

Pharmageddon: Bugs vs Drugs

A medical education card-based game with simple rules, beautiful art, and lifesaving knowledge. Learn antibiotics using an endlessly replayable system that tests your knowledge beyond the means of flash cards and trivia-style questions. Decide when to play the best antibiotic to kill the most pathogens while inflicting the least side effects.

Ages: 16+

Play Count: 1 – 4 players

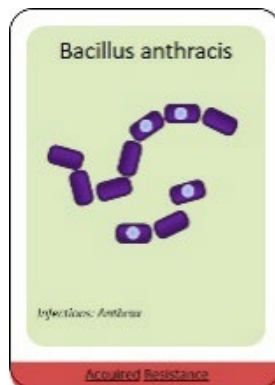
Playing Time: 20 – 30 minutes

Complexity: light – medium

Components:



65 Drug Cards



98 Bug Cards

62 Bug Cards
21 Syndrome Cards
17 Event Cards

OVERVIEW

OBJECTIVE

Pharmageddon is here. Cast off Occam's Razor and unifying diagnoses. The cause of the fever is not one bug a countless many! Your objective is to have killed the most Bug Cards at the end of the microbial onslaught. Be careful, though, get overzealous with your antibiotics and the side effects could do you in.

FOR SET UP & GAME PLAY SEE PAGE 5.

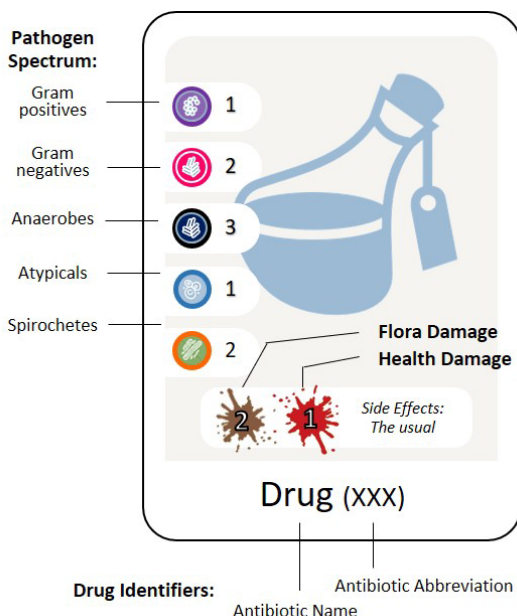
FOR 1 PLAYER MODE VARIATION SEE PAGE 7.

FOR 2+ PLAYER CO-OP MODE VARIATION SEE PAGE 8.

COMPONENTS

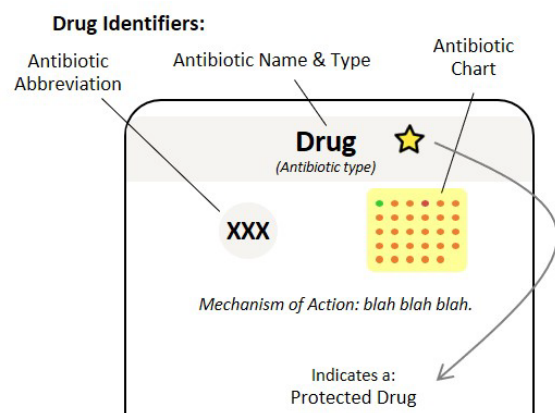
1. Drug Cards

Drug Cards are the antibiotic weapons used to stem the oncoming microbial tide. They are dealt out at the start of the game, and players may draw additional cards each round. One or two may be played by a player during their turn to kill invading pathogens (Bug Cards, see next Component). The image side of a Drug Card appears below:



Each Drug Card has the antibiotic's name and associated abbreviation listed at the bottom of the card. These are used to identify an antibiotic when determining efficacy against a Bug Card. To give a clue as to what pathogens a Drug Card may be effective against, a Drug Card's **Spectrum** is provided on the left of the card for each of 5 pathogen types: gram positives, gram negatives, anaerobes, atypicals, and spirochetes. Each pathogen type can have a score from 0-3 with 0 indicating no coverage and a 3 indicating significant but not necessarily complete coverage.

