

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.



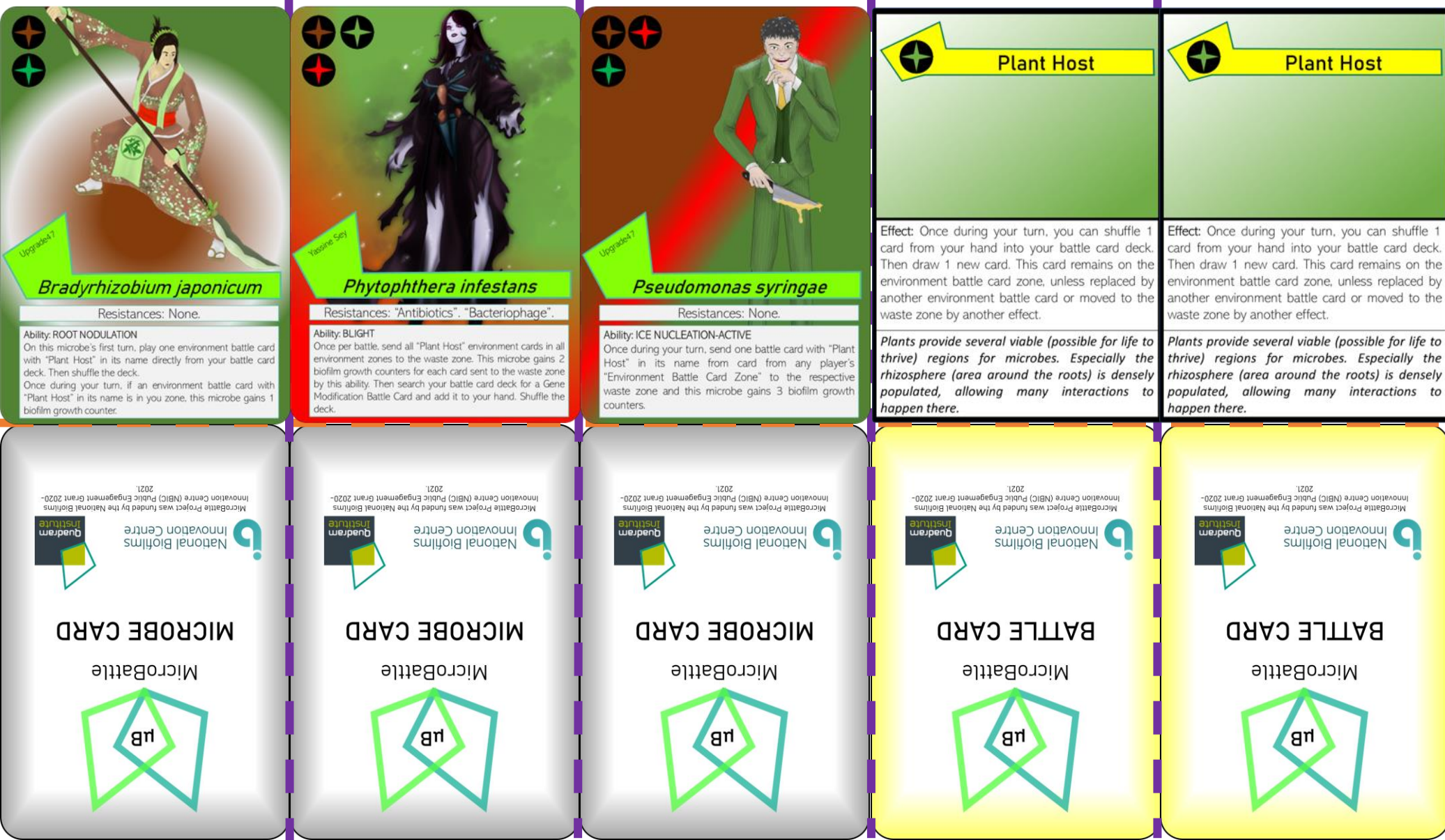
Waste Zone

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.



