PHARMAGEDDON

BUGS VS DRUGS

Rule Book

OVERVIEW

OBJECTIVE

Pharmageddon is here. Cast off Occam's Razor and unifying diagnoses. The cause of the fever is not one bug but 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.

JUMP TO:

For video walkthroughs visit: https://www.youtube.com/@svenheimlich4070

COMPONENTS

1. Drug Cards

Drug Cards are the antibiotic weapons used to stem the oncoming microbial tide. One or two may be played during a player's turn to kill invading pathogens (Bug Cards, see page 4).

Each Drug Card has the antibiotic's unique abbreviation and its location on the Antibiotic Key. These features are used when checking activity 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 the five 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 causes its own **Flora damage** and **Health damage**. Flora damage is the collateral damage dealt to the protective flora that aid in the body's defense, help metabolize nutrients and vitamins, and contribute to homeostasis. In the game it is an estimate of the drug's *C. difficile* risk. Health damage is the collateral damage dealt to the body directly as side effects of the drug. If you accumulate too much Flora or Health damage, you won't be able to play any additional Drug Cards until you recover (see Player Sheet, page 6).

Drug Limitations are listed on the data side of the card but are only relevant in specific situations. These include drug formulations (IV vs PO) and restrictions related to use during pregnancy, in pediatric patients, and in breastfeeding patients. A **Protected Drug** star (☆) indicates that the Antibiotic Police caution against overuse (or else!)

Pathogen Spectrum:

Gram positives

Gram negatives

Anaerobes

Atypicals

Spirochetes

Drug Card

image side & data side:

Drug (XYZ)

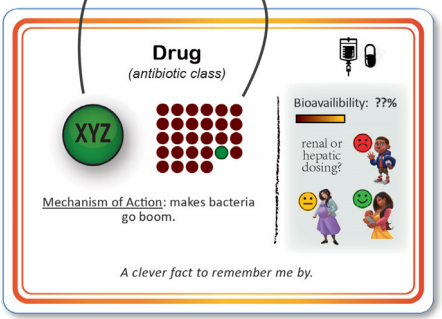
Drug Identifiers:

Antibiotic Name

Antibiotic Abbreviation

Antibiotic Abbreviation

Antibiotic Key



Drug Limitations

Resistance

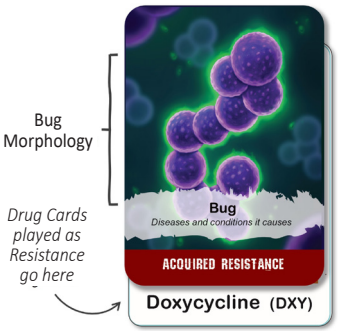
Drug Cards may also be played during an opponent's turn as **Resistance** to block the player trying to kill pathogens. If the card played is identical to, or has a shared resistance mechanism with, the card played by the opposing player, it makes the pathogen being attacked resistant to that antibiotic. The pathogen is not killed, and the opposing player's turn ends. The Drug Card played for Resistance is tucked underneath the now-resistant pathogen's Bug Card to indicate it is resistant for the rest of the game. 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 Bug Cards below.) If a player attempts to play a Drug Card for Resistance and guesses wrong, the opposing player may continue with their turn, and the Drug Card is discarded to the game discard.

Note: for a simpler game, Pharmageddon can be played without Resistance as well.

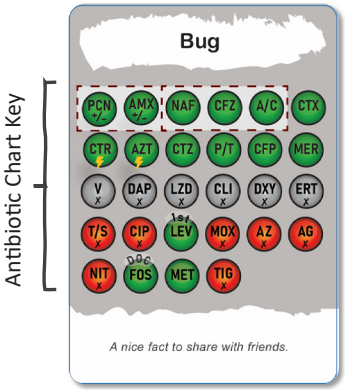
2. Bug Cards

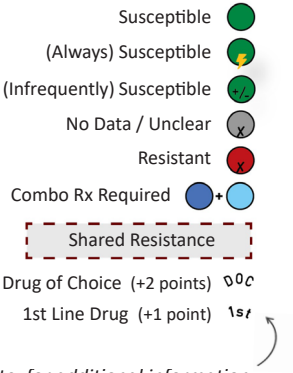
Bug Cards are the enemy in Pharmageddon and also the means to victory. They must be eliminated through the strategic use of Drug Cards.

