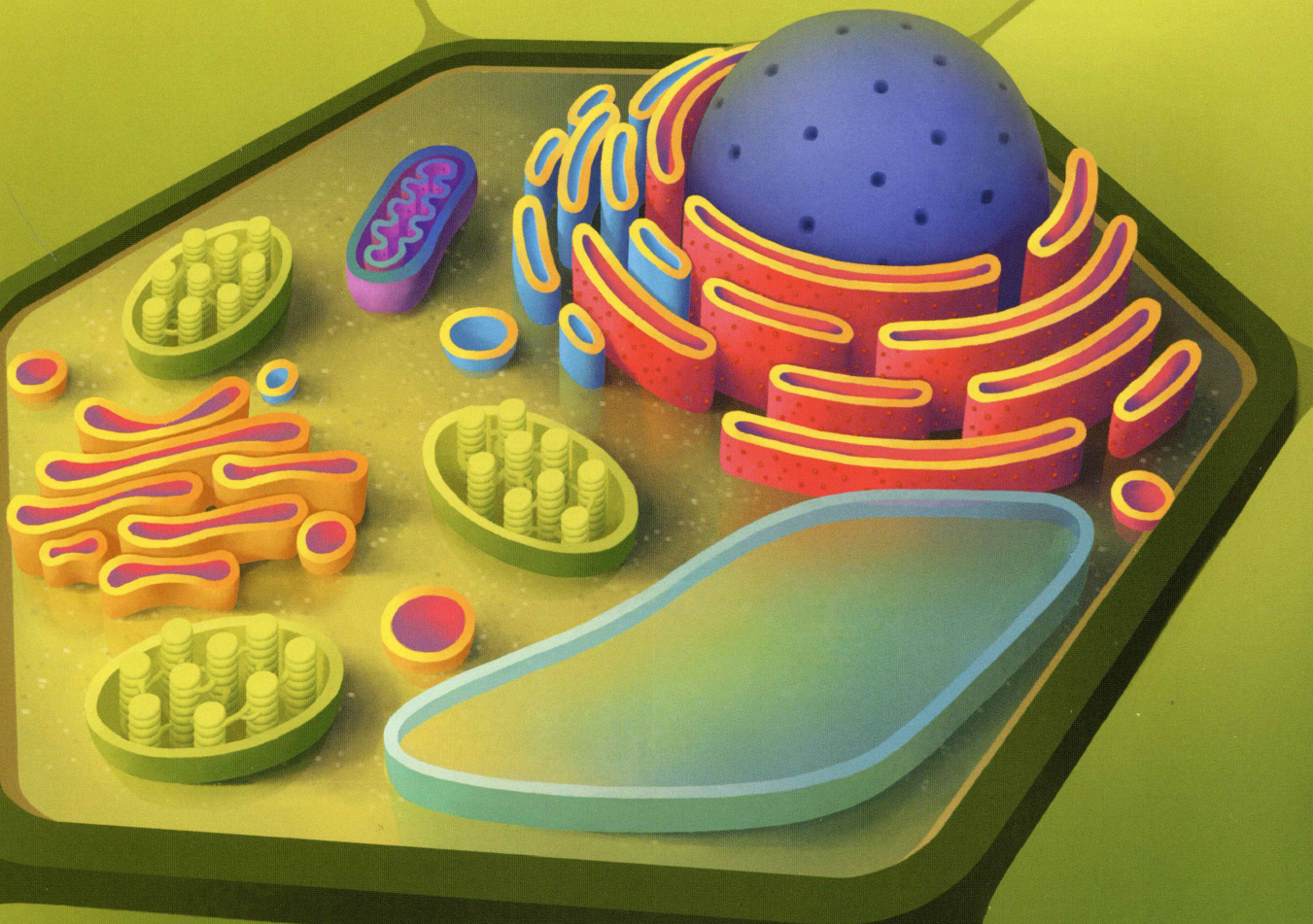


Rulebook

CELLULOSE

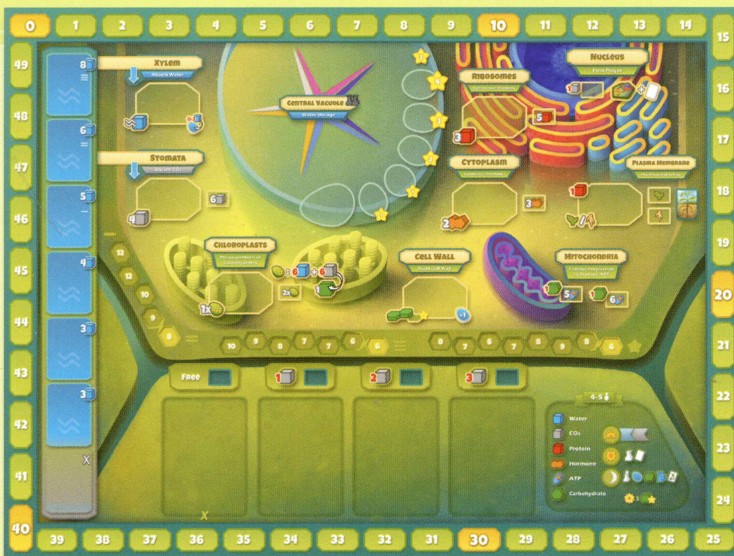
A Plant Cell Biology Game



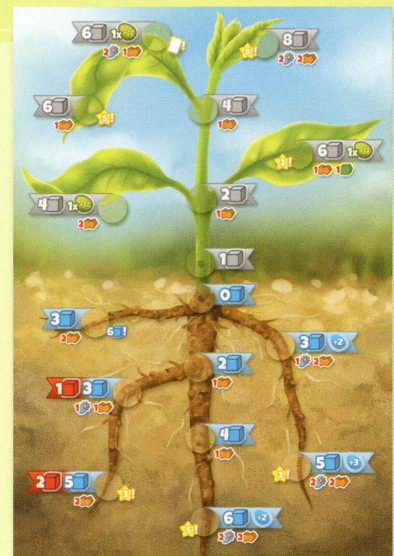
GAME OVERVIEW

Cellulose is a *worker placement* game set inside a plant cell. Players take turns activating organelles that contribute to the function and health of the cell. They will compete for limited access to water and other resources, carry out photosynthesis to produce carbohydrates, and release plant growth hormones to grow their plant's roots and shoots, giving them better access to resources on future turns. Players score points for building carbohydrates into the cell wall, for contributing water to the central vacuole, and for constructing cell components such as enzymes, starches, and protein storage vacuoles. The game continues until the cell wall is completed, and the player with the most points is the winner.

GAME COMPONENTS



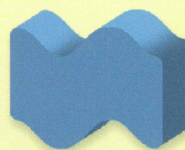
1 Double-Sided Game Board



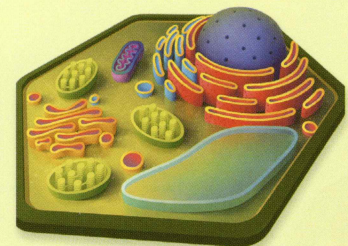
1 Double-Sided Plant Board



46 Cell Component Cards

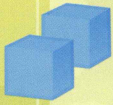


1 Water Level Marker

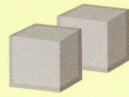


1 First Player Marker

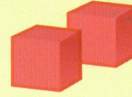
RESOURCE COMPONENTS



45 Water



30 CO₂



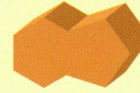
25 Proteins



8 6x Water



6 6x CO₂



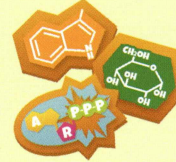
15 Plant Growth Hormones



25 Carbohydrates



25 ATP



8 Extra Resource Tokens

PLAYER PIECES



3 Action Markers



1 Health Point Marker



1 Central Vacuole Marker



2 Plant Growth Markers

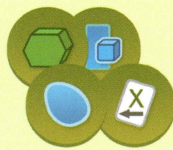


3 Gray Action Markers

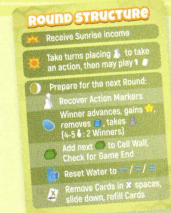
5 Sets of Pieces in Player Colors



2 Scenario Cards



4 Evening Phase Reminder Tokens



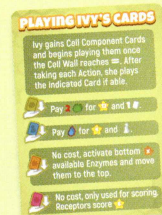
5 Player Aids



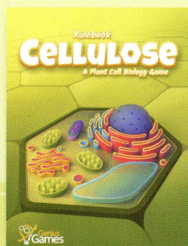
1 Double-Sided Solo Mat



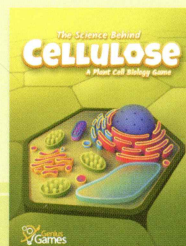
16 Solo Cards



1 Solo Aid






1 Rulebook



1 Science Behind Cellulose Booklet

GAME SETUP

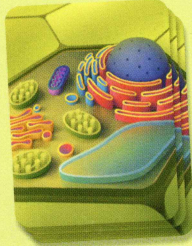
1 Place the **Game Board** in the center of the play area showing the side corresponding to the number of players (1-3  or 4-5 , shown in the lower-right corner). Place the **Plant Board** nearby with the "Sprout" side up, as shown. (4  example setup shown.)

