The Honey Bee Game

http://neuron.illinois.edu/swarm
Swarm! was created by Project NEURON as part of an NIH-SEPA grant. The materials are available freely online at http://neuron.illinois.edu/swarm
Swarm! Game Rules

Introduction

Swarm! is a game in which the teacher plays the role of Hive Leader, and students act as all the Nurse and Forager worker bees within the colony. Each student follows several bees (represented by game pieces) through their lifespan in the hive (different ages and roles are represented by the cells on the game board).

During game set-up, students position bees in their initial roles on the game board. Then gameplay proceeds through 10 rounds, with students performing several steps each round. For some steps, the entire class performs tasks together, and for other steps, small groups of students collaborate with peers sitting near each other.

By building the population and honey supply (by earning Brood Bonuses and Honey Bonuses, respectively), the colony can grow enough to “swarm” and produce a new colony! But it won’t be easy. Along the way environmental events may present significant challenges. Ready to play?
Preparation and materials

For the Hive Leader (the teacher):

- Excel spreadsheet
- Environment cards (one set)
- Annotated Quick Rules

For each group (3-4 students):

- Supply cup
- “Bees” or game pieces (at least 6 times the number of students)

For each student

- Quick Rules sheet with flowchart of gameplay
- Game Board
- One die

Note: Like any new board game, it may take a round or two to catch on. As the Hive Leader, the teacher may want to walk students through a practice round to help them understand the game mechanics before setting up the game pieces.

Goal

In order to swarm and win the game, the colony must accomplish all three of these goals:

- Survive for 10 rounds
- Earn 7 or more Honey Bonuses
- Earn 7 or more Brood Bonuses
Starting the Game

To introduce the game to your students and motivate them to play, read the following outloud:

Your classroom hive of honey bees has just become active again after a long winter. By building your population and honey supply, your colony must grow enough to “swarm” and produce a new colony! Your success as a hive depends on balancing the roles of the worker bees in your hive.

There are two main roles of bees in this game: nurses and foragers.

Nurse Bees (indicated by green cells on the board) take care of baby bees and sustain the hive’s population by contributing points toward the hive’s Brood Score.

Forager Bees (indicated by blue cells on the board) collect nectar and produce honey, contributing points toward the hive’s Honey Score.

Similar to honey bees in real life, your bees may switch roles depending on their age and the needs of the hive.

In order to swarm and win the game, your colony must accomplish all three of these goals:

- Survive for 10 rounds
- Earn 7 or more Honey Bonuses (from high Honey Scores)
- Earn 7 or more Brood Bonuses (from high Brood Scores)

Finally, be aware of changes in the environment that may positively or negatively affect the colony. Good luck!
Colony Establishment (Set-Up)

1. **Record Number of students in class.** Using the Excel sheet, record the number of students in the class and the initial number of bees per student (the default is 4, although you may change this if you wish). The sheet will use this information later to calculate the HONEY and BROOD SCORES.

<table>
<thead>
<tr>
<th>Colony Establishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students in class:</td>
</tr>
<tr>
<td>Number of bees per student (default=4):</td>
</tr>
</tbody>
</table>

2. **Students assign bee roles.** Each student will assign a role to each of their bees, one at a time, by rolling a die twice. The dice are needed for this step only and will not be used afterward.

   First roll:
   - If the student rolls a 1, 2, or 3, then that bee is assigned to the corresponding cell on the game board as a **Young Nurse 1, 2, or 3**, and no second roll is needed.
   - If the roll is a 4, 5, or 6, then the student rolls the die a second time.

   Second roll
   - If the student rolls a 1, 2, or 3 the second time, then that bee is assigned to the corresponding cell as a **Mature Forager 1, 2, or 3**.
   - If the student rolls a 4, 5, or 6, then that bee is assigned to the **Mature Nurse** cell.

---

**Establish the colony (game set-up)**

Assign a role to each of your bees by rolling a die twice. Place each bee on your board in the appropriate cell, using the numbers in lower right-hand corner of the cells to guide you.

**First roll**
- 1, 2, or 3: **Young Nurse 1, 2, or 3**
- 4, 5, or 6: Roll again (see below)

**Second roll**
- 1, 2, or 3: **Mature Forager 1, 2, or 3**
- 4, 5, or 6: **Mature Nurse**
Round Progression

1. **Record Bee Points.** In the Excel sheet (see right), record the number of Nurse Bee Points and Forager Bee Points produced by the bees in each group. To be efficient, assign a member of each group to report their group’s points to you.

   Students count the number of Nurse and Forager Bee Points (indicated on the game board by Larva and Honey Dipper symbols, respectively) produced by their bees. Some bees generate more points than others, depending on their role:

   **Nurse Bee Points**
   - Young Nurses and Mature Nurses produce 2 points each
   - Reverted Nurses produce 1 point each

   **Forager Bee Points**
   - Mature Foragers produce 2 points each
   - Precocious Foragers produce 1 point each

   Space is provided on the student sheet to keep track of individual and group bee points.
2. **Report the Honey Score and Brood Score.** The Excel sheet will automatically generate scores based on the Nurse and Forager Bee Points for the whole class (see example). Write the Honey and Brood Scores on the board, but students should not record it yet, because the scores may change based on an environment card.

![Excel Sheet Image]

Below is a suggested table that you can use at the front of the classroom to record initial and final scores and earned bonuses.

<table>
<thead>
<tr>
<th>Round</th>
<th>Honey Score</th>
<th>Honey Bonus</th>
<th>Brood Score</th>
<th>Brood Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>88</td>
<td></td>
<td>2.3</td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td>89 109</td>
<td>✓</td>
<td>2.0</td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td>96</td>
<td>✓</td>
<td>2.4 1.6</td>
<td></td>
</tr>
</tbody>
</table>

**Teacher information about the Honey Score and Brood Score**

The Honey Score is related to the number of Foragers in the hive. The colony must score over 90% to earn a Honey Bonus. Recall that the colony must earn at least 7 honey bonuses to win.

