

# Case Study: Bacteria Combat

In 2015-2018, Game Doctor developed a new mobile game to educate teenagers on antibiotic resistance. In collaboration with University of Glasgow and developers in Dundee, Game Doctor developed Bacteria Combat, an engaging card battle game. Bacteria Combat multiplayer has received 3000 downloads since publication on Google Play and iTunes. The mobile game has been showcased at Glasgow Science Festival and Dundee Science Festival. User testing shows the game is an effective learning tool on antibiotics and bacteria.

## Background

Antimicrobial resistance (AMR) is a major health concern that kills approximately 700,000 people every year. One strategy to combat AMR is effective education of antibiotic users, namely young people who will be the future users of new medicines. However, the current generation of students, often termed 'digital natives' show significant changes in their media consumption behaviours. 83% of 12-15-year olds own their own smartphone and 77% play digital games. To engage the current students with science and STEM, we must adopt alternative strategies that include relevant technologies such as mobile games and immersive technology. To this end, Game Doctor aimed to develop an innovative and engaging mobile game to educate children and teenagers on AMR.

## Project Design

Game Doctor collaborated with microbiologists at University of Glasgow and developers at Future Fossil Studios to develop an educational game on AMR. For the first phase, learning outcomes were designed to inform product development, testing and evaluation. The learning outcomes of the game are: 1) Bacteria are not just germs; 2) There are both good and bad bacteria; 3) Antibiotics are not effective against resistant bacteria. For game design, the team aimed to use Top Trumps and Pokemon game mechanics to create a novel card battle game on microbiology. The key characters in the game were infectious bacteria (e.g. *Salmonella*, *Neisseria*, *E. coli*, *Campylobacter*, *Yersinia pestis*), probiotic/commensal bacteria (e.g. *Bifidobacteria*, *Lactobacillus*) and jokers cards (Antibiotics, Immune Cells). To defeat opponents, players use their strongest stat (strength, speed, resistance) or special power (Toxins, Slime production, Invisible to Immune System). The game was initially piloted as a card game to test learning outcomes and game mechanics. To develop the mobile game, four prototypes were developed and tested with end users to assess gameplay, user interface, learning and engagement. Bacteria Combat was published as a single player game in 2016 and as a multiplayer game in 2017/2018. The current version is a multiplayer mobile game that educates players on the properties of bacteria and antibiotic resistance.



**Bacteria Combat is a card battle game for tablets and iPads. Players battle against Bacteria Bot (single player) or against friends (multiplayer). Players enter the battle arena and use their top card to challenge opponents. Between battles, players are challenged with quiz questions.**

## Funding

Development of Bacteria Combat was funded by Microbiology Society, Society for Applied Microbiology, Biochemical Society, e-Bug Public Health England, University of Glasgow and Firstport Start-It Fund.

## Implementation

Bacteria Combat single player was published to iTunes and Google Play in 2016. The current version, Bacteria Combat multiplayer was published to iTunes in 2017 and Google Play in 2018. Bacteria Combat was also published as a web game for internet browsers in 2017. During development, Bacteria Combat prototypes were exhibited at a wide range of events including Glasgow Science Festival (2016), Glasgow Science Centre (2016), European Conference for Game-Based Learning (2017), Dundee Science Festival (2017), Worcestershire Skills Show (2019) and across schools in Scotland, London and Gloucestershire (2016-2018).

Game Doctor collaborated with e-Bug at **Public Health England** in 2017 and published the game on the e-Bug website to increase implementation and uptake in U.K and Europe.

## Reach and Impact

Bacteria Combat has received 3000 downloads on Google Play and iTunes application stores since its release. The app is rated as 4 stars and has been downloaded in over 20 countries including U.K, US, India, Iraq, Austria, Mexico and Malaysia. Bacteria Combat is being implemented as an educational tool internationally. Bacteria Combat web game was utilised in a microbiology module for Masters students at Drexel University by Dr Elise Mosser (2017-2018). In addition, the game has been implemented in a new module, *Games for Health* at Otego University created by Professor Yang (2019). Bacteria Combat was awarded a commendation at Herald Higher Education Awards in 2016. The game also featured on **Forbes 30 under 30** for Science and Healthcare in 2017.

## Evaluation

Evaluation carried out with 150 school students in Greater Glasgow (aged 9-12) showed that gameplay alone had the ability to change perceptions towards bacteria. Questionnaires completed after game sessions showed that 95% of students stated that bacteria were "interesting" compared to 5% who stated they were "boring". In addition, 55% of students stated that Antibiotics were "hit or miss" compared to 45% who stated that they were "amazing". 95% of students stated they would play the game again. Qualitative data also showed students enjoyed playing the game but wanted more cards to be available. Pilot testing of the multiplayer game at Worcestershire Skills Show showed that engagement is improved when students compete with friends rather than the computer. All feedback is being used to further develop the game into an online multiplayer platform including different classes of microorganisms (e.g. viruses, fungi).

## Featured Articles

- Enterprise: Game On. **Nature**. 2017
- Kids set for Bacteria Combat with launch of new App. **University of Glasgow**. 2015
- An Interview with Carla Brown. **Crastina**. 2015 Nov
- Bacteria vs Antibiotics? **Biochemical Society**. 2015
- App to teach children about antibiotic resistance. **The Scotsman**. 2015