Each Drug Card has a section indicating **Flora Damage** and **Health Damage**. Flora damage is the collateral damage dealt to the body's normal protective flora which aid in the body's defense, helps metabolize nutrients and vitamins, and contribute to homeostasis. It is an estimate of the drug's *C. difficile* risk. Health damage is the collateral damage dealt to the body itself due to side effects of the drug. Deal too much Flora or Health Damage and you won't be able to play any additional Drug Cards (see Player Sheet, page 5).



The data side of a Drug Card provides additional identifiers including a locator for where the antibiotic can be found on the Antibiotic Chart.

Drug Limitations are listed at the bottom of the card but are only relevant in specific situations. These include drug formulations (IV vs PO) and use in pregnancy, children, and breast feeding. A **Protected Drug** star (★) indicates the Antibiotic Police caution against overuse (or else!)

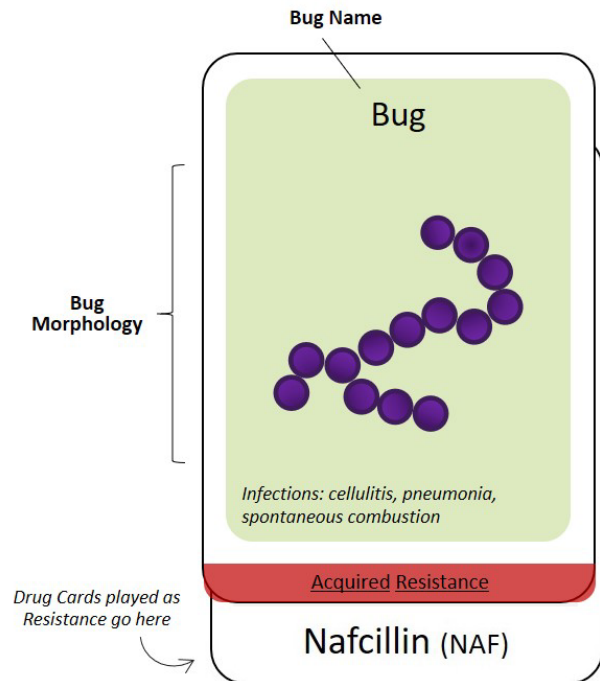
Resistance

Drug Cards may also be played another way, during an opponent's turn, as **Resistance**. In this situation it is played to block a Drug Card played by another player when they are trying to kill pathogens. The card must be played prior to flipping the Bug Card. If the Drug Card played is identical to or has shared resistance with the Drug Card played by the opposing player, it renders the pathogen being attacked resistant to that antibiotic. The pathogen is not killed, and the opposing player can no longer kill any additional pathogens. The opposing player's Drug Card is instead tucked underneath the now resistant pathogen's Bug Card to indicate it is resistant for all future rounds until killed. Resistance may not be played for all Drug Cards on all pathogens so educated guesses must be made. Further guidance is provided for each pathogen on the data side of its Bug Card (see next Component.) If a player attempts to play a Drug Card for Resistance and guesses wrong the opposing player may continue with their turn. The Drug Card is discarded to the game discard.

2. Bug Cards

Bug Cards are the enemy in Pharmageddon and also the means to victory. They are laid out image side up (see "Set Up" later) at the beginning of each round and must be eliminated through the strategic use of Drug Cards.

The image side of each Bug Card includes the organism's name and morphology which may provide clues on the appropriate Drug Cards to use. Each card also includes a section at the bottom of the card where Drug Cards played for Resistance are placed.



The data side of each Bug Card provides the Antibiotic Key for each organism which indicates which Drug Cards are effective (in green) and which are ineffective (in gray or red). A golden halo around any effective drug indicates that a Drug Card cannot be played for Resistance to it (see prior section). The dashed pink lines group related antibiotics together with shared resistance mechanisms. Any antibiotic within a pink lined group may be played as Resistance for any other antibiotic within that same group or any connecting group toward the left or above it if the groups are connected.