The Brood Score is related to the ratio of Nurse bees to Forager bees in the colony. The colony must achieve a Brood Score of 2 or greater to earn a Brood Bonus. Recall that the colony must earn at least 7 brood bonuses to win.
3. **Report the Environment Event.** Draw an Environment Event card from the pile and report the results to the class. Students will record the event on their sheets. The events may be positive or negative, and may affect the Honey or Brood Scores. Update the scores on the board, if necessary.

4. **Students record final Honey Score and Brood Score.** If a Honey Bonus or Brood Bonus was earned this round, mark it on the table, and students should also keep track on their sheets.
5. **Students add new bees.** If (and only if) the hive receives a Brood Bonus and a student has dead bees, then those individual students will add as many new bees to their Brood cell as there are dead bees in their Dead cell(s). If a student does not have any bees in their Dead cells, they do not get to add bees.

6. **Students remove dead bees.** Each student returns pieces in the Dead cells of their game board to the supply cup.

7. **Students age bees.** Students must move each bee forward one cell in the direction of the solid arrows, unless otherwise indicated by the Environment Event cards. Bee roles that age include Brood, Young Nurses, Precocious Foragers, and Mature Foragers. If a bee ages and moves into a Dead cell, the bee stays put until the next round.
8. **Students change bee roles.** Students decide whether or not to switch bees from Nurses to Foragers or vice versa by optionally following dashed arrows. Students should consider the Honey and Brood Scores while making their decisions. Possible role changes include:

- **Mature Nurses** can become **Mature Foragers**
- **Young Nurses** can become **Precocious Foragers** (note that they will only contribute half as much to the Honey Score as a Mature Forager)
- **Mature Foragers** can become **Reverted Nurses** (note that they will only contribute half as much to the Brood Score as a Young Nurse)
- **Reverted Nurses** can switch back to **Mature Foragers** (note that strictly following the order of gameplay prevents a player from moving into and back out of the same Reverted Nurse cell)

---

**Age Bees step vs. Change Bee Roles step:**
- The Age Bees step happens **before** Change Bee Roles step.
- Aging bees is done by **all** students for **every** bee that qualifies (moving bees along solid arrows).
- Changing bees’ roles is **optional**. Individual students may or may not decide to change their bees’ roles. They may also decide to change some bee’s roles but not others.

---

*Swarm! Game Rulebook* - 9
9. **Students record reasoning.** Students write down why they decided to change or maintain bee roles. This can be used later to help facilitate discussions about honey bee behavior.

<table>
<thead>
<tr>
<th>Round</th>
<th>Bee Points</th>
<th>Environment Event</th>
<th>Honey Score</th>
<th>Brood Score</th>
<th>Did you decide to change bee roles? Explain factors that contributed to your decision.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nurse</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forager</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. **Repeat rounds until the game ends.** The class wins (the colony swarms) if they have accumulated 7 or more Honey Bonuses and 7 or more Brood Bonuses after 10 rounds of gameplay.

Still have questions about how to play? Need help? Want to download the materials?

Visit [http://neuron.illinois.edu/swarm](http://neuron.illinois.edu/swarm)!
What makes honey bees work together?
Lesson 2: Why do honey bees do different jobs?

SWARM! Student Sheet

<table>
<thead>
<tr>
<th>Round</th>
<th>Bee Points</th>
<th>Environment Event</th>
<th>Honey Score</th>
<th>Brood Score</th>
<th>Did you decide to change bee roles? Explain factors that contributed to your decision.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nurse</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forager</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Reference Image of Student Quickrules

SWARM!
The Honey Bee Game

In order to swarm and win the game:
- Survive 10 rounds
- Receive ≥ 7 Honey Bonuses
- Receive ≥ 7 Brood Bonuses

Establish the colony (game set-up)
Assign a role to each of your bees by rolling a die twice. Place each bee on your board in the appropriate cell, using the numbers in lower right-hand corner of the cells to guide you.

First roll
1, 2, or 3: Young Nurse, 1, 2, or 3
4, 5, or 6: Roll again (see below)

Second roll
1, 2, or 3: Mature Forager, 1, 2, or 3
4, 5, or 6: Mature Nurse

Count and report total number of Nurse and Forager Bee Points produced by your bees, depending on their roles (refer to symbols on board and code below).

Record Environment Event

Record Honey Score
≥ 90%: You earned a Honey Bonus!
< 90%: No bonus

Record Brood Score
≥ 2: You earned a Brood Bonus!
< 2: No bonus

Sum group’s Bee Points, report to Hive Leader

Record reasoning
On your student sheet, write down why you decided to change or maintain bee roles.

Change bee roles
Optional: Bees (in cells with a dashed arrow) may change between Nurse and Forager roles, or vice versa, by moving in the direction of the arrow.

Age bees
All bees (in cells with a solid arrow) must move forward one cell in the direction of the solid arrow. If a bee moves into a Dead cell, leave it until next round.

Remove dead bees
Place dead bees from Dead cells into bee cup.

Add new bees
If the hive received a Brood Bonus, you may add as many new bees to your Brood cell as there are dead bees in your Dead cells.
The Honey Bee Game

http://neuron.illinois.edu/swarm

= each Larva symbol worth 1 Nurse Bee Point
= each Honey Dipper symbol worth 1 Forager Bee Point
Still have questions about how to play?

Need help? Want to download the materials?

Visit http://neuron.illinois.edu/swarm!