

## Biofilm Growth Counters

15

6

10

14

5

9

13

2

4

8

12

1

3

7

11

**Aim of the Game:** Take it in turns to reach 15 biofilm growth counters for your microbe before your opponent (2-4 players). A game has three "Battles" - with best of 3 Battles determining the winner.

**Before the Game:** Design a Battle Card Deck supporting the growth of a choice of 3 microbe cards that you have selected. There can only be a maximum of 3 of each kind of card and between 25 - 30 cards. See page 8 for help! Print or draw out your game board (page 7).

**Before each Battle:** From your roster of 3 microbe cards, select and place your first microbe into your microbe zone at same time as your opponent. Every battle must start with a different microbe card.

**A Battle starts with 3 cards** in the hand from a shuffled Battle Card Deck. Try not to show your opponent your cards.

**A Turn starts by drawing a new card**, then grow your microbe's biofilm or disrupt your opponent's microbe's growth using any number of battle cards.



**At 10 biofilm growth counters** your microbe cannot lose more than 2 counters as a result of a growth penalty battle card (↓) (the biofilm has matured and become more resistant).

**At 15 biofilm growth counters**, your microbe wins the round and is ready to disperse. These can be monitored on your game board.

**A player also loses the battle** if they have no more playable cards after their battle card deck is empty.



## Microbe Zone

Load your microbe into this space for it to grow. Microbes stay in this zone unless moved by other means.

## Gene Modification Card Zone

Place up to 1 "Gene Modification" Battle Card at a time here to affect your microbe.

They stay active in this zone until your microbe leaves its "Microbe Zone". They can only be removed by the effect of another battle card, or microbe.



## Battle Card Zone

This Zone needs to be free to use Growth Promoting, Growth Penalty or General Active Cards.



## Environment Battle Card Zone

Place "Environment" Battle Cards here. It can only be replaced by a new environment battle card, or removed by another effect.