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. Drug Cards played for Resistance should be placed underneath the Bug Card with the name of the drug visible below it.



The data side of each Bug Card provides the Antibiotic Key for each organism. The key indicates which Drug Cards are effective (in **green**) and which are ineffective (in **gray** or **red**). A lightning bolt indicates another Drug Card cannot be played for Resistance against it (see Resistance section). The dashed red lines group together related antibiotics with shared resistance mechanisms. Any antibiotic within a red-lined group may be played for Resistance against another, and the bug will become resistant to all antibiotics within that same group or within any connecting group to the left or above its group as long as the dashed lines 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 to the two antibiotics (PCN and AMX) in the group to the left of it. The pathogen is not killed and the "Nafcillin" Drug Card is placed underneath the Bug Card to indicate resistance.

If "Penicillin" had been played for Resistance, indicated by PCN, the play would have failed as CFZ is in a lined group to the right of PCN.

Note: for additional information on the "1st" and "DOC" flags see "Expert Scoring" on page 8.

There is an additional subclass of Bug Cards that represent common clinical syndromes like "Community Acquired Pneumonia" and "Animal Bite" instead of individual pathogens. They are played the same way as standard Bug Cards, but may require the use of two different antibiotics played simultaneously to eradicate all pathogens commonly encountered in this syndrome. In such instances, the antibiotics required for combination therapy are marked in **dark blue** and **light blue**. One of each must be played to kill the Bug Card. Some clinical syndromes may vary in their severity, with different antibiotic regimens being necessary for mild or moderate to severe disease.

Killing Pathogens

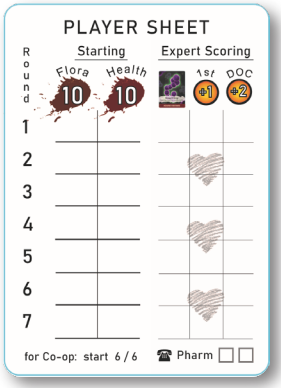
The whole point of the game is to kill pathogens for points. To kill pathogens, a player first selects the Drug Card(s) they wish to play and pays the Flora and Health damage. They then select Bug Cards to kill from the game play area, one at a time. A pathogen is killed if the antibiotic is susceptible (**green**) on the Antibiotic Key of the targeted Bug Card. They then place the killed Bug Card in their kill pile, and may continue killing additional pathogens until they guess wrong. If the drug is ineffective (**red** or **gray**), the Bug Card is placed back in the playing area. An opposing player may play 1 of their Drug Cards for Resistance at any time prior to the active player flipping the Bug Card.

A few additional **Event Cards** can be found in the Bug Card deck that affect the rules of play for the round they are drawn, award an instant bonus, or penalize 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 done through a simple pen and paper tally. Each player starts with 10 of both and subtracts damage to each as indicated on any Drug Card(s) they play during their turn. A player cannot play a Drug Card if the damage inflicted to their Flora and Health would reduce either score below 0.

Flora and Health may only be replenished by playing a Drug Card to Recover (see page 9) during a turn. If using expert scoring, each player's score is also recorded each turn on the Player Sheet.



REFERENCES

The antibiotic decisions for each pathogen are the cumulative result of multiple sources, including Principles and Practice of Infectious Diseases, the 2019 Sanford Guide, Antimicrobe.org, UpToDate, and countless individual studies and reviews published over the decades available through PubMed.