Scenario Play and Solo Mode
For Scenarios and the Mangrove Board, see p. 20. For Solo Play, see pp. 21-27.







8 Optionally, assign players the **4 Evening Phase Reminder Tokens** to ensure that all Evening Phase Steps are completed each Round.

You are now ready to play Cellulose!



7 Shuffle the **Cell Component Cards**, and place the deck face down next to the board, with room for a discard pile. Place 4 Cards face up onto the spaces on the board.

2 Place the **Water Level Marker** on the starting space of the Water Level Track, indicated by  [5 Water].

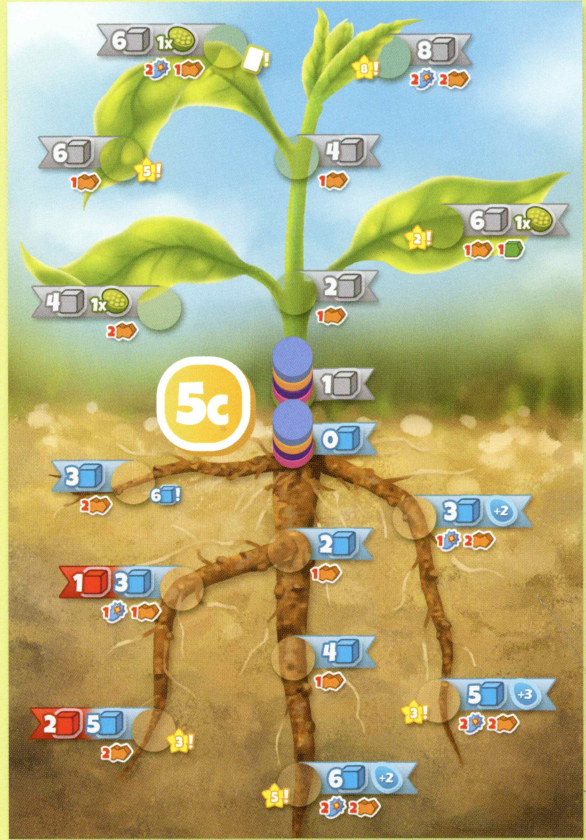
3 Place 1 Gray Action Marker (1-3 ) or 2 Gray Action Markers (4-5 ) next to the Central Vacuole for the Central Vacuole Majority Reward. 



6 Give the **First Player Marker** to the last one to water a plant (or decide randomly). Play will proceed clockwise from this player, and subsequent players are given the following starting resources:

- 2nd Player – 2 Water**
- 3rd Player – 3 Water**
- 4th Player – 4 Water**
- 5th Player – 5 Water**

4 Place the **resources** in reach of all players. All resources are unlimited — use a multiplier token or replacement if they run out.



5 **A** Each player takes the pieces in their player color: **3 Action Markers** 🍷, **1 Health Point Marker** 🍷, **1 Central Vacuole Marker** 🍷, and **2 Plant Growth Markers** 🍷. *Exception: In a 1-2 🍷 game, each player also takes 1 Gray Action Marker* 🍷.

B Each player places their **Health Point** and **Central Vacuole Markers** on the starting spaces of the corresponding Tracks, as shown.




C Each player places their **Plant Growth Markers** on the starting spaces of the Shoot Track and Root Track on the Plant Board, indicated by 🍷.

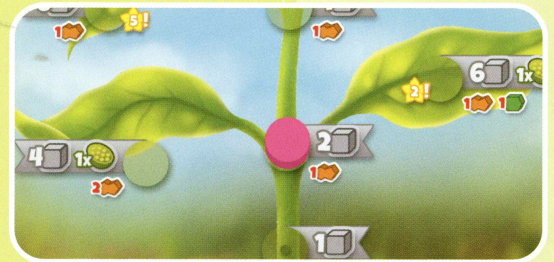




GAME CONCEPTS

PHASES OF A ROUND

Cellulose is played over a series of Rounds (days), each with the following 3 phases:

 **Sunrise** – In the Sunrise Phase, players collect Water () and Carbon Dioxide (CO₂ ) income according to the Plant Board. Throughout the game, you will have the chance to advance along the Plant Board Tracks and play Cards in order to increase the resources and other bonuses you receive each Sunrise.




 **Daytime** – During the Daytime Phase, players take turns placing their Action Markers () on Action Spaces and immediately taking the corresponding actions. Action Spaces are limited, so you must choose carefully, knowing that other players might take the best spaces earlier and block your options for the Round.




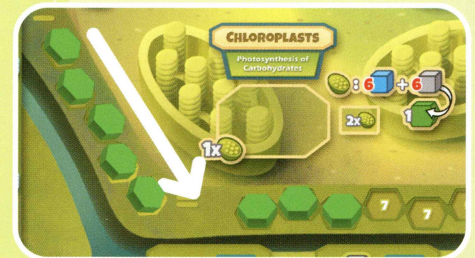
Action Spaces allow you to collect and convert resources, advance on the Plant Board Tracks, contribute to building the Cell Wall, and gain Cell Component Cards.

After you place an Action Marker, you may play 1 Cell Component Card from your hand by paying its cost.

 **Evening** – After all players have placed all of their Action Markers, several cleanup steps occur in the Evening Phase in order to refresh the Board for the next Round.

THE CELL WALL

A plant's cell wall is composed of carbohydrates in the chemical form *cellulose*. Running through the center of the Game Board, the **Cell Wall** has spaces where Carbohydrates () will be placed, from left to right. The Cell Wall is one of the primary ways to score Health Points, and it determines the length of the game.



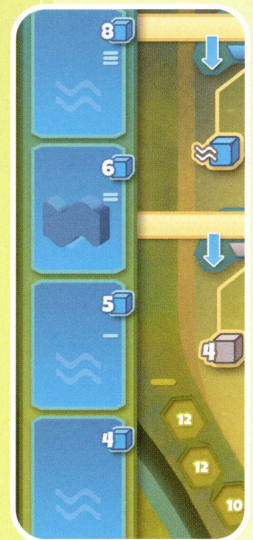
Players will have opportunities to add their Carbohydrates to the Cell Wall, receiving the Health Points shown on the space covered. The point values fluctuate, so timing this action well can score more Points.

During each Evening Phase, 1 Carbohydrate is added to the next open space on the Cell Wall. The game ends when the Cell Wall has been completed; that is, when all of the spaces on the Cell Wall are covered.

WATER LEVEL TRACK

The **Water Level Track** on the left side of the board marks the Water available for players to collect and use each Round. The Water Level Marker (👉) is lowered each time players take an action to collect Water or CO₂. If the Water Level Marker reaches the bottom space, no more Water is available for the Round.

During the Evening Phase, the Water Level Marker resets for the following Round. As sections of the Cell Wall are completed, the Water Level will be reset to higher levels and more Water will be available.



CENTRAL VACUOLE

Players can add Water to the **Central Vacuole** when performing various actions. When doing so, players place Water on the region of the Central Vacuole matching their player color.

In the Evening Phase of each Round, **Central Vacuole Rewards** are given for having contributed the most Water to the Central Vacuole.






RESOURCE BENEFITS AND COSTS

Resources gained through actions are shown in white numbers. Costs for actions or on Cards are always shown in red numbers.







