and concussion assessment technology, such as Banyan Biomarkers (blood-based concussion testing), HeadCheck Health (concussion management and neurocognitive and balance testing tool), and Brainscope (EEG concussion assessment).

#### 3.3. Competitive Advantage

Our product provides the following competitive advantages: Higher reliability and objectivity than neurocognitive testing due to biomarker data collection, with support from scientific studies; Non-invasive assessment method, unlike Banyan which require the extraction of blood and potential inconvenience to user, along with the requirement of medical professionals, and; Concussion management web and mobile app integration with other wearable technologies encouraging user adoption relative to Brainscope.

### 4. Commercialization Plan

#### 4.1. Science / Technology Overview

The Concussion Assessment and Monitoring Application (CAMA) is an online tool that may be used by an organization to assess and monitor the brain health of its athletes. The tool comprises of an online database connected to the EEGlewave server, an EEG hardware system, and EEGlewave's proprietary algorithm for concussion assessment and monitoring (see Figure 1). EEG, other biomarkers, and neurocognitive assessment data collected from athletes may be inputted into the database and analyzed with the proprietary algorithm. Resultant information concerning the athlete's brain health would be returned to coaches, physicians, and athletes via web and mobile apps.

To encourage athlete use, data services for sports performance measures (e.g. heart rate monitoring) and statistical performance measures would be integrated into the mobile app. To increase initial adoption, EEG hardware and the web app would be distributed to schools free-of-charge. Discounted subscription models for the mobile app would be available to students and parents.

#### 4.2. Growth Strategy

Intellectual property of the proprietary algorithm is currently owned by UBC, with a license being granted to EEGlewave for commercial use and sublicensing. Other software infrastructure such as the database, web app, and mobile app would be developed separate from UBC and owned entirely by the Company.

Partnerships with EEG hardware manufacturers, other sports performance/health wearable technology manufacturers, concussion care providers, and sports social media platforms would be key to user base adoption strategy and reducing capital costs. Such partnerships would provide the necessary competitive advantage for the platform and rapid adoption from the target market. Consolidation or the creation of joint ventures would allow the Company to introduce its brand and develop a user base for its product, while also

providing access to human capital and intellectual property. Free-of-charge distribution of the platform at the school level would also increase the subscriber base at the individual athlete level.

#### 4.3. Milestones

Key milestones for the first 1.5 years include: **Jun 2017** – Obtain contract with EEG hardware manufacturer to provide hardware for initial customer testing and feedback; **Oct 2017** - Release of Web and Mobile App 1.0 for testing and feedback; **Dec 2017** – Obtain partnership with 5 high schools for testing and feedback and early adoption; **Mar 2018** – Obtain partnership with social media platform to increase adoption of target market; **Jun 2018** – Obtain partnership with 15 additional high schools for testing and feedback and release of Web and Mobile App 2.0 for integration with sports performance measures.

Key milestone of 1.5mm subscribers is set for Year 5, with the goal of breakeven. Significant costs would include equipment for software development and testing, office rental, and salary expenses. Marketing costs would be minimal through collaborations with other companies.

### 5. Financial Plan

#### 5.1. Financial Needs and Justification

Expected expenses for the initial year is \$300,000, including employee salary and depreciation. Years 2 and 3 expenses are estimated to be \$1,500,000, with expansion to 5 full-time employees by Year 3. The first 3 years would be key for software infrastructure development and entry into the target market. Projected subscriber numbers are 66,000 and 330,000 by the end of Years 3 and 4 respectively. Estimates are based on being able to leverage into subscription 25% of actual and projected subscribers of a sports social media platform startup that is currently at post Stage-A funding. Financial projections expect a total negative balance of \$1.3mm by Year 3, followed by a positive balance of \$2.9mm by Year 5 and \$103.6mm by Year 7, with revenue coming from 5 to 10% of the projected subscriber base which pays for premium services and advertising revenues from both paid and free subscribers. (See Figure 3 and Appendix B for more details.)