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Additional Practical Clinical Notes

Resistance Patterns – For many organisms, the antibiotic resistance patterns on the data side of the Bug Card accurately portray all resistance transmission patterns commonly seen. (For example, *Staphylococcus aureus* can produce a simple penicillinase that hydrolyzes Penicillin and Ampicillin / Amoxicillin and can possess a mutated mecA gene which provides resistance against all other beta-lactams except Ceftaroline.) However, for some organisms—primarily many of the gram negative enterics—the number of potential beta-lactamases produced is substantially greater, and the transmission of multiple resistance genes from different antimicrobial classes 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 spectrum of activity standpoint that 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. For example, Doxycycline can typically stand in for Minocycline in most cases, but for *Stenotrophomonas* and *Acinetobacter*, Minocycline is the better choice.

The Drug to Tissue Pipeline – Aside from choosing the right drug for the bug, the ability to achieve the right concentration of the drug for the bug is important as well. This includes how much drug is absorbed from the GI tract (bioavailability), how much drug penetrates the target tissue (the CNS, bone, and prostate are particularly tricky areas to penetrate), and vascular supply (or lack thereof) to infected tissues. Sepsis and shock can further limit oral absorption and tissue distribution as well. Due to the complexity involved, these issues are not addressed. Also not addressed are the local inactivation of drugs by molecules within tissue (e.g. Daptomycin and surfactant in the lungs) and the alteration of drugs by abnormal tissue microenvironment (e.g. Aminoglycosides in the low pH of abscesses). When making an antibiotic selection, just remember to always ask, “Can I get enough drug to the bug?” When in doubt, your ID and pharmacy colleagues can help guide the way.

Multiplayer Versus

Game Setup:

shared drafting area:
Always 3 Drug Cards + Deck

game
Drug Card
discard

each player:
5 Drug Cards
(in hand)

1 Player Sheet

shared
play area:
Always 3 x 3
Bug Cards

personal
Drug Card
discard

personal
Bug Card
kill pile

Multiplayer Versus

GAME SETUP

1 Shuffle & Deal Drug Deck

Shuffle the Drug Card deck and deal 5 cards to each player. Then place 3 additional cards image-side up to the left of the deck, also image-side up, for future card 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

Note: After a Drug Card is played, 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 Recover or for Resistance, it is discarded to the game discard.

ROUND OVERVIEW

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 one of the following actions:

- Play 1 or 2 Drug Cards to kill Bug Cards after paying **Health** and **Flora** costs
  - 2nd card costs 1 less Flora than indicated on card

OR

- **Recover** - Discard 1 Drug Card to heal 3 damage (may be any combo of Flora and Health)

2 Player then selects Drug Cards from the 3 available or from the top of the deck until they have a hand of 5 again. Additional Drug Cards are then placed image-side up next to the deck as needed until there are 3 cards in the shared drafting area again.

- Twice per game, each player may "Call Pharmacy," and refresh all 3 Drug Cards

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 continues clockwise 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 highest number is crowned Bug King (or whatevs)!

-- EXPERT 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.

ONE PLAYER MODE

In One Player mode, it is you alone against the germy hordes. There is no set number of rounds; you play until you finish your Bug Deck or your Bug Deck finishes you. Damage also impacts you slightly differently in One Player mode, and enough damage can end your game. These and other rule tweaks can be found 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 fully 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 drawing of Bug Cards each round is slightly different (see respective sections below).

Resistance is the same in practice, but without opponents, 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 susceptible.

Your **Player Sheet** is the same, except that in addition to the 10 Flora and Health you start the game with, you also start with 3 **Lives.** If you lose all 3 Lives, the game is over!

A Life is lost if, at any point, a Bug Card cannot be added to the 3 x 3 square, or if your Flora or Health go below 0. If either dip below 0, increase both back to 3 after crossing off 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 card draws.

2 Shuffle & Place Bug Deck

Count out the number of Bug Cards for the Bug Card deck for the chosen difficulty level (see "Scoring & Game Difficulty" on next page). Shuffle the Bug Card deck, and place 3 cards image-side up in the 3 x 3 game play area in any arrangement. Then place the deck near the square for future card draws.