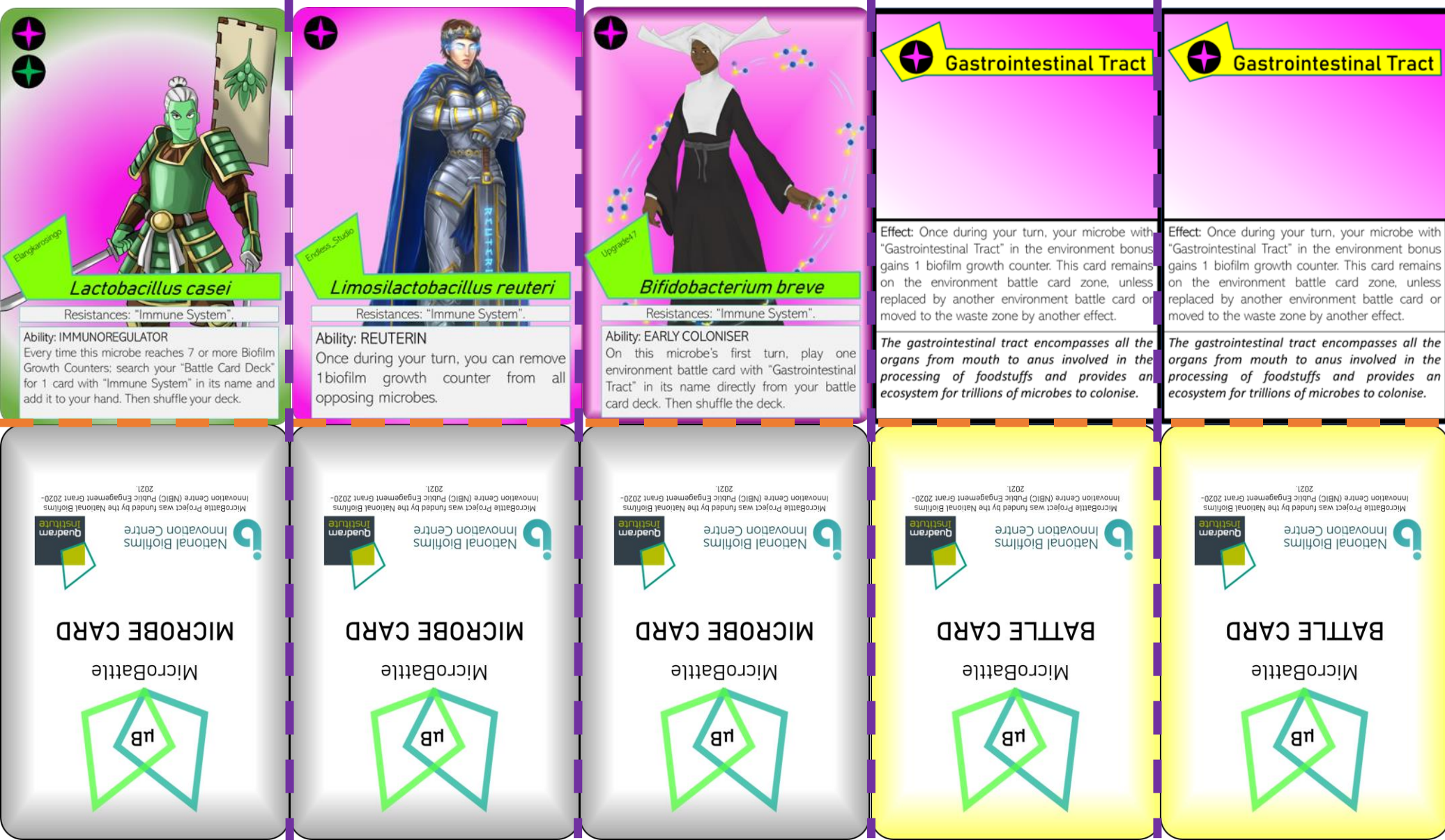
Waste Zone

## Battle Card Deck

Place a shuffled deck of Battle Cards face down. There can only be a maximum of 3 of each kind of card and between 25-30 cards.

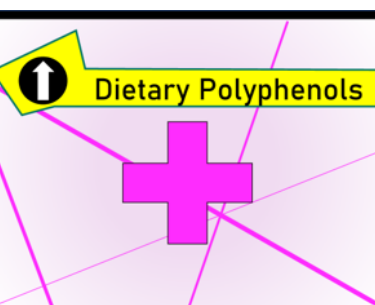
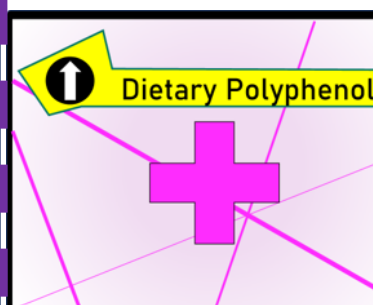
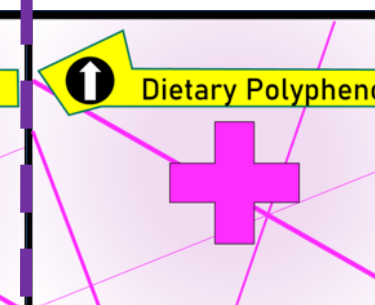

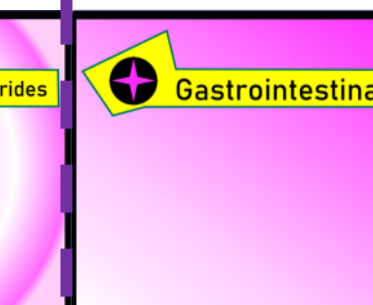
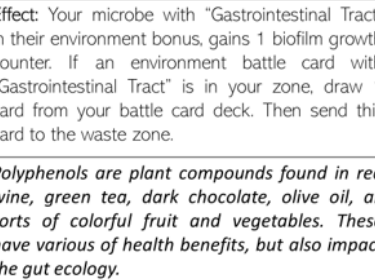
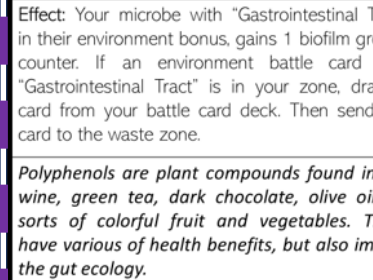
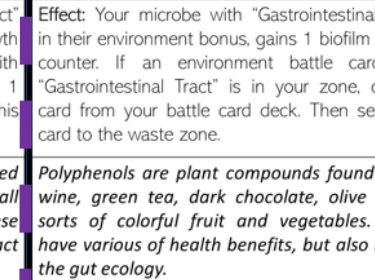
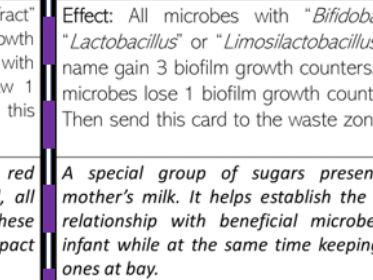
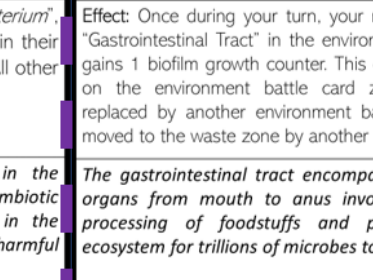
MicroBattle Project was funded by the National Biofilms Innovation Centre (NBIC) Public Engagement Grant 2020-2021.