6 GAIN 6 WATER

2 PAY 2 PLANT HORMONES

Other common benefits in the game:

-  Gain 3 Health Points
-  Add 2 Water to the Central Vacuole (from the general supply)
-  Draw the top face-down Card

RESOURCES

-  WATER
-  CO₂
-  PROTEIN
-  CARBOHYDRATE
-  PLANT HORMONE
-  ATP

SUNRISE PHASE

Each Round begins with the **Sunrise Phase**, in which players receive income according to the Plant Board and any of the Cell Component Cards they have played which have Sunrise bonuses.

Each player checks their Plant Growth Markers and receives income from the following sources:

- ★ The **Shoot Growth Track** on the top half of the Plant Board may provide:

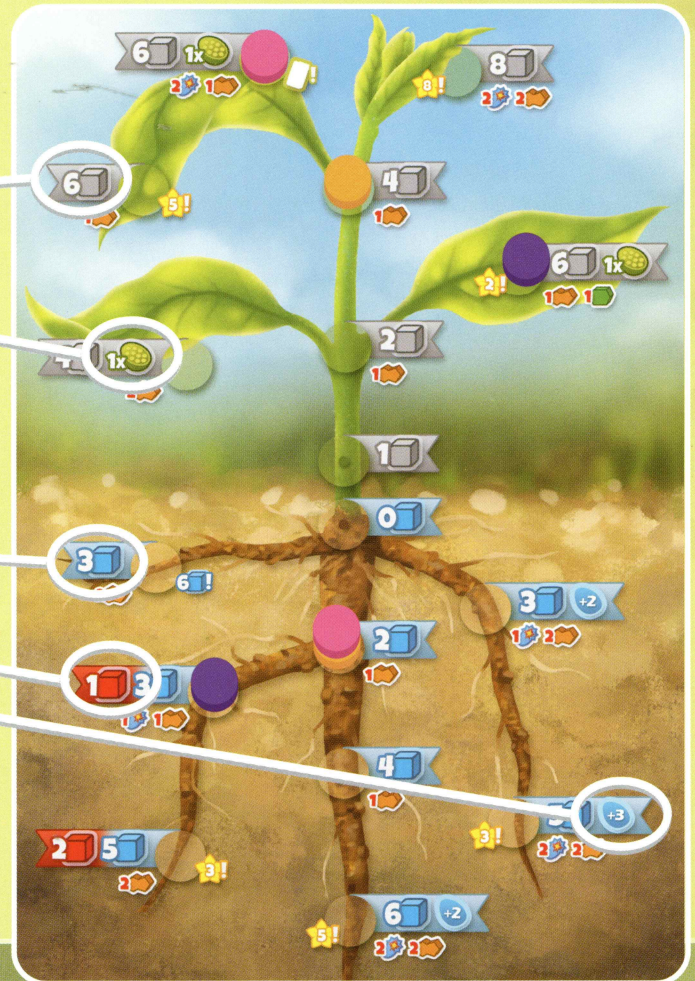
- CO₂
- A bonus Photosynthesis action (exchange 6 + 6 for 1)

- ★ The **Root Growth Track** on the bottom half of the Plant Board may provide:

- Water
- Protein
- Add Water to the Central Vacuole (from the supply)

Note: Sunrise income is only shown on banners . Plant Board spaces also have costs (red numbers with resources) and may have one-time benefits (shown with).

- ★ Some **Cell Component Cards** have Sunrise bonuses as well (see p. 16)




Example: In the Sunrise Phase, **Samira** collects 6 CO₂, 3 Water, and 1 Protein from her **Purple Plant Growth Markers**. She has the option of taking the Photosynthesis action, exchanging 6 Water and 6 CO₂ for 1 Carbohydrate (she may use the resources just acquired to do so). Samira's Aquaporin Card also adds 1 Water to her region of the Central Vacuole. Note that she does not receive any Health Points for her Marker on the Shoot Track, since this was a one-time bonus.

The player with the First Player Marker receives their income first, proceeding in clockwise order (though players can typically just take these simultaneously). Each player may take their Sunrise income benefits in any order, potentially using some benefits to pay for others (for example, using Water and CO₂ for Photosynthesis).



DAYTIME PHASE

DAYTIME PHASE

In the **Daytime Phase**, players take turns placing 1 of their Action Markers () on an available Action Space and immediately taking the corresponding action. They may then play 1 Cell Component Card from their hand (see *Daytime: Playing Cards*, pp. 14–16).

The player with the First Player Marker takes the first turn of the Round, then play proceeds clockwise. On your turn, you must place 1 of your Action Markers to take an action. Some players might run out of Action Markers earlier than others. If you have no remaining Action Markers, you automatically pass your turn. Play continues until all players run out of Action Markers, then proceeds to the Evening Phase.

There are 2 types of Action Spaces: **Small Action Spaces** (for 1 Action Marker) and **Large Action Spaces** (for any number of Action Markers of different colors). You may not place an Action Marker on a Small Action Space that already has an Action Marker, and you may not place an Action Marker on a Large Action Space that already has an Action Marker of that same color. You also may not place an Action Marker on any Action Space with an action you cannot take (for example, if it requires resources that you don't have).

Note: These are the only restrictions on placing Action Markers. You *may* use different Action Spaces corresponding to the same action. You may also use a Large Action Space multiple times in a Round by using a Gray Action Marker or certain Card effects.








SMALL ACTION SPACE

1 Action Marker



LARGE ACTION SPACE

1 Action Marker per Color

Example: David places his Action Marker to make ATP (). He pays 1 Carbohydrate () and takes 6 ATP. He may then play 1 Cell Component Card from his hand. He plays a Lipase Enzyme, paying 1 ATP and 2 Proteins (), and immediately receiving the benefit shown ( ).





DAYTIME ACTIONS

The actions players may take are:



COLLECT WATER (XYLEM)

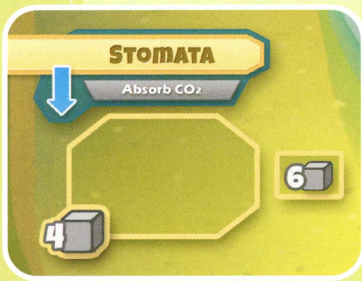
Collect Water () according to the **current Water Level**, then move the Water Level Marker () down 1 space. This action may not be taken if the Water Level Marker is currently on the lowest space.



When taking Water in this way, you may add **up to 3 Water** directly to the region in the Central Vacuole matching your player color.

Example: Theo places his Action Marker on the Xylem Action Space while the Water Level is at 5. He keeps 3 Water and adds 2 to the yellow region on the Central Vacuole. He then moves the Water Level down to 4.







COLLECT CO₂ (STOMATA)

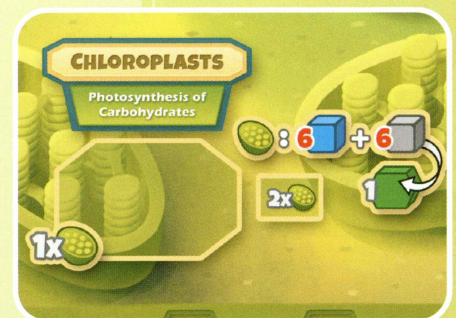


Collect CO₂ () as shown on the Action Space: 6 CO₂ for the Small Space or 4 CO₂ for the Large Space. After collecting CO₂, move the Water Level Marker () down 1 space, if able. This action may be taken even if the Water Level is already at the bottom space of the Water Level Track.

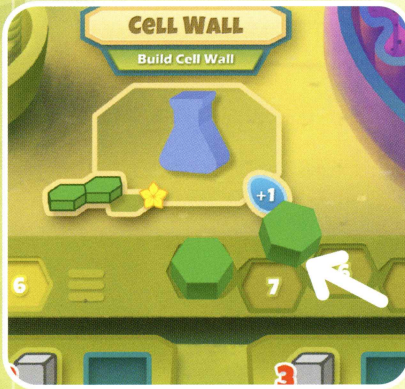
MAKE CARBOHYDRATES (CHLOROPLASTS)


Convert **6 Water** and **6 CO₂** into 1 Carbohydrate (). There is a Large Space to perform this conversion 1 time, as well as 1 Small Space to perform the conversion exactly 2 times (exchange **12 Water** and **12 CO₂** for 2 Carbohydrates). Making a Carbohydrate is necessary to Build the Cell Wall or Make ATP (the next 2 actions).