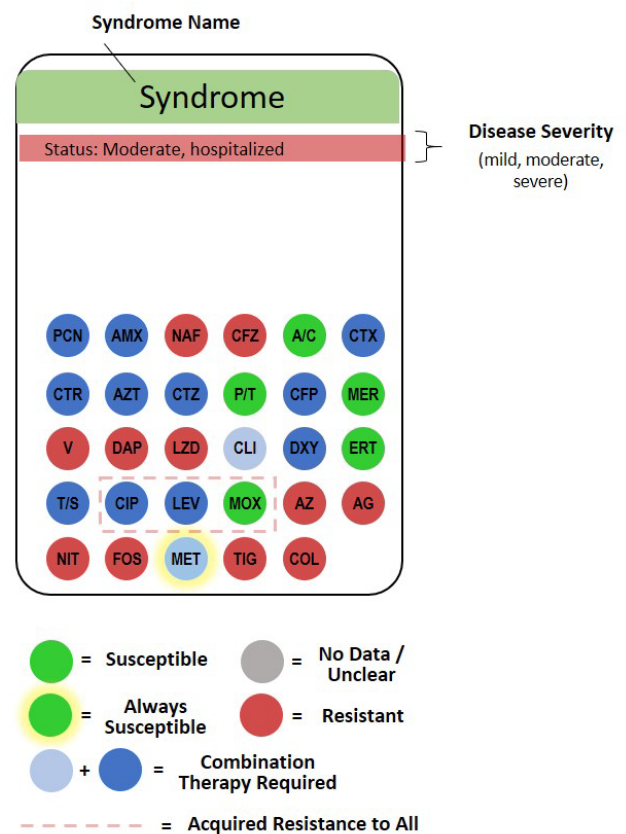


Example: a player plays a “Cefazolin” Drug Card, indicated by the CFZ in the Antibiotic Key, against this pathogen. Another player with a “Nafcillin” Drug card, indicated by NAF in the key, suspects the two antibiotics share resistance mechanisms for this pathogen so plays the “Nafcillin” Drug Card as Resistance. Since NAF and CFZ are both within the same dashed line group the pathogen is now resistant to all antibiotics within the group and the two antibiotics (PCN and AMX) in the group to the left of it. The pathogen is not killed, and the original Drug Card is placed underneath the Bug Card to indicate its resistance.

Note: for additional information on the “1st” and “DOC” superscripts see “Advanced Scoring” page 6.

There is an additional subclass of Bug Cards which represent common clinical syndromes like “Community Acquired Pneumonia” and “Animal Bite.” They are played the same way as standard Bug Cards but may sometimes require the use of two different antibiotics played

simultaneously to obtain adequate coverage of all pathogens commonly encountered in this syndrome. In such instances the antibiotics required for combination therapy are marked in dark blue and light blue. Some clinical syndromes may vary in their severity with different antibiotic regimens being necessary for mild or moderate to severe disease. The rest of the card is the same.



Hint: for mild, outpatient syndromes only oral antibiotics may be played!

Killing Pathogens

The whole point of the game is to kill pathogens. To kill pathogens a player must first select the Drug Card(s) they wish to play and pay the Flora and Health damage. They then select Bug Cards to kill from the game play area one at a time. If

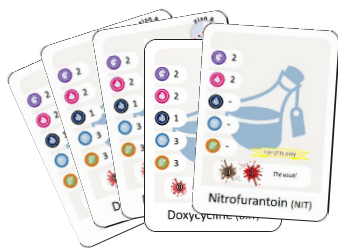
a player kills a pathogen, by matching their antibiotic to the Antibiotic Key on the Bug Card, they place the killed Bug Card in their victory pile and may continue killing additional pathogens until they guess wrong. If they guess wrong the Bug Card is placed back in the playing area. An opposing player may play a Drug Card for Resistance at any time prior to flipping the targeted Bug Card.

A few additional **Event Cards** can be found in the Bug Card deck either affecting the rules of play the round they are drawn, awarding a one-time instant bonus or penalty to one player in the game, or penalizing the player with highest antibiotic use.

3. PLAYER SHEETS

Players will need to track their **Flora** and **Health** via their **Player Sheet**, which can be accomplished through a simple pen and paper tally. Each player starts with 10 of both and subtracts damage to each as indicated on the Drug Card they play during their turn. A player cannot play a Drug Card if the damage inflicted to either Flora or Health would reduce it below 0. Flora and Health may only be replenished by playing a Drug Card for Recover (see page 6) during their turn. Each player's score is also recorded each turn on the Player Sheet.