#### 5.2. Fundraising plan

Expenses would be matched through fundraising activities. Non-dilutive government funding such as IRAP (estimated \$500,000) would first be utilized, followed by debt and convertible funding. Once the Company has reached a level of maturity, investments through seed funding would be utilized to cover expenses. Partnerships and consolidation with other companies may also reduce expenses through shared resources.

#### 5.3. Exit

In the early stages of growth, the Company will grow through consolidation with other companies within the industry to increase human capital and decrease resource expenses. Acquisition of the Company by major industry players such as medical devices manufacturers (e.g. General Electric, Johnson's and Johnson's) or an IPO are potential exit strategies to increase shareholders' earnings through the selling of shares. Expected valuations at Years 6 and 8 are \$1.6 to \$3.7mm and \$16.6 to \$37.1mm with IRR ranging from 35% to 50%.

### 6. Team

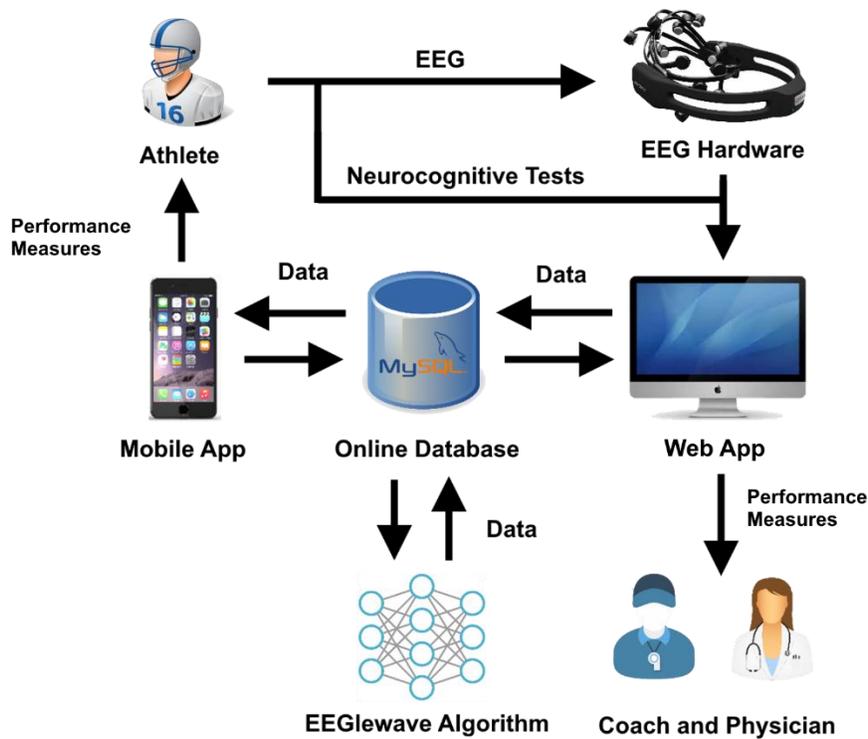
Saurabh, Research Associate at the Pacific Parkinson Centre, and Arnold Yeung, UBC Mechatronics Engineering Graduate, are currently CTO and CFO respectively. We are seeking additional members with the necessary expertise to join the management team for positions such as CEO and CMO. Future additions to the team include: James Lee, Principal at Markets Resources LLC, as an executive director and Eran Elizur, CEO at Ikomed Technologies Ltd., as an advisor or non-executive director. The Company will begin with 1.5 full-time employees, followed by an expansion to 5 and 10 employees by Years 4 and 5.

The Board of Directors currently consists of 3 position: President by Saurabh, Secretary by Arnold Yeung and Treasurer by Dr. Arif Babul, UVic Distinguished Professor of Physics and Astronomy (in lieu of Dr. Naznin Virji-Babul, UBC Assistant Professor of Physical Therapy).