DRAG and DROP microbe and battle card images from the MicroBattle card folder into the respective slots. Distortion of card size may occur, but after cutting and trimming they will be playable.



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 <p><b>Dietary Polyphenols</b></p> <p>Effect: Your microbe with "Gastrointestinal Tract" in their environment bonus, gains 1 biofilm growth counter. If an environment battle card with "Gastrointestinal Tract" is in your zone, draw 1 card from your battle card deck. Then send this card to the waste zone.</p> <p>Polyphenols are plant compounds found in red wine, green tea, dark chocolate, olive oil, all sorts of colorful fruit and vegetables. These have various of health benefits, but also impact the gut ecology.</p>	 <p><b>Dietary Polyphenols</b></p> <p>Effect: Your microbe with "Gastrointestinal Tract" in their environment bonus, gains 1 biofilm growth counter. If an environment battle card with "Gastrointestinal Tract" is in your zone, draw 1 card from your battle card deck. Then send this card to the waste zone.</p> <p>Polyphenols are plant compounds found in red wine, green tea, dark chocolate, olive oil, all sorts of colorful fruit and vegetables. These have various of health benefits, but also impact the gut ecology.</p>	 <p><b>Dietary Polyphenols</b></p> <p>Effect: Your microbe with "Gastrointestinal Tract" in their environment bonus, gains 1 biofilm growth counter. If an environment battle card with "Gastrointestinal Tract" is in your zone, draw 1 card from your battle card deck. Then send this card to the waste zone.</p> <p>Polyphenols are plant compounds found in red wine, green tea, dark chocolate, olive oil, all sorts of colorful fruit and vegetables. These have various of health benefits, but also impact the gut ecology.</p>	 <p><b>Human Milk Oligosaccharides</b></p> <p>Effect: All microbes with "<i>Bifidobacterium</i>", "<i>Lactobacillus</i>" or "<i>Limosilactobacillus</i>" in their name gain 3 biofilm growth counters. All other microbes lose 1 biofilm growth counter. Then send this card to the waste zone.</p> <p>A special group of sugars present in the mother's milk. It helps establish the symbiotic relationship with beneficial microbes in the infant while at the same time keeping harmful ones at bay.</p>	 <p><b>Gastrointestinal Tract</b></p> <p>Effect: Once during your turn, your microbe with "Gastrointestinal Tract" in the environment bonus gains 1 biofilm growth counter. This card remains on the environment battle card zone, unless replaced by another environment battle card or moved to the waste zone by another effect.</p> <p>The gastrointestinal tract encompasses all the organs from mouth to anus involved in the processing of foodstuffs and provides an ecosystem for trillions of microbes to colonise.</p>
 <p><b>BATTLE CARD</b></p> <p>MicroBattle</p>	 <p><b>BATTLE CARD</b></p> <p>MicroBattle</p>	 <p><b>BATTLE CARD</b></p> <p>MicroBattle</p>	 <p><b>BATTLE CARD</b></p> <p>MicroBattle</p>	 <p><b>BATTLE CARD</b></p> <p>MicroBattle</p>