Throughout the game, whenever an effect allows you to take the Photosynthesis action, it enables this exact exchange (**6**  + **6**  for **1** ).



BUILD CELL WALL (CELL WALL)





Place 1 of your Carbohydrates () on the next available **Cell Wall** space to earn the **Health Points** indicated. Carbohydrates **must** be placed in order from left to right; players may not skip ahead to higher-scoring spaces.

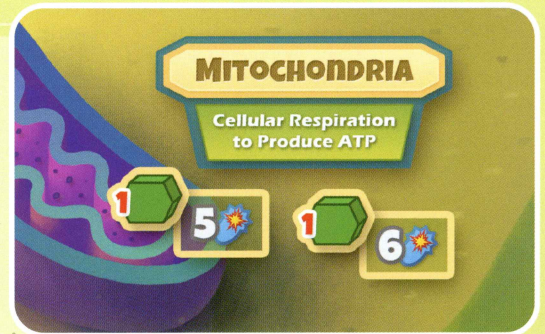
Additionally, whenever a player adds a Carbohydrate to the Cell Wall (using this Action Space or other effects), they also add 1 Water from the general supply to the region in the Central Vacuole matching their player color.

If the Cell Wall is completely covered, Carbohydrates can no longer be added, and the game will end in the current Round's Evening Phase. Carbohydrates that have not been placed on the Cell Wall are each worth 4 Health Points during Endgame Scoring.

Example: **Nori** takes the Build Cell Wall action and adds 1 of her Carbohydrates to the Cell Wall, scoring 7 Points. She also adds 1 Water to her region of the Central Vacuole.

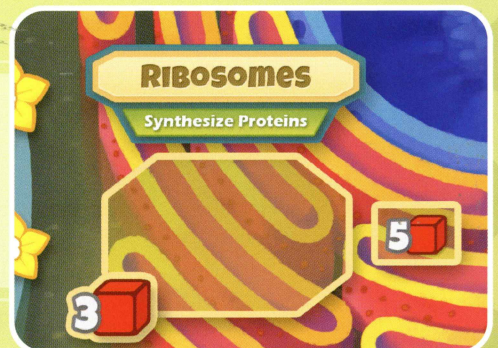
MAKE ATP (MITOCHONDRIA)

Convert 1 Carbohydrate () into ATP (). This action produces either 6 ATP or 5 ATP, depending on which Action Space is taken. ATP is used to pay for some spaces on the Shoot and Root Growth Tracks on the Plant Board and to play certain Cell Component Cards.



COLLECT PROTEINS (RIBOSOMES)

Collect either 5 Proteins () or 3 Proteins, depending on which Action Space is taken. Proteins are mainly used to play Cell Component Cards.



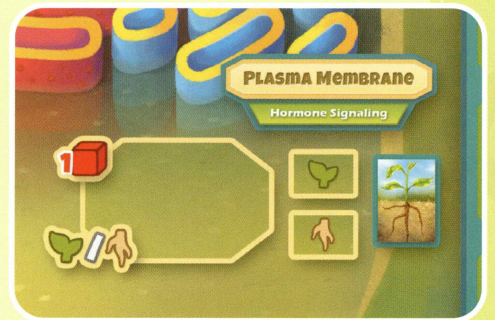
COLLECT PLANT HORMONES (CYTOPLASM)



Collect either 3 or 2 Plant Growth Hormones (🍷), depending on which Action Space is taken. Plant Growth Hormones are used to advance your Plant Growth Markers on the Plant Board to receive additional income.

PLANT GROWTH (PLASMA MEMBRANE)

Advance 1 of your Markers (👤) on the Plant Board to earn additional income. There are 3 Action Spaces: a Shoot Growth Space 🌱 to move up the top half of the Plant Board, a Root Growth Space 🖐️ for the bottom half, and a Space that costs 1 Protein (📦) to do either 🌱 or 🖐️ (not both).



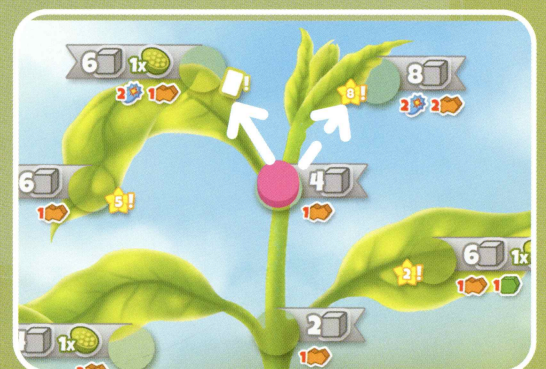
To take the Plant Growth action, move your corresponding Plant Growth Marker to the next connected space on its Track on the Plant Board, paying the indicated cost. Spaces are connected by the Plant Board art showing shoot and root systems. If multiple paths are available, you may choose any connected space, but will not be able to move backwards later. Different players may have Plant Growth Markers on the same space.

When moving to a new space:

! Some spaces on the Plant Board provide a one-time bonus (Health Points, resources, or a Cell Component Card), shown by !. Take these immediately when moving onto the space.

📄 All spaces on the Plant Board have banners with resource income and/or bonus actions. You will receive these on every subsequent Sunrise Phase, while still on that space [see Sunrise Phase, p. 8].

Example: David places his Action Marker on the Plant Growth Action Space for advancing his Shoot Growth Marker. He has 2 paths available from his current space, with different costs and benefits. David decides to go to the left and pays 2 ATP and 1 Hormone. He immediately draws a Cell Component Card, and will begin earning 6 CO₂ and a bonus Photosynthesis action on the next Sunrise Phase.

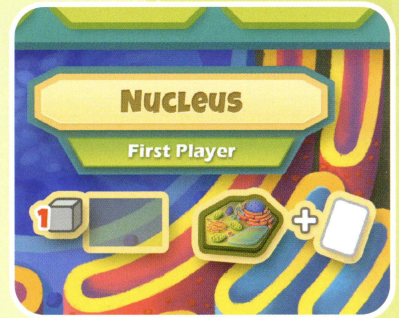




TAKE FIRST PLAYER MARKER (NUCLEUS)

Pay 1 CO₂ [] to take the First Player Marker [] and draw the top face-down Cell Component Card from the deck into your hand. Receiving the First Player Marker has no immediate effect, but you will go first in the next Round. This is the only way that the First Player Marker changes possession throughout the game.

You may take the First Player action even if you already have the First Player Marker.



TAKE CELL COMPONENT CARDS

Take a Cell Component Card from the face-up options into your hand, paying the CO₂ cost shown above the Card. Cards have a variety of costs and benefits, and you may play 1 Card each turn after completing your action. Empty spaces are not refilled until the Evening Phase.

Note: The face-up Cell Component Cards on the Board are only taken through the corresponding Action Spaces. Benefits with the [] icon draw a face-down Card from the deck.



DAYTIME PHASE: PLAYING CARDS

After placing an Action Marker and taking an action, you may also play any 1 Cell Component Card from your hand by paying its cost and placing it face-up in front of you. You may only play Cell Component Cards after placing an Action Marker to take an action, regardless of the action taken. You may play a Card on the same turn that you gain it.

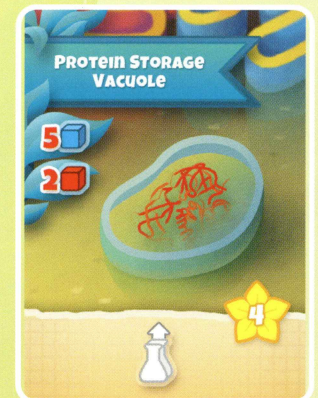
After playing a Cell Component Card, earn Health Points and any immediate bonuses on the card. Some cards have ongoing abilities (described below).

There is no limit to the number of Cards you may have in your hand or in play, including duplicate copies of the same Cards.



★ **STARCH CARDS** allow you to immediately draw the indicated number of Cell Component Cards from the deck, and then discard the indicated number of Cards to the discard pile. You may discard Cards that were in your hand prior to playing the Starch.