**Table 1: Number of Participants in High-Risk Sports for 2014-2015 Season**

| Sport                     | # of High School Participants* |
|---------------------------|--------------------------------|
| American Football         | 1,085,182                      |
| Ice Hockey                | 45,293                         |
| Lacrosse                  | 193,235                        |
| Soccer                    | 808,250                        |
| Wrestling                 | 269,704                        |
| Competitive Spirit Squads | 128,450                        |
| Baseball                  | 487,770                        |
| <b>Total</b>              | <b>3,017,884</b>               |

\* Data is obtained from [5]



**Figure 1: Product components and interactions of the Concussion Assessment and Monitoring Application (CAMA)**



**Figure 2: Relevant industry segments**

**Table 2: Key Players in Associated Industry Segments**

| <b>Industry Segment</b>  | <b>Key Players</b>  |
|--|---|
| <b>Sports Coaching and Performance</b>                         | <ul style="list-style-type: none"> <li>• Individual sports coaching (e.g. schools, camps)</li> <li>• Cognitive training apps and games</li> <li>• Sports and fitness equipment</li> </ul>   |
| <b>Wearable Technology</b>                                     | <ul style="list-style-type: none"> <li>• EEG hardware systems</li> <li>• Virtual reality (VR) systems</li> <li>• Smartwatches</li> <li>• Medical devices (e.g. EKG, heart rate monitors, pulse oximeters)</li> <li>• Mobile phones</li> </ul>   |
| <b>Concussion Care</b>   | <ul style="list-style-type: none"> <li>• Physician’s assessment and recommendation (including concussion clinics)</li> <li>• SCAT4 and other editions</li> <li>• ImPACT (ImPACT Applications, Inc.)</li> <li>• Other neurocognitive tests</li> <li>• Banyan Biomarkers (blood-based concussion assessment)</li> </ul> |
| <b>Sports Coaching and Performance<br/>Wearable Technology</b> | <ul style="list-style-type: none"> <li>• Fitbit and similar devices</li> <li>• Moov Now (heart rate monitor catered towards sports performances)</li> <li>• Sensors and accelerometers to measure sports performance</li> </ul>   |
| <b>Sports Coaching and Performance<br/>Concussion Care</b>     | <ul style="list-style-type: none"> <li>• Physiotherapy and rehabilitation</li> </ul>  |
| <b>Wearable Technology<br/>Concussion Care</b>                 | <ul style="list-style-type: none"> <li>• Force Impact Technologies (mouth guards to detect impact)</li> <li>• Headcheck Health (accelerometer integration with neurocognitive tests)</li> <li>• Brainscope (EEG for concussion assessment)</li> </ul>   |