MicroBattle – Plant Microbe Pack

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<div><div><div>↑</div><div>Root Exudates</div></div><div></div><div><p>Effect: Your microbe with "Plant Host" in its environment bonus gains 3 biofilm growth counters. Other microbes with "Plant Host" in their environment bonus also gain 1 biofilm growth counter. Then send this card to the waste zone.</p><p><i>The rhizosphere (area around the roots of plants) is densely populated with microbes, which have been attracted by the nutrients exuded from the root.</i></p></div></div>	<div><div><div>↑</div><div>Root Exudates</div></div><div></div><div><p>Effect: Your microbe with "Plant Host" in its environment bonus gains 3 biofilm growth counters. Other microbes with "Plant Host" in their environment bonus also gain 1 biofilm growth counter. Then send this card to the waste zone.</p><p><i>The rhizosphere (area around the roots of plants) is densely populated with microbes, which have been attracted by the nutrients exuded from the root.</i></p></div></div>	<div><div><div>↑</div><div>Root Exudates</div></div><div></div><div><p>Effect: Your microbe with "Plant Host" in its environment bonus gains 3 biofilm growth counters. Other microbes with "Plant Host" in their environment bonus also gain 1 biofilm growth counter. Then send this card to the waste zone.</p><p><i>The rhizosphere (area around the roots of plants) is densely populated with microbes, which have been attracted by the nutrients exuded from the root.</i></p></div></div>	<div><div><div>★</div><div>Plant Host</div></div><div></div><div><p>Effect: Once during your turn, you can shuffle 1 card from your hand into your battle card deck. Then draw 1 new card. 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><i>Plants provide several viable (possible for life to thrive) regions for microbes. Especially the rhizosphere (area around the roots) is densely populated, allowing many interactions to happen there.</i></p></div></div>	<div><div><div>↑</div><div>Natural Reservoir</div></div><div></div><div><p>Effect: Your microbe with "Infection" in its environment bonus, gains 1 biofilm growth counter. If your environment battle card zone is empty, search your deck for an environment battle card and add it to your hand, then shuffle the deck. Then send this card to the waste zone.</p><p><i>Natural reservoirs are environments where disease-causing microbes (pathogens) can live and survive outside of their main infection target. The ability to live in multiple environments makes some pathogens very difficult to eliminate.</i></p></div></div>
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<div><div>1</div><div>Manure Fertilizer</div><div></div><div><p>Effect: Your microbe with "Soil" in its environment bonus gains 2 biofilm growth counters. For every "Manure Fertilizer" battle card already in the waste zone, add +1 biofilm growth counter. Then send this card to the waste zone.</p><p><i>Decomposing matter is an essential component for a healthy soil and can provide many nutrients and biomass for the microbial population.</i></p></div></div>	<div><div>1</div><div>Manure Fertilizer</div><div></div><div><p>Effect: Your microbe with "Soil" in its environment bonus gains 2 biofilm growth counters. For every "Manure Fertilizer" battle card already in the waste zone, add +1 biofilm growth counter. Then send this card to the waste zone.</p><p><i>Decomposing matter is an essential component for a healthy soil and can provide many nutrients and biomass for the microbial population.</i></p></div></div>	<div><div>1</div><div>Manure Fertilizer</div><div></div><div><p>Effect: Your microbe with "Soil" in its environment bonus gains 2 biofilm growth counters. For every "Manure Fertilizer" battle card already in the waste zone, add +1 biofilm growth counter. Then send this card to the waste zone.</p><p><i>Decomposing matter is an essential component for a healthy soil and can provide many nutrients and biomass for the microbial population.</i></p></div></div>	<div><div>1</div><div>Nitrogen Fertilizer</div><div></div><div><p>Effect: Your microbe with "Soil" or "Aquatic" in the environment bonus gains 2 biofilm growth counters. Then send this card to the waste zone. If there are 2 other "Nitrogen Fertilizer" cards in your waste zone, add one battle card with "Algal Bloom" or "Soil Nitrogen Cycle" in its name to your hand from your Battle Card deck and shuffle the deck.</p><p><i>Use of nitrogen fertilizers in farming to meet the global food demand sometimes upsets the soil's microbiological balance and can leach into the ground water reservoir and other aquatic environments.</i></p></div></div>	<div><div>1</div><div>Nitrogen Fertilizer</div><div></div><div><p>Effect: Your microbe with "Soil" or "Aquatic" in the environment bonus gains 2 biofilm growth counters. Then send this card to the waste zone. If there are 2 other "Nitrogen Fertilizer" cards in your waste zone, add one battle card with "Algal Bloom" or "Soil Nitrogen Cycle" in its name to your hand from your Battle Card deck and shuffle the deck.</p><p><i>Use of nitrogen fertilizers in farming to meet the global food demand sometimes upsets the soil's microbiological balance and can leach into the ground water reservoir and other aquatic environments.</i></p></div></div>
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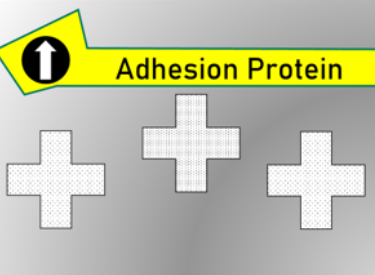