★ **PROTEIN STORAGE VACUOLE (PSV) CARDS** allow you to reclaim 1 of your previously placed Action Markers from an Action Space. In effect, playing PSV Cards gives you extra actions, since you will be able to place the Action Marker again later. They also free up Small and Large Action Spaces, providing the possibility of using the same Space multiple times in the same Round.

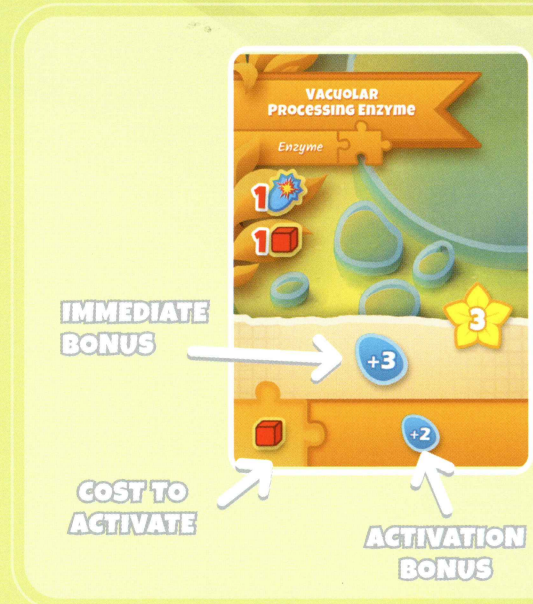


★ **ENZYME CARDS** provide a variety of benefits when played, then can be re-activated each time you play a new Enzyme Card:

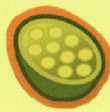
- ★ When you play an Enzyme, receive its **immediate bonus** as normal, and place it in front of you.
- ★ For the rest of the game, Enzymes in your play area can be activated whenever you play a new Enzyme by paying 1 Protein (🟥) to gain the **activation bonus** on the bottom orange bar of the Card.

In this way, each new Enzyme you play allows you to activate any number of previously played Enzyme Cards, paying 1 Protein for each Enzyme you wish to activate.

Enzyme bonuses include the following:



Gain 2 Health Points



Take the Photosynthesis action



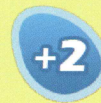
Take the Build Cell Wall action



Take a Root or Shoot Plant Growth action



Draw the top Cell Component Card from the deck



Place 2 Water from the general supply on your region of the Central Vacuole

Example: Samira pays 1 ATP and 1 Protein to play a Vacuolar Processing Enzyme. She immediately receive 3 Health Points and add 3 Water (from the general supply) to her region of the Central Vacuole.

She can also activate any number of her previously played Enzyme Cards: she pays 1 Protein to use RuBisCO and take the Photosynthesis action. She could also pay another Protein to activate her GH3 Synthetase, but she does not have the required resources to advance on the Plant Board.



Finally, she adds the Vacuolar Processing Enzyme to her stack of Enzyme Cards. The next time she plays an Enzyme, she will have the potential to activate any number of her 3 completed Enzyme Cards.

★ **SPECIALIZATION CARDS** score Endgame Health Points 🌼. Some Cards also provide ongoing bonuses. The 5 Specialization Cards are:



During Endgame Scoring, gain Health Points equal to the amount of CO₂ you receive each Sunrise.



During Endgame Scoring, gain Health Points equal to the amount of Water you receive each Sunrise.

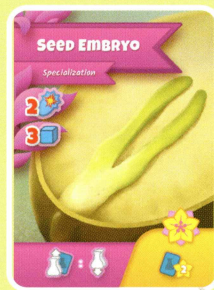


Example: **Nori** earns 6 Water each Sunrise, and will therefore score 6 Health Points for her Cytokinin Receptor Card.



Each Sunrise, place 1 Water from the general supply on your region of the Central Vacuole.

During Endgame Scoring, receive Endgame Health Points for double the Points shown on your space of the Central Vacuole Track.



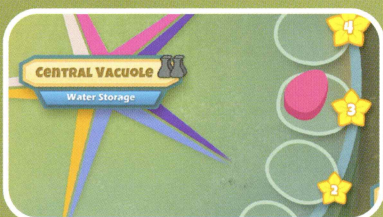
When reclaiming an Action Marker using a PSV, you may play the Action Marker immediately.

During Endgame Scoring, score 2 Health Points per PSV Card you have played.



Each Sunrise, you may pay 1 Protein to activate 1 of your previously played Enzyme Cards.


During Endgame Scoring, gain 1 Health Point per Enzyme Card you have played.



Example: **David** is on the **3** space of the Central Vacuole. He will score 6 additional Endgame Health Points for each of his Aquaporin Cards.


EVENING PHASE

Once all players have placed all of their Action Markers, advance to the Evening Phase to reset the Board for the next Round.

1 RETRIEVE ACTION MARKERS: All players collect their Action Markers from the Game Board (including 1 Gray Action Marker each in a 1-2  game). Return the Central Vacuole Gray Action Marker(s) to the Central Vacuole.

2 CENTRAL VACUOLE MAJORITY REWARD: Check the Central Vacuole to see who has contributed the **most Water** and will score the Central Vacuole Reward(s). The player with the most Water in the region corresponding to their player color will:

- a. **Advance** their Central Vacuole Marker along the Central Vacuole Track and immediately **score** the indicated number of Health Points.
- c. **Remove the Water** from only their region, returning it to the general supply.
- c. **Take a Gray Action Marker** for the following Round.

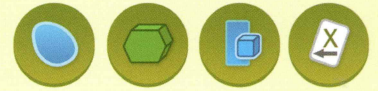
In a 4-5  game, repeat these steps for a second Central Vacuole Reward.

Ties for a Central Vacuole Reward are fully shared (all tying players score), but players will only take a Gray Action Marker if there enough Gray Action Markers still available for all the tying players. A tie will always end the Central Vacuole Rewards for that Round. (For detailed examples, see Rules Clarifications, p. 19.)

If a player wins the Central Vacuole Reward while their Marker is at the top of the track, their Marker does not move, but they score 2 Health Points.

A player must have Water placed to win a Reward. If no Water is placed in the Central Vacuole, no Rewards are given.

To allow this Phase to proceed quickly, use the Evening Phase Reminder Tokens to assign steps 2-5 to players.



Example: At the end of the Round, **Samira** has the Central Vacuole majority with 8 Water, while **Theo** and **Nori** are tied with 4 Water. **Samira** scores first: she moves up the Track, scores 3 Health Points, takes a Gray Action Marker, and returns the Water in the purple region to the general supply.





Theo and **Nori** will both move up the track and score the indicated Points — 1 Point for **Nori** and 2 Points for **Theo**. However, because only 1 Gray Action Marker remains, neither will receive it. **Theo** and **Nori** will still remove the Water from their regions of the Central Vacuole.

David, who only had 1 Water, receives nothing. However, he is now the only player with any Water in the Central Vacuole at the start of the next Round.



EVENING PHASE, ENDING THE GAME

3 CELL WALL: Add 1 Carbohydrate from the general supply to the next empty space on the Cell Wall (no one scores these Points).

If the final space of the Cell Wall is now covered (or was already covered), the game is over, and Endgame Scoring will occur.

4 WATER LEVEL: Reset the Water Level Marker () according to the last fully-completed section of the growing Cell Wall. For example, the Marker will reset to  [5 Water] at the beginning of the game until Carbohydrates have covered all spaces up to the . After that point, the Water Level Marker will reset to  [6 Water] at the end of the Round.



5 CELL COMPONENT CARDS: Discard any Cell Component Cards remaining in the leftmost 2 Card spaces (for 1-3 ) or leftmost 1 Card space (for 4-5 ), as indicated by "X". Slide the remaining Cards to the left, then replenish all empty spaces with face-up Cards from the deck. If there are no cards left, shuffle the discard pile to form a new deck.


If the Cell Wall has remaining space, proceed to the Sunrise Phase of the next Round.

ENDING THE GAME

When the Cell Wall is complete during the Cell Wall step of the Evening Phase, the game is over. Note that if the final space on the Cell Wall is covered by a player during the Daytime Phase, players still continue the Daytime Phase until all Action Markers have been placed. The Central Vacuole will always still score in the final Round.