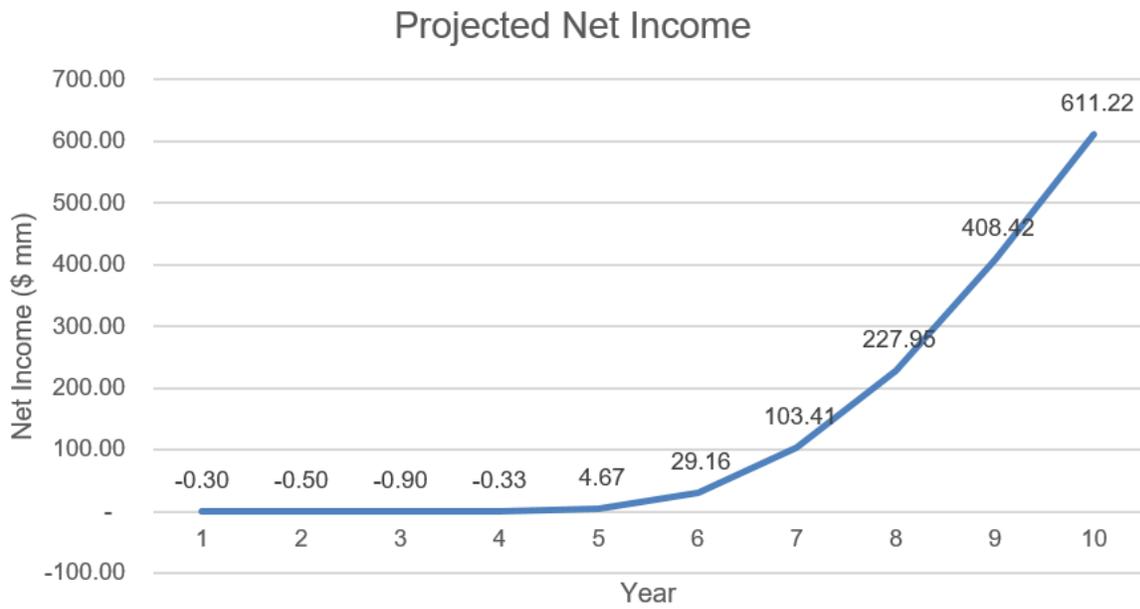


Figure 3: Financial projections over initial 10 years

## 8. Appendix B: Financial Projections

| <u>Users and Revenues</u>                                  | Year 1              | Year 2              | Year 3              | Year 4              | Year 5              | Year 6               | Year 7                |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------|-----------------------|
| Subscribers  | 1,000               | 11,000              | 66,000              | 330,000             | 1,485,000           | 5,197,500            | 12,993,750            |
| <i>Growth Rate</i>   | 1000%               | 500%                | 400%                | 350%                | 250%                | 150%                 | 75%                   |
| <i>% paid subscriber penetration</i>                       | 5%                  | 5%                  | 5.50%               | 7.00%               | 10.00%              | 11.00%               | 12.10%                |
| <i>revenue per subscriber (annual)</i>                     | 20.00               | 25.00               | 30.00               | 36.00               | 39.60               | 43.56                | 47.92                 |
| <b>Subscription Revenues for Paid Services</b>             | <b>1,000</b>        | <b>13,750</b>       | <b>108,900</b>      | <b>831,600</b>      | <b>5,880,600</b>    | <b>24,904,341</b>    | <b>75,335,632</b>     |
| <i>Advertising earnings per subscriber</i>                 | -                   | -                   | 1.00                | 2.00                | 2.50                | 3.00                 | 4.00                  |
| <b>Advertising Revenues</b>                                | <b>-</b>            | <b>-</b>            | <b>66,000</b>       | <b>660,000</b>      | <b>3,712,500</b>    | <b>15,592,500</b>    | <b>51,975,000</b>     |
| Other Revenues   |                     |                     |                     |                     |                     |                      |                       |
| <b>Total Revenues</b>                                      | <b>1,000</b>        | <b>13,750</b>       | <b>174,900</b>      | <b>1,491,600</b>    | <b>9,593,100</b>    | <b>40,496,841</b>    | <b>127,310,632</b>    |
| <u>Current Expenses</u>                                    |                     |                     |                     |                     |                     |                      |                       |
| <b>Operating Costs + UBC License Fees</b>                  | <b>772.50</b>       | <b>7,081.25</b>     | <b>62,358.45</b>    | <b>57,978.71</b>    | <b>2,479,555.41</b> | <b>8,558,553.51</b>  | <b>20,890,583.72</b>  |
| <i>% revenue subject to UBC License Fees</i>               | 75%                 | 50%                 | 35%                 | 25%                 | 15%                 | 15%                  | 15%                   |
| <i>UBC License fee rate</i>                                | 3%                  | 3%                  | 3%                  | 3%                  | 3%                  | 3%                   | 3%                    |
| UBC License fees   | 22.50               | 206.25              | 1,143.45            | 6,237.00            | 26,462.70           | 112,069.53           | 339,010.34            |
| <i>% variable expense ratio</i>                            | 75%                 | 50%                 | 35%                 | 30%                 | 26%                 | 21%                  | 16%                   |
| Variable operating and SG&A                                | 750                 | 6,875               | 61,215              | 451,742             | 2,453,093           | 8,446,484            | 20,551,573            |
| <b>Corporate</b>   | <b>197,500</b>      | <b>384,500</b>      | <b>788,250</b>      | <b>926,325</b>      | <b>1,568,853</b>    | <b>1,818,316</b>     | <b>2,115,870</b>      |
| <i>Headcount</i>   | 1.5                 | 3                   | 5                   | 5                   | 10                  | 10                   | 10                    |
| <i>Average cost per HC (fully loaded - office exp etc)</i> | 65,000              | 71,500              | 78,650              | 86,515              | 95,167              | 104,683              | 115,151               |
| Corporate Staff (fully loaded costs)                       | 97,500              | 214,500             | 393,250             | 432,575             | 951,665             | 1,046,832            | 1,151,515             |
| <i>Current Payment of Deferred Comp</i>                    |                     |                     |                     |                     |                     |                      |                       |
| Corporate Overhead and business development                | 100,000             | 170,000             | 395,000             | 493,750             | 617,188             | 771,484              | 964,355               |
| <i>Less: Other License and franchise fees/revenues</i>     |                     |                     |                     |                     |                     |                      |                       |
| <b>Non Cash Expenses</b>                                   | <b>100,000.00</b>   | <b>120,000.00</b>   | <b>226,000.00</b>   | <b>440,800.00</b>   | <b>872,640.00</b>   | <b>958,112.00</b>    | <b>896,489.60</b>     |
| <i>Deferred Comp and Incentive</i>                         |                     |                     |                     |                     |                     |                      |                       |
| <i>Depreciation and Amortization</i>                       | 100,000.00          | 120,000.00          | 226,000.00          | 440,800.00          | 872,640.00          | 958,112.00           | 896,489.60            |
| <b>Total Expenses</b>                                      | <b>298,272.50</b>   | <b>511,581.25</b>   | <b>1,076,608.45</b> | <b>1,825,103.71</b> | <b>4,921,047.91</b> | <b>11,334,981.39</b> | <b>23,902,943.44</b>  |
| <b>Net Income</b>  | <b>(297,272.50)</b> | <b>(497,831.25)</b> | <b>(901,708.45)</b> | <b>(333,503.71)</b> | <b>4,672,052.09</b> | <b>29,161,859.61</b> | <b>103,407,688.09</b> |