ROUND OVERVIEW

1 Player takes one of the following actions:

- Play 1 or 2 Drug Cards to kill Bug Cards after paying **Health** and **Flora** costs
  - 2nd card costs 1 less Flora than indicated on card

OR

- Recover - Discard 1 Drug card to heal 3 damage (may be any combo of Flora and Health)

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

3 Player then draws X Bug Cards from the deck—depending on the chosen difficulty level (see "Scoring & Game Difficulty" next section)—and places them image-side up in the playing area. If the 3 x 3 square fills before all newly drawn cards are added, the player must cross off 1 Life from their Player Sheet. They then remove as many existing Bug Cards as needed to add the newly drawn Bug Cards.

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

SCORING & GAME DIFFICULTY

The game ends when the player empties the Bug Card deck, winning them the coveted title of the difficulty level they have completed. If the player has been overtaken by plague and gonorrhea before then, please send condolences to their family.

Players can gradually increase game difficulty level by increasing the starting Bug Card deck size and increasing the number of Bug Cards drawn from the deck each round.

Difficulty Levels (Co-op & Solo)

Difficulty	Draw	Deck Size
MS2	1 per turn	15
MS3		20
MS4		25
Lowly Intern	2 per turn	20
Lowly Resident		25
Master Chief		30
Junior Faculty	3 per turn	25
Professor		35
Surgeon General		50
Antibiotic Wizard	3 per turn	ALL!

MULTIPLAYER CO-OP

In Multiplayer Co-op mode, it is you and a friend (or more) against the microbial masses. Play is a combination of the Multiplayer Versus and One Player modes. There is no set number of rounds; you play until you finish your Bug Deck or your Bug Deck finishes you. Damage also impacts you slightly differently in Co-Op mode, and enough damage can end your game. These and other rule tweaks can be found below.

COMPONENTS

Drug Cards are played the same as in Multiplayer Versus mode, except you may play a Drug Card even if you cannot fully pay the damage costs in exchange for 1 Life (see "Lives" in One Player mode).

Bug Cards are played the same as in Multiplayer Versus mode, except for the initial set up and drawing of Bug Cards each round (see respective sections below), which is the same as in 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 the deck is added to the Bug Card as resistance if susceptible.

Your **Player Sheet** is used the same as in One Player mode, except that each player's starting Flora and Health are set at 6 and cannot exceed 6 at any point, even with Recover.

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 left of the deck for future cards draws.

2 Shuffle & Place Bug Deck

Count out the number of Bug Cards for the Bug Card deck for the chosen difficulty level (see "Scoring & Game Difficulty" in One Player Mode). Shuffle the Bug Card deck, and place 3 cards image-side up in the 3 x 3 game play area in any arrangement. Then place the deck near the square for future card draws.

3 Assign First Player

ROUND OVERVIEW

1 Player takes one of the following actions:

- Play 1 or 2 Drug Cards to kill Bug Cards after paying **Health** and **Flora** costs
  - 2nd card costs 1 less Flora than indicated on card

OR

- Recover - Discard 1 Drug card to heal 3 damage (may be any combo of Flora and Health)

2 Player then draws Drug Cards from the 3 available or from the top of the deck until 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 game, each player may "Call Pharmacy," and refresh all 3 Drug Cards.

3 Player then draws X Bug Cards from the deck—depending on the chosen difficulty level (see "Scoring" in One Player Mode)—and places them image-side up in the playing area. If the 3 x 3 square fills before all newly drawn cards are added, the player must cross off 1 Life from their Player Sheet. They then remove as many existing Bug Cards as needed to add the newly drawn Bug Cards.

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

SCORING

The game ends after the Bug Card deck is emptied, as in One Player mode. Players may kill off the final cards in the play area if desired.

FAQ

Q: Do Event Cards count for end game scoring?

A: No.

Q: When a Drug Card is played to kill Bug Cards, are the Health and Flora costs paid once or for each Bug Card 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 Resistance?

A: No. Health and Flora costs are paid only when killing Bug Cards.

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

A: No. The total Flora damage can never be less than any individual Drug Card. Good try though.

Q: When increasing Health and Flora after going below 0 and losing a LIfe, are both reset to 3 if one is already above it?