Players then have the chance to **play any number of Cell Component Cards from their hands**, paying costs as normal, but ignoring all abilities and benefits other than the Health Points they score.

Players calculate their scores as follows:

- ★ Many Health Points have already been accumulated **during the game** by placing Carbohydrates on the Cell Wall, advancing along the Central Vacuole Track, and playing Cell Component Cards.
- ★ Players score **4 Health Points** for each unused Carbohydrate.
- ★ Specialization Cell Component Cards score **Endgame Health Points**  as indicated (see p. 16).
- ★ Additional Water, CO₂, Plant Growth Hormones, Proteins, and ATP **do not score any Points**.

The player with the most Health Points wins! In the case of a tie, the player furthest along the Central Vacuole Track wins. In the case of a further tie, the player who receives the most Water during the Sunrise Phase wins. If the tie remains, the victory is shared.

RULES CLARIFICATIONS

- ★ In the Sunrise Phase, players may sequence their benefits in any order. You may, for example, collect Water and CO₂ and then use those resources for Photosynthesis. You could even use the Enzyme Production ability to activate a GH3 Synthase Enzyme, move 1 of your Plant Board Markers, then collect the Plant Board benefits of your new space (you would still only collect the benefits from that Marker once).
- ★ Each player must take a turn placing an Action Marker if they have any Action Markers remaining. Some players may have more Action Markers than others and therefore take more turns. Once players have used all their Action Markers, they will automatically pass their turns, and may not play Cards. In the very unlikely scenario that a player has an Action Marker but no available legal actions, they pass.
- ★ Large Action Spaces may contain at most 1 Action Marker of each color, including Gray. You may activate the same Large Space multiple times in a Round by using 1 Action Marker in your player color and 1 Gray Action Marker, or by using a Protein Storage Vacuole to recover an Action Marker and play it again. You may take different Action Spaces corresponding to the same action (for example, you may take both Large and Small Action Spaces to Collect CO₂).
- ★ Ties for the Central Vacuole Reward can affect how many Rewards and Gray Action Markers are awarded.
 - In a 1-3  game (1 Gray Action Marker as a Reward) a tie between players with the most Water in their region of the Central Vacuole will result in all tying players moving up the Central Vacuole Track, scoring Health Points, and removing their Water – but no one will receive a Gray Action Marker.
 - In a 4-5  game (2 Gray Action Markers as Rewards) there are more possibilities:
 - A 2-way tie with the most Water will earn only those players full Rewards.
 - A tie among 3 or more players means that tying players will score Points and remove their Water, but no one will receive a Gray Action Marker for that Round.
 - A tie for the second-most Water (after a single player wins the majority) means the players tying for second will receive the other benefits but no Gray Action Marker – only 1 Gray Action Marker will be given out that Round.
- ★ Action Space abilities must be used, but Card and Plant Board bonuses are always optional. You may, for example, play a Cellulose Synthetase Enzyme and decide not to Build the Cell Wall, or play a RuBisCO Enzyme and only do Photosynthesis once.
- ★ When you play a Protein Storage Vacuole, immediately recover an Action Marker that you previously placed on the Board. You won't place it now (unless you have a Seed Embryo Card), but you will have an extra turn this Phase. You can use a PSV to recover a Gray Action Marker that you placed.
- ★ When playing an Enzyme Card, you cannot pay 1 Protein to activate the Enzyme you just played. Enzymes may be activated in any order, but only once for each new Enzyme that is played.
- ★ Using the ability on Seed Embryo after playing a Protein Storage Vacuole allows you to immediately place another Action Marker, but you cannot then play another Card (so, you cannot chain together PSV Cards to take more than 2 consecutive actions).
- ★ Having 2 Seed Embryo Cards does not allow you to place 2 Action Markers when playing a PSV. Having 2 Enzyme Production or Aquaporin Cards *does* let you use their abilities twice in the Sunrise Phase.

SCENARIOS AND THE MANGROVE PLANT BOARD

Once players are familiar with Cellulose, Scenario Cards and the alternate Plant Board can be used to add additional variety and challenges. These are not recommended for new players, as they deliberately shift the focus of the game in irregular ways.


SCENARIOS

To play with a Scenario, choose a Scenario Card and follow the setup and gameplay instructions on the Card. Scenarios allow players to explore the unique adaptations of different plant species. Two Scenarios are included with Cellulose:

- ★ The **Cactus Scenario** highlights the features of the cactus family that allow cacti to survive in dry conditions. Water is scarce but valuable, and players must adapt accordingly.
- ★ The **Mangrove Scenario** makes use of the alternate Mangrove Plant Board that changes how players progress in the game. Mangroves have access to plentiful but brackish water, and struggle through harsh conditions as they support large ecological networks.

THE MANGROVE PLANT BOARD

The alternate side of the Plant Board contains a Mangrove Tree, which may be used instead of the standard Sprout Plant Board (with or without the Mangrove Scenario). It works the same as the standard Plant Board with the following changes:

- ★ Players taking a Root Growth action may move their Root Growth Markers freely along the root paths connecting different spaces, paying the cost of the space they move to. This allows them to move sideways between paths or even “backwards” throughout the game.
- ★ The bottom-most spaces of the three paths each have a powerful bonus action attached. A player taking a Root Growth action from these spaces may pay the indicated cost to take the corresponding bonus action, then place their Root Growth Marker on any of the 3 Root Growth Track spaces showing a . The bonus actions provide the following benefits:



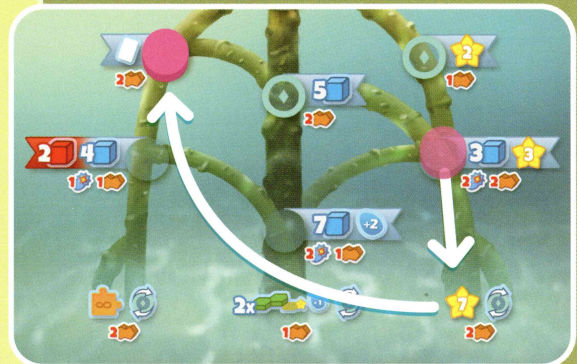
You may activate any number of your Enzyme benefits without paying Proteins.




You may take the Build Cell Wall action up to 2 times.



Score 7 Health Points.



Example: David has been earning Health Points on the rightmost Root Track, but is ready to shift his strategy. He takes a Root Growth Action and pays 2 Hormones to receive , then places his Plant Growth Marker on the left middle space, where he will start receiving 1 Cell Component Card each Sunrise.


CELLULOSE SOLO RULES


Cellulose may be played as a solo game against an *automa* opponent named **Ivy**. When playing the solo game, your turns and actions follow the regular game rules. Ivy's turns, however, are determined by drawing from her deck of **Action Cards**, which will instruct you where to place her Action Markers and what decisions she makes. Instead of using the Plant Board, Ivy has her own **Growth Track** and **Strategy Map** on **Ivy's Mat**. These will track and shape her evolving strategy each game. The following rules assume you already know the basic multiplayer game.



SETUP

Choose whether to play an **Easy, Medium, or Hard** game against Ivy.

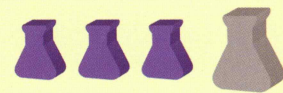
Set up for a normal 2  game in which you will begin as First Player (Ivy receives no starting resources). Ivy will not place her Markers on the Plant Board. Instead, place **Ivy's Mat** in her area showing the side labeled with the difficulty you have chosen. Place 1 of her Plant Markers in the center space of the Strategy Map as her **Strategy Marker**, and the other on the bottom space of her Growth Track, as shown.

Separate the **Action Cards** into 3 types by the symbol in the bottom right corner (—, =, or ). Shuffle the — Cards and place them face down in Ivy's area as her starting Action Card deck, then set the other Action Cards aside for now.

For a **Hard** game, give Ivy 2 Specialization Cards on different Strategy Map axes (that is, 1 Card for the Growth or Enzyme Strategy, and 1 Card for the PSV or Central Vacuole Strategy). These may be selected or randomized. Put these Cards in play, and adjust Ivy's Strategy Map accordingly (see below).