## 9. References

- [1] M. Field, M. Collins, M. Lovell and J. Maroon, "Does age play a role in recovery from sports-related concussion? A comparison of high school and collegiate athletes," *J Pediatr*, vol. 142, no. 5, pp. 546-553, 2003.
- [2] "Americans Growing More Concerned About Head Injuries in Football," The Harris Poll, 21 December 2015. [Online]. Available: <http://www.theharrispoll.com/sports/Football-Injuries.html>. [Accessed 23 January 2017].
- [3] J. Kosman, "Youth football may never be the same after this," New York Post, 8 March 2016. [Online]. Available: <http://nypost.com/2016/03/08/pop-warner-football-settles-concussion-lawsuit/>. [Accessed 24 January 2017].
- [4] "Fast Facts: Back to school statistics," National Center for Education Statistics, 2016. [Online]. Available: <https://nces.ed.gov/fastfacts/display.asp?id=372>. [Accessed 9 February 2017].
- [5] "2014-15 High School Athletics Participation Survey," National Federation of State High School Associations, 2016.
- [6] D. Gillmor, "Concussion business is booming, but players are still taking a hit," The Star, 7 June 2015. [Online]. Available: <https://www.thestar.com/news/insight/2015/06/07/concussion-business-is-booming-but-players-are-still-taking-a-hit.html>. [Accessed 14 December 2016].
- [7] "Brain Monitoring Market by Product (MRI, CT, PET, EEG, MEG, ICP), Procedure (Invasive, Noninvasive), Application (TBI, Stroke, Dementia, Headache, Epilepsy) & End User (Hospital, Neurological Center, Diagnostic, ASC, Ambulance) - Global Forecast to 2020," Markets and Markets, February 2016. [Online]. Available: <http://www.marketsandmarkets.com/Market-Reports/brain-monitoring-devices-market-909.html>. [Accessed 15 December 2016].
- [8] "Wearable Technology Market by Product (Wristwear, Headwear/Eyewear, Footwear, Neckwear, Bodywear), Type (Smart Textile, Non-Textile), Application (Consumer Electronics, Healthcare, Enterprise & Industrial), and Geography - Global Forecast to 2022," MarketsandMarkets.com, January 2017. [Online]. Available: [http://www.marketsandmarkets.com/Market-Reports/wearable-electronics-market-983.html?gclid=CNykwIKI\\_9ECFQ5EfgodGDgBNQ](http://www.marketsandmarkets.com/Market-Reports/wearable-electronics-market-983.html?gclid=CNykwIKI_9ECFQ5EfgodGDgBNQ). [Accessed 7 February 2017].