Player hand



SETUP – Multiplayer Versus

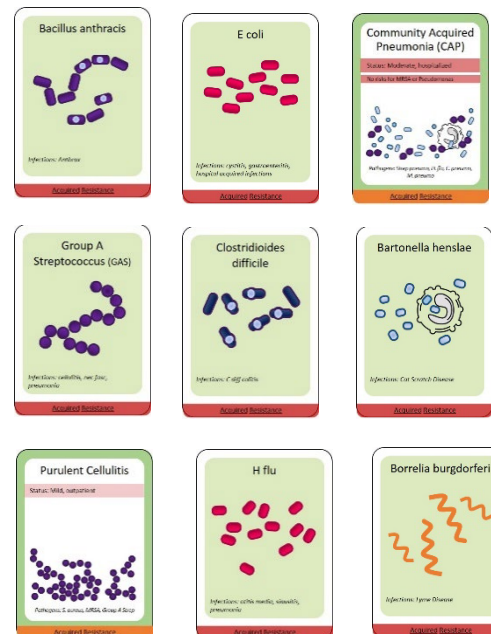
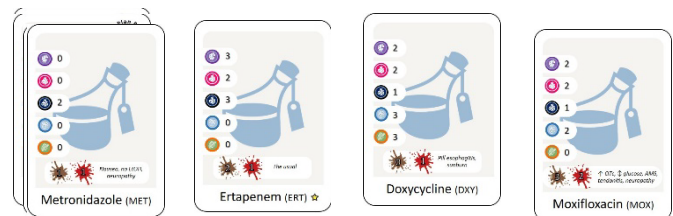
1. Shuffle & Deal Drug Deck

Shuffle the Drug Card deck and deal 5 cards to each player. Players may keep the cards private if they wish. Then place 3 additional cards image side up to the right of the deck nearby for future cards draws.

2. Shuffle & Place Bug Deck

Shuffle the Bug Card deck and place 9 cards image side up in the game play area in a 3 x 3 square. Then place the deck near the square for future card draws.

3. Assign First Player



Game play area

PLAYER TURN - Multiplayer Vs

A round is broken down into individual player turns. Each player plays sequentially though any player may play 1 of their Drug Cards for Resistance during another's turn.

1. Player takes 1 of 2 actions:

- Play 1 or 2 Drug Cards to kill pathogens
 - 2nd card costs 1 less flora damage
- **Recover** - Discard 1 Drug card to heal 3 damage (may be any combo of Flora and Health)

Note: Whenever a Drug Card is played for any reason it is discarded. If the card is played to kill pathogens, it is discarded to the player's personal discard. If it is played for Resistance, it is discarded to the game discard.

2. The player then draws Drug Cards from the 3 available or from the top of the deck till they have a hand of 5 again. Additional Drug Cards are then placed image side up next to the deck until there are 3 cards again.

- ❖ Twice per a game a player may "Call Pharmacy," and refresh all 3 Drug Cards if desired.

3. Player then places Bug Cards from the deck image side up in the playing area until the 3 x 3 square is refreshed.

Play then moves to the next clockwise player until all players have played 7 rounds.

SCORING

After 7 rounds have been played each player counts up their number of Bug Cards killed. The player with the greatest number is crowned Bug King (or whatever)!

--- ADVANCED SCORING OPTION ---

Each Bug Card killed during a turn by a drug with a superscript "1st" (1st line) in its Antibiotic Key is worth +1 and each "DOC" (Drug of Choice) is worth +2. Record this on the Player Sheet each round.

SOURCES

The antibiotic decisions for each pathogen are the cumulative result of multiple sources including *Principles and Practice of Infectious Diseases*, the 2019 Sanford Guide (bioavailability), Antimicrobe.org, UpToDate, and countless individual studies and reviews published over the decades available through PubMed. For ongoing conversations about any particular antibiotic combination please visit the Pharmageddon threads on studentdoctor.net and boardgamegeek.com.

ONE PLAYER MODE

In one player mode it is you alone against the germie hordes. There is no set number of rounds; you play until you finish your Bug Deck (deck size dependent on difficulty level) or your Bug Deck finishes you. Damage is also measured slightly differently in one player mode in addition to a few other rule tweaks below.

COMPONENTS

Drug Cards are played the same as in multiplayer versus mode though their initial setup and hand draw each round is slightly different (see respective sections below). Additionally, you may now play a Drug Card even if you cannot pay the damage costs in exchange for 1 Life (see below).