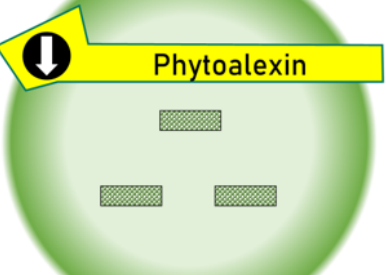
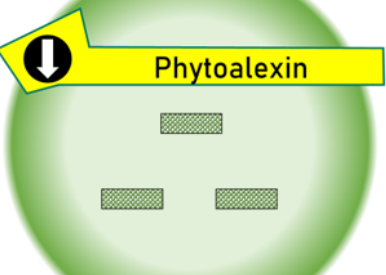
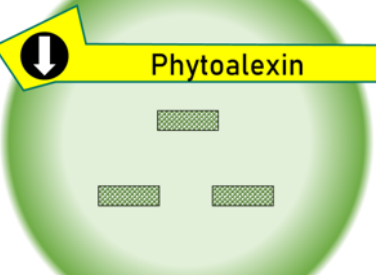
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 <p>Adhesion Protein</p> <p>Effect: If your microbe has 3 or less biofilm growth counters, your microbe gains 3 biofilm growth counters. Then send this card to the waste zone.</p> <p><i>Microbes can produce glycosylated proteins (coated in sugars) attached to the cell wall to adhere to surfaces and each other. Adhesion is an essential step in biofilm formation.</i></p>	 <p>Niche Occupation</p> <p>Effect: Add 1 "Environment Battle Card" from your deck to your hand and shuffle that deck. Then send this card to the waste zone.</p> <p><i>Organisms have often evolved to be highly adapted to a particular ecosystem and life cycle.</i></p>	 <p>Phytoalexin</p> <p>Effect: If an environment battle card "Plant Host" is in your zone, remove up to 3 biofilm growth counters from all opposing microbes. Then send this card to the waste zone.</p> <p><i>Phytoalexins are a group of antimicrobial compounds secreted by plants to combat pathogens, for example, capsidiol in pepper.</i></p>	 <p>Phytoalexin</p> <p>Effect: If an environment battle card "Plant Host" is in your zone, remove up to 3 biofilm growth counters from all opposing microbes. Then send this card to the waste zone.</p> <p><i>Phytoalexins are a group of antimicrobial compounds secreted by plants to combat pathogens, for example, capsidiol in pepper.</i></p>	 <p>Phytoalexin</p> <p>Effect: If an environment battle card "Plant Host" is in your zone, remove up to 3 biofilm growth counters from all opposing microbes. Then send this card to the waste zone.</p> <p><i>Phytoalexins are a group of antimicrobial compounds secreted by plants to combat pathogens, for example, capsidiol in pepper.</i></p>
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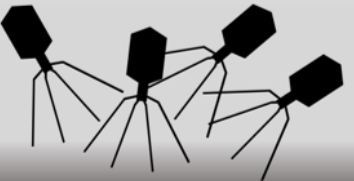

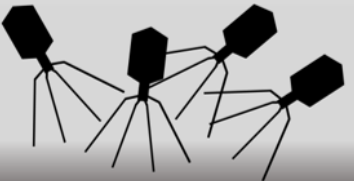







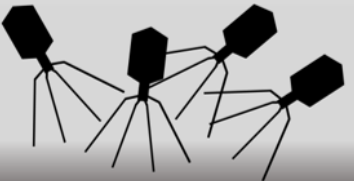
















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(1) Please trim white excess paper. (2) Fold along **Orange Line** and glue card backs together. (3) Cut along **Purple Lines** to separate cards after glue has set.