# MicroBattle – Gut Symbiont Pack

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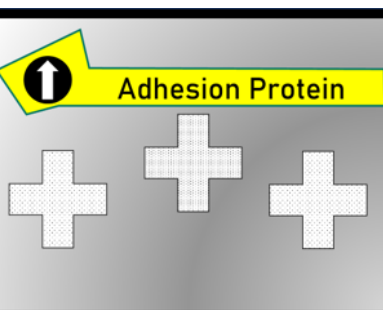

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 <p><b>Adhesion Protein</b></p>	 <p><b>Immune System - Phagocytosis</b></p>	 <p><b>Immune System - Phagocytosis</b></p>	 <p><b>Immune System - Innate Immunity</b></p>	 <p><b>Immune System - Phagocytosis</b></p>
<p><b>Effect:</b> If your microbe has 3 or less biofilm growth counters, your microbe gains 3 biofilm growth counters. Then send this card to the waste zone.</p> <p><i>Microbes can produce glycosylated proteins (coated in sugars) attached to the cell wall to adhere to surfaces and each other. Adhesion is an essential step in biofilm formation.</i></p>	<p><b>Effect:</b> Remove up to 2 biofilm growth counters from all microbes. All microbes affected also cannot gain biofilm growth counters until the start of your next turn. Then send this card to the waste zone.</p> <p><i>In the context of the immune system, phagocytosis is the means by which certain immune cells, like macrophages, can ingest and destroy pathogens as well as carry on further immunological processes.</i></p>	<p><b>Effect:</b> Remove up to 2 biofilm growth counters from all microbes. All microbes affected also cannot gain biofilm growth counters until the start of your next turn. Then send this card to the waste zone.</p> <p><i>In the context of the immune system, phagocytosis is the means by which certain immune cells, like macrophages, can ingest and destroy pathogens as well as carry on further immunological processes.</i></p>	<p><b>Effect:</b> If environment battle cards with "Infection" or "Gastrointestinal Tract" in their name are in your zone, remove up to 4 growth counters from all microbes in play. Then send this card to the waste zone.</p> <p><i>Innate immunity are a range of responses to potentially harmful players and maintaining defenses in a non-specific way.</i></p>	<p><b>Effect:</b> Remove up to 2 biofilm growth counters from all microbes. All microbes affected also cannot gain biofilm growth counters until the start of your next turn. Then send this card to the waste zone.</p> <p><i>In the context of the immune system, phagocytosis is the means by which certain immune cells, like macrophages, can ingest and destroy pathogens as well as carry on further immunological processes.</i></p>
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**Niche Occupation**

Effect: Add 1 "Environment Battle Card" from your deck to your hand and shuffle that deck. Then send this card to the waste zone.

*Organisms have often evolved to be highly adapted to a particular ecosystem and life cycle.*

**Chemotaxis**

Effect: If your microbe is at 3 biofilm growth counters or less, or 13 biofilm growth counters or more, apply the following effect: Draw 1 new card from your Battle Card Deck. Then send this card to the waste zone.

*Chemotaxis refers to mobility and navigation in the direction of a molecule of interest (nutrients, signals from other microbes or hosts). Whilst the mature biofilm is static there is movement at the beginning and end of the cycle.*

**Electrochemical Communication**

Effect: Shuffle 1 growth promoting (↑) battle card into your battle card deck. Draw 2 new cards. Then send this card to the waste zone.

*Microbes in a biofilm can signal electrochemically similarly to neurons. This can be to respond to external stressors and coordinate nutrient distribution.*

**Community Biofilm**

Effect: Discard 1 card from your hand to the waste zone to activate this card. Swap your current microbe with another one of your microbes retaining all growth counters and draw 1 new card from your Battle Card Deck. Then send this card to the waste zone.

*Mixed-species biofilms are the dominant form in nature leading to fascinating nutrient competition and communication dynamics.*

**Gene Modification - Resistance**

Effect: This card remains in the appropriate battle card zone and is associated with your microbe. When your microbe leaves its zone, this card is moved to the waste zone. Once during either player's turn in response to a growth penalty (↓) battle card, your microbe loses a maximum of 1 biofilm growth counter.

*Genes that provide resistances to anti-microbial compounds or improve survivability can be transferred from microbe to microbe. And so antibiotic resistances are a current health care crisis.*

**BATTLE CARD**

MicroBattle

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