Bug Cards are played the same as in multiplayer versus mode. The initial set up and draw of Bug Cards each round is slightly different (see respective sections below).

Resistance is the same in practice, but without competitors there is no risk of another player playing a Drug Card for resistance against you. Instead, if you play a Drug Card against a Bug Card and fail, the top card on the Drug Card deck is added to the Bug Card as resistance if able.

Your Player Sheet is the same except that in addition to the 10 of both **Flora** and **Health** you start the game with you also start with 3 **Lives** which, if lost, end the game.



A Life can be lost if at any point another Bug Card cannot be added to the 3 x 3 grid or if your Flora or Health go < 0. If either your Flora or Health

would dip below 0 increase both back to 3 after subtracting the Life.

SET UP

1. Shuffle & Deal Drug Deck

Shuffle the Drug Card deck and deal yourself 5 cards. Then place the deck nearby for future cards draws.

2. Shuffle & Place Bug Deck

Count out number of Bug Cards for the desired difficulty level (see “Scoring” next page). Shuffle the Bug Card deck and place 3 cards image side up in the game play area in a 3 x 3 square. Then place the deck near the square for future card draws.

ROUND OVERVIEW

1. Player takes 1 of 2 actions:

- Play 1 or 2 Drug Cards to kill pathogens
 - 2nd card costs 1 less flora damage
- Recover

2. Player then may discard any number of Drug Cards from their hand prior to drawing from the top of the Drug Card deck till they have a hand of 5 again.

3. Player then places X Bug Cards per desired difficulty level (see “Scoring” next page) from the deck image side up in the playing area. If the 3 x 3 square becomes full the player may select 1 Bug Card already in play to replace with the new Bug Card. The player may do this for all of the new Bug

Cards if needed. The player must also cross off 1 (only 1) Life from their Player Sheet.

Play then resumes at the top of the round until the Bug Card deck is emptied or the player loses all 3 Lives.

SCORING

The game ends after the Bug Card deck has been emptied. If the player has been overtaken by plague and gonorrhea before then please send condolences to their family.

Difficulty	Draw	Deck Size
MS2	1 per turn	25
MS3		35
MS4		50
Lowly Intern	2 per turn	25
Lowly Resident		35
Master Chief		50
Junior Faculty	3 per turn	25
Professor At Large		35
Surgeon General		50
Antibiotic Wizard	3 per turn	All!

MULTIPLAYER CO-OP MODE

In multiplayer co-op mode it is you and a friend (or two) against the microbial masses. Play is a combination of the multiplayer versus and one player modes previous. There is no set number of rounds; you play until you finish your Bug Deck (deck size dependent on difficulty level) or your Bug Deck finishes you. Damage is also measured slightly differently in co-op mode in addition to a few other rule tweaks below.

COMPONENTS

Drug Cards are played the same as in multiplayer mode except you may play a Drug Card even if you cannot pay the damage costs in exchange for 1 Life (see “Lives” in One Player Mode).

Bug Cards are played the same as multiplayer mode except for the initial set up and draw of Bug Cards each round (see respective sections below) which is the same as one player mode.

Resistance is the same as in one player mode. If you play a Drug Card against a Bug Card and fail, the top Drug Card from deck is added to the Bug Card as resistance if able.

Your Player Sheet is the same as one player mode except that starting **Flora** and **Health** should be reduced to 6 for each player and cannot exceed 6 even with Recovery.

SET UP

1. Shuffle & Deal Drug Deck

Shuffle the Drug Card deck and deal 5 cards to each player. Players may keep the cards private if they wish. Then place 3 additional cards

image side up to the right of the deck nearby for future cards draws.

2. Shuffle & Place Bug Deck

Count out number of Bug Cards for the desired difficulty level (see “Scoring” in One Player Mode). Shuffle the Bug Card deck and place 3 cards image side up in the game play area across the top row in a 3 x 3 square. Then place the deck near the square for future card draws.

3. Assign First Player

ROUND OVERVIEW

1. Player takes 1 of 2 actions:

- Play 1 or 2 Drug Cards to kill pathogens
 - 2nd card costs 1 less flora damage
- Recover

2. The player then draws Drug Cards from the 3 available or from the top of the deck till they have a hand of 5 again. Additional Drug Cards are then placed image side up next to the deck until there are 3 cards again.