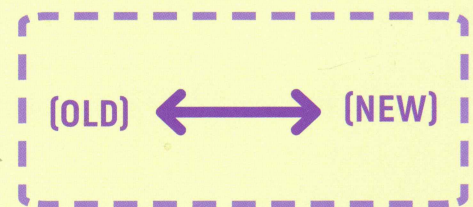
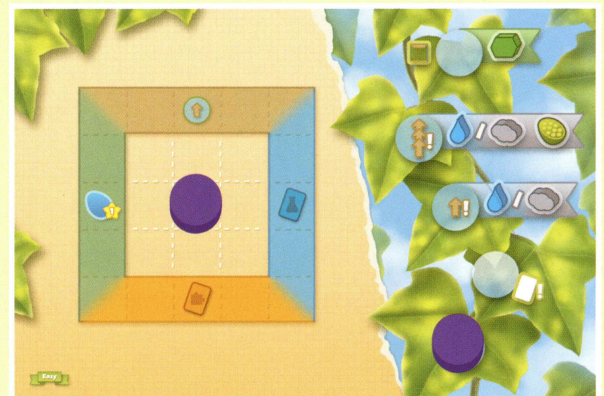
Note on Resources: Over the course of the game, Ivy will only ever acquire Carbohydrate, 6x Water, and 6x CO₂ resources. She will take actions pertaining to the other resources, but will never actually take or spend them: her rules always modify these actions. Whenever she takes **Cell Component Cards**, add them to her face-up hand, below her Mat. Add new cards to the right of older Cards — she will often play older Cards first.

IVY'S SETUP (EASY)



STRATEGY MAP

GROWTH TRACK



IVY'S HAND




ACTION CARDS




IVY'S STRATEGY MAP


Ivy's Mat has two features on it: her Strategy Map and her Growth Track. Her **Strategy Map** is a 5x5 grid that tracks and determines Ivy's play style. Her Strategy Marker begins in the middle of the map and will move to track her progress among 4 potential Strategies (the colored bands on the edges).


Ivy moves her Strategy Marker when the following occur:

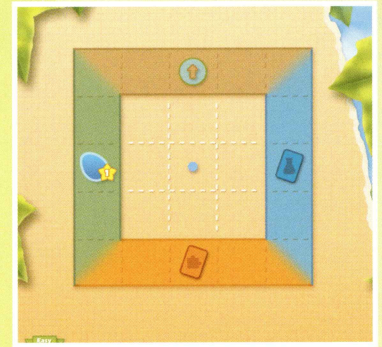
 → Move **right** toward the **Protein Storage Vacuole Strategy** whenever Ivy gains a PSV Card.

 ← Move **left** toward the **Central Vacuole Strategy** for each Health Point Ivy scores as a Central Vacuole Reward.

 ↑ Move **up** toward the **Growth Track Strategy** when Ivy moves her Plant Growth Marker to cover an arrow on her Growth Track.


 ↓ Move **down** toward the **Enzyme Strategy** whenever Ivy gains an Enzyme Card.


 ↕ Finally, move in the **corresponding direction** each time Ivy takes a **Specialization Card** (right for Seed Embryo, left for Aquaporin, up for Cytokinin or Gibberellin Receptors, or down for Enzyme Production).



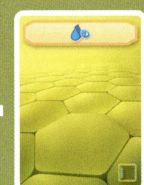
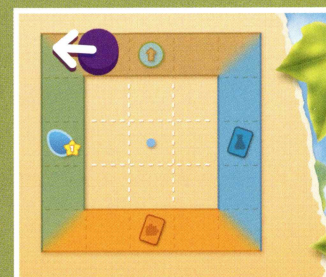
Ivy's Strategy Marker will initially move around the Strategy Map in any direction as the event triggers occur, until she reaches the spaces on the outside edges. **Once Ivy's Strategy Marker reaches any of the 4 colored edges, she has chosen that Strategy, and her Strategy Marker will never move out of that particular edge region.**

For example, if Ivy's Strategy Marker ever moves all the way left to the Central Vacuole Strategy, she gains the Central Vacuole Strategy and her Strategy Marker can never move back right again, even if she gains more PSV Cards. It *can* still move up and down until it reaches the top or bottom edge. In this way, she will usually reach 1 of the 4 corners on the Strategy Map by the end of the game.

Ivy's Strategies are indicated by icons highlighting the corresponding edge, such as  for the Central Vacuole.

When Ivy gains any Strategy, take the **set-aside Action Card with the matching Strategy icon** (that is,  for Enzyme Strategy) and add it to Ivy's Action Card discard pile.

Example: Ivy plays an Enzyme that draws her an "Aquaporin" Cell Component Card. She moves her Strategy Marker left, into the Central Vacuole Strategy region. She has now committed to this Strategy, and adds the corresponding Action Card to her discard pile. (In a Medium or Hard game, she will begin receiving a Sunrise Bonus of adding 2 Water to the Central Vacuole).



In a **Medium or Hard** game, Ivy unlocks additional bonuses when she gains a Strategy.



If she has the PSV Strategy, she earns 2 additional Health Points for each of her PSV Cards during Endgame Scoring.



If she has the Central Vacuole Strategy, she adds 2 Water to the Central Vacuole each Sunrise.



If she gains the Enzyme Strategy, immediately draw Cell Component Cards from the deck until 2 Enzyme Cards are revealed, and put them into her play area. She doesn't score Health Points or take their benefits, but they can be activated as she plays future Enzyme Cards. Shuffle the other Cards back into the deck.



If she has the Growth Track Strategy, she will take the Build Cell Wall action, if possible, after receiving Sunrise benefits each Round.

IVY'S GROWTH TRACK

Ivy uses a special **Growth Track** on her Mat instead of the normal Plant Board. The 🌱 / 🖐️ Growth actions (including on Enzyme activations) will allow her to advance up her Track, without paying additional costs. She will receive any indicated immediate bonuses, and begin earning the Sunrise benefits as normal.



In addition to the familiar icons on Ivy's Growth Track, the 3rd and 4th spaces can receive 6 Water or 6 CO₂, whichever resource she has less of. If she has the same number of both (or none of either), she will take Water.

Ivy's Growth Track has two interactions with her Strategy Map. First, when moving onto the 3rd and 4th space, move her Strategy Marker upward for each arrow shown (↑). (Note that 3 arrows means that this will always commit her to the Growth Track Strategy, if she has not already chosen the Enzyme Strategy.) Additionally, **Ivy cannot move to the final space on her Growth Track unless she has a Growth Track Strategy.**



IVY'S TURNS AND ACTION CARDS

On each of Ivy's Daytime Phase turns, **while she has at least 1 Action Marker remaining**, draw the top Action Card from her deck (reshuffle her discard pile if none are available to draw). Check the actions shown in the bars on the Action Card. Ivy will perform the topmost action that she is able to do with her available resources and Action Markers. Some of the actions have special conditions for her to take that action, as described below. If she cannot do any of the actions shown, draw another Action Card. After performing an action on an Action Card, she may also play a Cell Component Card, as described below.

When placing on an Action Space, Ivy will use Gray Action Markers first (if able), and will always place on the best available Action Space (to block you: it usually won't affect her action). Her versions of the actions are as follows:



As long as the Water Level is not empty, collect 6 Water (regardless of the current Water Level), and additionally add the indicated Water to her region of the Central Vacuole.



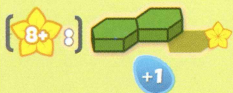
Collect 6 CO₂ (regardless of which Action Space is taken).



Collect 6 Water or 6 CO₂, whichever Ivy has less of. If she has the same number of both (or none of either), she will take Water. If the Water Level is out, she will take CO₂. If taking Water, also add the indicated Water to her region the Central Vacuole.



Perform Photosynthesis, using the 2x Action Space if possible. Some versions of this action will *only* use the 2x Photosynthesis, so Ivy will not take the action if she does not have the resources or the 2x Action Space is not available.




Build the Cell Wall, adding 1 Water to the Central Vacuole. On some versions of this action, Ivy will only do so if it yields the indicated minimum number of Health Points.



Place an Action Marker on the indicated Action Space (the Ribosome or Mitochondria) and score the indicated Health Points, if any are shown. (No resources are taken or paid.)