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.

<div><div></div><div>Bacteriophage</div><div></div><div><p>Effect: Choose and apply 1 of these 3 effects:</p><ul style="list-style-type: none">Remove 3 biofilm growth counters from all microbes.Add 1 "Gene Modification" active card from your battle card deck to your hand. Then shuffle that deck.Move 1 of your opponent's "Gene Modification" battle cards to the waste zone.<p>Then send this card to the waste zone.</p><p><i>Bacteriophages are viruses that infect bacteria and archaea. They use the host's genetic machinery, and sometimes a bit of the previous host's genomic DNA may get distributed.</i></p></div></div> <td><div><div></div><div>Bacteriophage</div><div></div><div><p>Effect: Choose and apply 1 of these 3 effects:</p><ul style="list-style-type: none">Remove 3 biofilm growth counters from all microbes.Add 1 "Gene Modification" active card from your battle card deck to your hand. Then shuffle that deck.Move 1 of your opponent's "Gene Modification" battle cards to the waste zone.<p>Then send this card to the waste zone.</p><p><i>Bacteriophages are viruses that infect bacteria and archaea. They use the host's genetic machinery, and sometimes a bit of the previous host's genomic DNA may get distributed.</i></p></div></div></td> <td><div><div></div><div>Niche Occupation</div><div></div><div><p>Effect: Add 1 "Environment Battle Card" from your deck to your hand and shuffle that deck. Then send this card to the waste zone.</p><p><i>Organisms have often evolved to be highly adapted to a particular ecosystem and life cycle.</i></p></div></div></td> <td><div><div></div><div>Gene Modification - Resistance</div><div></div><div><p>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.</p><p>Once during either player's turn in response to a growth penalty (↓) battle card, your microbe loses a maximum of 1 biofilm growth counter.</p><p><i>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.</i></p></div></div></td> <td><div><div></div><div>Gene Modification – Nutrient Transporter</div><div></div><div><p>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.</p><p>Once per turn, when your opponent plays a growth promoting (↑) battle card, your microbe gains 1 biofilm growth counter.</p><p><i>The competition for nutrients is strong in the microbial world. And so dedicated protein machinery for theft of other microbe's metabolic and growth by-products can be very advantageous...</i></p></div></div></td>	<div><div></div><div>Bacteriophage</div><div></div><div><p>Effect: Choose and apply 1 of these 3 effects:</p><ul style="list-style-type: none">Remove 3 biofilm growth counters from all microbes.Add 1 "Gene Modification" active card from your battle card deck to your hand. Then shuffle that deck.Move 1 of your opponent's "Gene Modification" battle cards to the waste zone.<p>Then send this card to the waste zone.</p><p><i>Bacteriophages are viruses that infect bacteria and archaea. They use the host's genetic machinery, and sometimes a bit of the previous host's genomic DNA may get distributed.</i></p></div></div>	<div><div></div><div>Niche Occupation</div><div></div><div><p>Effect: Add 1 "Environment Battle Card" from your deck to your hand and shuffle that deck. Then send this card to the waste zone.</p><p><i>Organisms have often evolved to be highly adapted to a particular ecosystem and life cycle.</i></p></div></div>	<div><div></div><div>Gene Modification - Resistance</div><div></div><div><p>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.</p><p>Once during either player's turn in response to a growth penalty (↓) battle card, your microbe loses a maximum of 1 biofilm growth counter.</p><p><i>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.</i></p></div></div>	<div><div></div><div>Gene Modification – Nutrient Transporter</div><div></div><div><p>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.</p><p>Once per turn, when your opponent plays a growth promoting (↑) battle card, your microbe gains 1 biofilm growth counter.</p><p><i>The competition for nutrients is strong in the microbial world. And so dedicated protein machinery for theft of other microbe's metabolic and growth by-products can be very advantageous...</i></p></div></div>
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