- ❖ Once per a game a player may refresh all 3 Drug Cards if desired.

4. Player then places X Bug Cards per desired difficulty level (see “Scoring” next page) from the deck image side up in the playing area. If the 3 x 3 square becomes full the player may select 1 Bug Card already in play to replace with the new Bug Card. The

player may do this for all of the new Bug Cards if needed. The player must also cross off 1 (only 1) Life from their Player Sheet.

Play then moves to the next player until the Bug Card deck is emptied or the players lose all 3 Lives.

SCORING

The game ends after the Bug Card deck has been emptied. Players may choose to additionally clear out the final 9 cards from the 3 x 3 square for additional scoring purposes if desired. Each player counts up their number of Bug Cards killed. The player with the greatest number is crowned Bug King (or whatever)!

Additional Practical & Clinical Notes

Resistance Patterns – For many organisms the antibiotic resistance patterns on the data side of the Bug Card accurately portrays all resistance transmission patterns commonly seen (for example *Staphylococcus aureus* produces a simple penicillinase which hydrolyzes Penicillin and Ampicillin / Amoxicillin, can possess a mutated *mecA* gene which provides resistance against all other beta-lactams except Ceftaroline, and a variety of separate resistance mechanisms for other classes blah blah blah.) For other organisms, however, primarily many of the gram negative enterics, the number of potential beta-lactamases produced is substantially greater and the transmission potential of multiple resistance genes from different antimicrobial classes through plasmids is also more common. As such while the Antibiotic Key for these organisms covers the most common and important resistance patterns it is not comprehensive. Although rare it is certainly possible to encounter an *Escherichia coli* which is Ceftriaxone-resistant, but not also Cefepime-resistant. **Be familiar with general resistance patterns, but always double check your susceptibility results.**

Duo Antibiotic Cards – In many cases two antibiotics are sufficiently similar from a pathogen coverage standpoint they are often considered interchangeable. Two examples of this are Cefazolin / Cephalexin and Ampicillin-Sulbactam / Amoxicillin-Clavulanate where the former is frequently considered the IV version of the latter (which is PO). From a practical perspective this is a very reliable shorthand. This is not always 100% true, however, and for highly complicated or severe infections it is always worth reviewing the medical literature to optimize care. Doxycycline, for example, can typically stand in for Minocycline in most cases, but for *Stenotrophomonas* and *Acinetobacter* Minocycline, though not an optimal agent, may be the better choice.

The Drug to Tissue Pipeline – Aside from choosing the right drug for the bug, the proper selection of an antibiotic involves drugs that can obtain the right concentrations for the bug as well. This includes how much drug is absorbed from the gastrointestinal tract (bioavailability), how much drug penetrates the target tissue (the CNS, bone, and prostate are particularly tricky areas to penetrate) and, in some cases, first pass metabolism in the liver. Sepsis and shock can further alter many of these variables as well. Due to the complexity involved these issues are not addressed. Also not addressed are when drugs are locally inactivated by molecules produced within the tissue (i.e. Daptomycin and surfactant in the lungs) or when drugs are altered by significant abnormalities within tissue chemistry (i.e. the Aminoglycosides in the low pH of most abscesses). Just remember that when making an antibiotic selection to also always ask, **“can I get enough drug to the bug?”** When in doubt your ID and pharmacy colleagues can help guide the way.

FAQ

Q: Do Event Cards count for end game scoring?

A: No. Although Event Cards can be found in the Bug Card deck, only Bug Cards count for end game scoring.

Q: When a Drug Card is played to kill Bug Cards, are the health and flora costs for paid once or each time a Bug Card is targeted?

A: The health and flora costs are paid only once.

Q: Are the health and flora costs for a Drug Card paid when played for Acquired Resistance?

A: No. Health and flora costs are paid only when playing a Drug Card to kill Bug Cards. Not for Acquired Resistance.

Q: When playing 2 Drug Cards can a card with 0 flora damage be played 2nd to reduce the 1st card's (and therefore total) Flora damage by 1?

A: No. The total flora damage from playing Drug Cards can never be less than any individual Drug Card.

Q: When counting starred Drug Cards for an Antibiotic Police event, are all starred Drug Cards counted or just the ones since the last Antibiotic Police event?

A: Only the starred Drug Cards played since the last Antibiotic Police event should be counted.