A: No. If one is 4+, it is not reset.

health	flora	Drugs of Pharmageddon Antibiotic					
1	1	Penicillin	3	1	1	0	3
1	1	Amoxicillin	3	2	1	0	3
1	1	Nafcillin	2	0	1	0	0
1	2	Amox-Clav	3	2	2	0	2
1	2	Pip-Tazo	3	3	3	0	0
1	2	Cefazolin	2	1	0	0	0
1	3	Ceftriaxone	2	3	1	1	3
1	3	Ceftaroline	2	2	0	0	0
1	3	Ceftazidime	0	3	0	0	0
1	3	Cefepime	2	3	0	0	0
1	2	Aztreonam	0	3	0	0	0
1	2	Meropenem	3	3	3	0	0
1	2	Ertapenem	3	2	3	0	0
2	0	Vancomycin	3	0	2	0	0
1	0	Daptomycin	3	0	0	0	0
2	0	Linezolid	3	0	1	0	0
1	3	Clindamycin	2	0	3	1	0
1	0	Doxycycline	2	2	1	3	3
3	0	Tigecycline	2	2	1	1	0
2	1	Trim-Sulfa	1	3	0	1	0
1	1	Azithromycin	1	2	0	3	3
3	1	Aminoglycosides	0	3	0	1	0
2	3	Ciprofloxacin	1	3	0	1	0
2	3	Levofloxacin	2	3	0	2	0
2	3	Moxifloxacin	2	2	1	2	0
1	0	Metronidazole	0	0	2	0	0
1	0	Nitrofurantoin	2	2	-	-	-
1	0	Fosfomycin	2	2	-	-	-

			Drugs of Pharmageddon **Antibiotic**	MRSA 	VRE 	PsA 	ESBL 
🙂	🙂	🙂	Penicillin				
🙂	🙂	🙂	Amoxicillin				
🙂	🙂	🙂	Nafcillin				
🙂	🙂	🙂	Amox-Clav				
🙂	🙂	🙂	Pip-Tazo			√	
🙂	🙂	🙂	Cefazolin				
🙂	🙂	😐	Ceftriaxone				
🙂	🙂	🙂	Ceftaroline	√			
🙂	🙂	🙂	Ceftazidime			√	
🙂	🙂	🙂	Cefepime			√	
🙂	🙂	🙂	Aztreonam			√	
🙂	🙂	🙂	Meropenem			√	√
🙂	🙂	🙂	Ertapenem				√
🙂	🙂	🙂	Vancomycin	√			
🙂	🙂	😐	Daptomycin	√	√		
😐	😐	🙂	Linezolid	√	√		
🙂	😐	🙂	Clindamycin	√			
☹️	😐	😐	Doxycycline	√			
☹️	😐	😐	Tigecycline	√	√		√
☹️	☹️	😐	Trim-Sulfa	√			√
🙂	🙂	🙂	Azithromycin				
☹️	🙂	🙂	Aminoglycosides			√	√
😐	😐	😐	Ciprofloxacin			√	√
😐	😐	😐	Levofloxacin			√	√
😐	😐	😐	Moxifloxacin				√
😐	😐	🙂	Metronidazole				
☹️	😐	😐	Nitrofurantoin	√	√		√
🙂	🙂	🙂	Fosfomycin	√	√		√

PHARMAGEDDON

BUGS VS DRUGS

A medical education card 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 at the right time to kill the most pathogens while inflicting the least collateral damage.

Ages: 16+
Play Count: 1 – 4 players
Playing Time: 20 – 30 minutes

Designer: Scott Crabtree MD, MPH
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Febrile
A Cultured Podcast

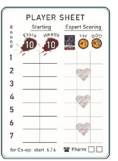
IDSTEWARDSHIP

Disclaimer: this is an educational game, and is not intended to be a point of care reference or replacement for clinical decision making.

Components:

65 Drug Cards
+
2 Rule Cards

103 Bug Cards
61 Pathogens
22 Syndromes
20 Events



50 Player Sheets
(double sided)