Place 2 Action Markers simultaneously – 1 on a Collect Hormone Space and 1 on the indicated Growth Space (or the Action Space costing 1 Protein, but she need not pay), then advance her Growth Marker. An Action Space of each type must be available to take this action, and she must have 2 Action Markers. Note that she may not move to the final space on her Growth Track unless she has the Growth Track Strategy ().






Take First Player if she does not already have it, then draw a Cell Component Card into Ivy's Hand.



Take 1 of the face-up Cell Component Cards of the type shown into Ivy's Hand (without paying CO₂). If there are multiple suitable options, she will take the Card in the left-most (cheapest) available space.

Some of Ivy's actions are preceded by additional conditions, and she will only take that action if the condition is met:



Only take this action if Ivy has the matching Strategy (in this case, Enzymes). If multiple Strategies are shown, she will only do an action corresponding to a Strategy she has. For example,    means she will take a Specialization Card matching 1 of her Strategies.

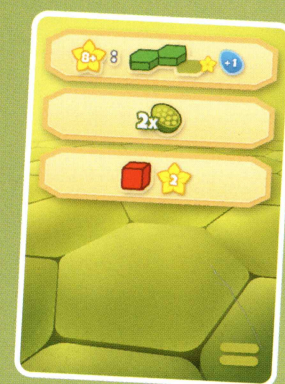


Only take this action if Ivy has a Cell Component Card of the indicated type in her hand. (She will typically play it afterwards.)







Only take this action if Ivy has fewer than 4 Cell Component Cards in her hand.

Example: On her first turn of the Round, Ivy draws this Action Card (with plenty of resources). She first considers taking the Build Cell Wall action, but the next available space will not score 8 Health Points. Next, she considers the 2x Photosynthesis action, but the Action Space has just been taken by the solo player. Finally, she takes the best available Protein Space with her Gray Action Marker. Ivy does not gain the 5 Protein, but she gains 2 Health Points.




GROWING IVY'S ACTION CARD DECK

Ivy has 3 kind of Action Cards. New Action Cards will be added to her Action Card discard pile throughout the game, and reshuffled in as her deck runs out:

-  Ivy starts with the Level 1 Action Cards.
-  Ivy adds the Level 2 Action Cards to her discard pile as soon as the first section of the Cell Wall is complete (that is, when the 4th Carbohydrate is placed).
-  When Ivy chooses a new Strategy by moving onto that edge of her Strategy Map, she adds the 1 matching Action Card to her discard pile. (For example, she adds the  Action Card if she gains the Enzyme Strategy.)











IVY'S CELL COMPONENT CARDS

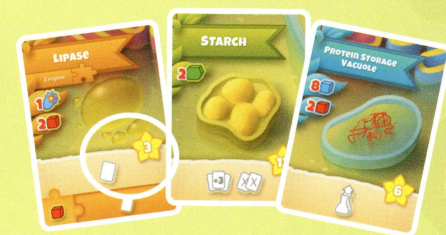
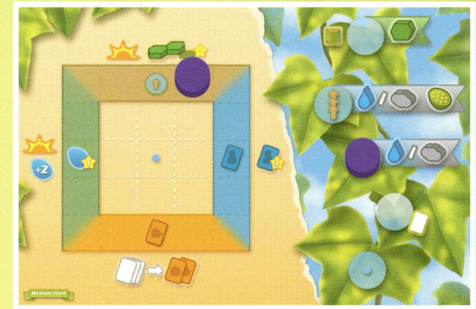
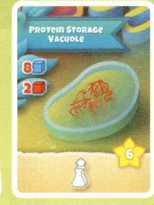
Ivy gains **Cell Component Cards** into her face-up "hand", below her Mat, adding new Cards to the right. While the first section of the Cell Wall is being built, she will not play any Cell Component Cards. Once the  has been reached on the Cell Wall, she may begin playing Cell Component Cards as part of her turns.

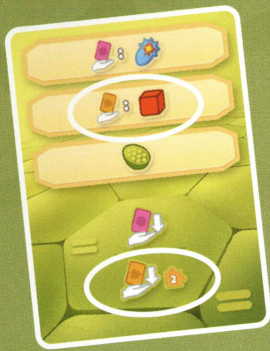
After completing an action on an Action Card, the bottom half of some Action Cards instruct Ivy to play a particular type of Cell Component Card, if she has that Card in hand and can afford to do so. If she has more than 1 Card of that type, she will play the oldest (leftmost) in her hand. On the Action Cards showing 2 options for Card plays, she will play the top type if possible, and the bottom type if not.

As she plays Cell Component Cards, move them into her play area. It is recommended to keep Enzyme Cards in a stack to the left of her Player Mat (to track activations), and the rest of the Cards above her Mat (to indicate that they've been played).

Ivy plays Cell Component Cards with the following modifications:

-  Ivy will always pay **2**  to play a Starch Card, earning . She will then draw 1 Cell Component Card.
-  Ivy always pays **6** Water () to play a Protein Storage Vacuole, earning . She will then take back the Action Marker she placed for that turn ().
-  Ivy plays Enzyme Cards for free, since she does not use Protein or ATP resources (though this often follows placing an Action Marker on a Protein Action Space). She then gains its Health Points and immediate bonus (if able), and she adds it to her stack of Enzymes.
 -  After playing an Enzyme Card, Ivy will also activate some number of previously played Enzymes (in this case, 2). Take the bottom-most Enzyme Card in the stack that has a benefit Ivy can use, activate its ability, and move it to the top of her Enzyme stack. Repeat this for as many different Enzymes as she can activate (at most once per Enzyme Card).
-  Ivy plays Specialization Cards for free, since she does not use Protein or ATP resources (though this often follows placing an Action Marker on an ATP Action Space). She **ignores the abilities of these Cards**, but scores them at the end of the game. The Gibberellin and Cytokinin Receptor Cards will always score her 6 Endgame Health Points.







Example: Ivy draws the Action Card shown and skips the first action, since she has no Specialization Cards in hand. She does have an Enzyme Card in hand, so she places an Action Marker on a Gain Protein Action Space.

On the bottom half of the Card, she again cannot play a Specialization Card but will play her Enzyme. She takes its immediate benefit (3 Health Points and a Card draw) and adds it to her stack of Enzymes. She then activates the bottom-most 2 eligible Enzyme Cards. In this case, she earns 2 Health Points from the bottom Enzyme, skips the next one (she has no Carbohydrates to place), and adds 2 Water to the Central Vacuole. The 2 activated Enzymes are moved to the top of the stack.

EVENING PHASE AND GAME END

The Evening Phase occurs normally. Remember, once the Cell Wall is built up to , Ivy will add  Action Cards to her discard and may begin playing Cell Component Cards. When the game ends, Ivy scores normally with the one exception that her Gibberellin and Cytokinin Receptor Cards will always score her 6 Endgame Health Points.



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REFERENCE GUIDE

ROUND STRUCTURE


SUNRISE

Take income according to Plant Board () and your Cell Component Cards  in play

DAYTIME

Players take turns placing  to immediately take the corresponding action, then may play 1 

EVENING

Players recover their Action Markers ()






Player(s) with most  in the  advance on the track and score , remove their , and take a Gray  (4-5  : awarded twice)



Add 1  to the Cell Wall, check for Game End



Reset Water Level  to last completed section  /  / 

Remove any Cards  in space(s) with X, slide all  to the left, and refill Cards in empty spaces

ACTION SPACES




Take  shown by the Water Level  and move Water Level down once  ↓
May add 0-3  to the Central Vacuole 


Take  shown on Action Space and  ↓

 /  Take the indicated resources

Pay 1  to take 

Pay 6  + 6  for 1 


Add 1  to the next space on the Cell Wall, scoring , and  +1


Pay the indicated cost on the Plant Board to advance your corresponding Plant Board Marker 

RESOURCES

 Water

 CO₂

 Protein



 Carbohydrate

 Hormone


 ATP

OTHER ICONS


 Gain Health Points


 +1 Add  to your region of the Central Vacuole (from supply)



 Draw the top Cell Component Card


 Receive the indicated benefit during each Sunrise Phase

CARDS

May pay 1 Protein each to activate previously-played  (p. 15)

 -3 Draw, then discard, the indicated number of Cards

 Recover 1 of your 

 Endgame Health Points and bonus powers (p. 16)