



MICROBATTLE

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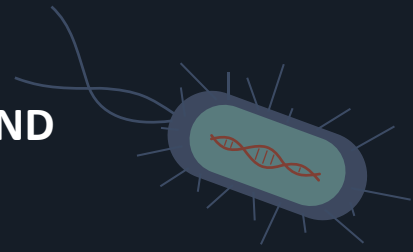
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Designed amid the global pandemic, this educational computer game is open to all age groups with the intention of letting players have basic understandings of how our body's immune system defends against various pathogens it encounters, and develop good and sustainable sanitary behaviors that potentially improves our immunity and overall health.

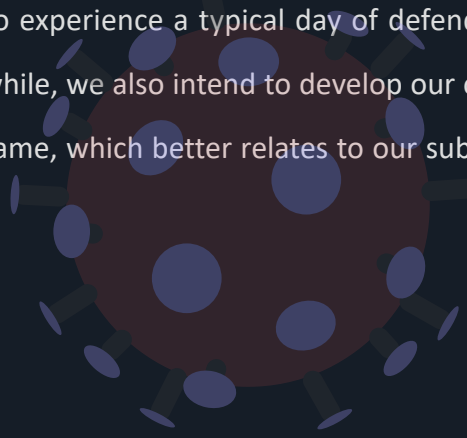
BACKGROUND



◆ This past year, 2020, has been a very special, tragic and cautionary year to all of us. The global pandemic of COVID-19 makes us aware of how important our physical health is. On the other hand, keeping healthy is not a straightforward and trivial business — it requires a lot of scientific, rigorous, correct, and global recognition and awareness of how our bodies work. Hence, we are inspired to make this educational game. The primary message we want to convey through this game is: first, we hope our players would learn more about **how our bodies defend against different pathogens**, and second, to become aware of **the importance of developing healthy daily habits**, not just during covid.

◆ After intensive research and study, we decided to tackle the topics of both **non-specific community and specific community**. We expect players to learn that non-specific immunity is the mechanism that our body uses to protect itself against any foreign material perceived to be harmful (e.g. skin, mucosal lining, phagocytes), while specific immunity allows for a targeted response against a specific pathogen (e.g. lymphocytes). In addition, we worked on developing game mechanics that foster good health behaviors that lower the risks of getting infected by pathogens, such as wearing masks, using sanitizers, and getting vaccinations, all of which will be described in detail later.

◆ Our main sources of inspiration include *Plants vs. Zombies*, *Chinese Parents*, and *Clash Royale*. We specifically liked the idea of a tower defense game, where pathogens are presented as enemies and immune cells as chesses, and the main battlefield is of course our body. Moreover, the idea of allowing players to "schedule events" also seems intriguing because it will allow them to experience a typical day of defending against pathogens and thereby learn to make health decisions. Meanwhile, we also intend to develop our own game mechanics different from those of a traditional tower defense game, which better relates to our subject matter and educational objectives.



Game inspirations: *Plants vs. Zombies* (up), *Chinese Parents* (down)



◇ **Map** The game map mainly consists of **grids**, where players place their chesses, **passages**, which are immune routes passing through the grids, and **towers**, which are organ settlements along the passages attacked by enemies.

◇ **Passage** We focus on 2 main tracts in the body, **respiratory and digestive**, where their respective pathogens go through.

◇ **Tower** Consist of **tonsil and lung** (respiratory), **stomach and intestine** (digestive), and **the skin**, that forms the boundary.

◇ **Enemy** Enemies are pathogens that enter and exit passages and attack towers and chesses. Each enemy unit has its **health level, attack level, and special skills**. We focus on four categories of pathogens: bacteria, fungi, virus, and parasite.

◇ **Bacteria** Consisting of BP and MTB, bacteria attack specifically the **respiratory tract**.

◇ **Fungi** Consisting of Cryptococcus and Aspergillus, fungi cause great damage to the **digestive tract**.

◇ **Virus** Influenza, Varicella, and COVID-19, viruses are nightmare enemies that attack both the **respiratory tract and skin**.

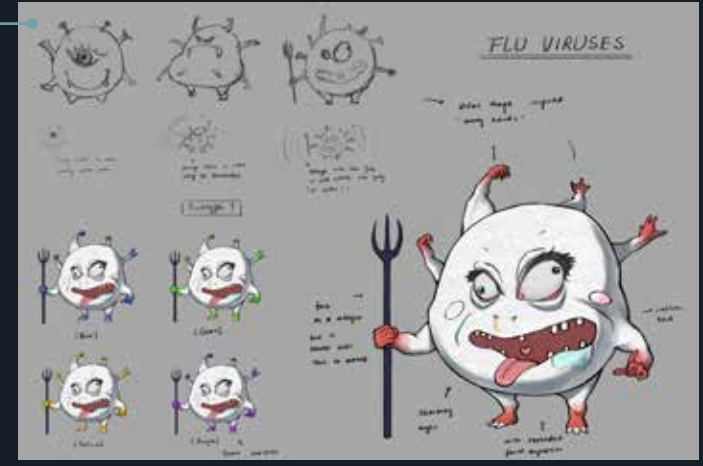
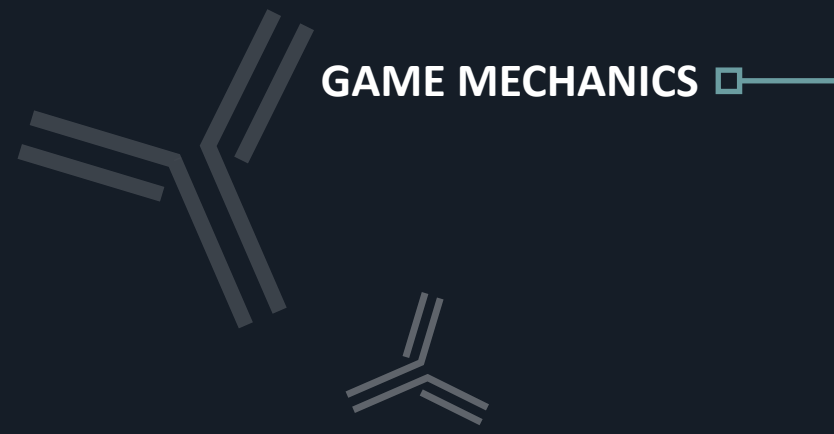
◇ **Parasite** Schistosome, Ascarid, and Mite, parasites are rare but powerful killers of both the **digestive tract and skin**.

◇ **Chess** Chesses are immune cells that players can acquire through **ATP (energy)** and defend against pathogens through the passages. Like enemies, each chess has its health level, attack level and special skills.

◇ **Phagocyte** Consisting of NK Cell, Mast Cell, Macrophage, Neutrophil, and dendritic cell, phagocytes are **non-specific** immune cells that attack pathogens through phagocytosis.

◇ **T-cell** Consisting of killer and helper T-cells, they are **specific** immune cells that bind to and trigger apoptosis of pathogens.

◇ **B-cell** B-cells are **specific** immune cells that produce antibodies (immunoglobulins) to neutralize specific pathogens.



Example Design of Enemy (Influenza)



Example Design of Chess (NK Cell)

□ GAME DYNAMICS

◇ Phase I. *Select Level*

- ◆ To start, players will have to select a difficulty level for this game. Basically there are three levels: *Very Easy*, *Normal*, and *Hell Difficult*.
- ◆ As difficulty level goes up, players will be given a more complex map with more chesses and unprecedented enemies, for which they need to develop higher strategies in order to take control. Moreover, there will possibly be limitations on the availability of shop items as well as energy gain.

◇ Phase II. *Select Events*

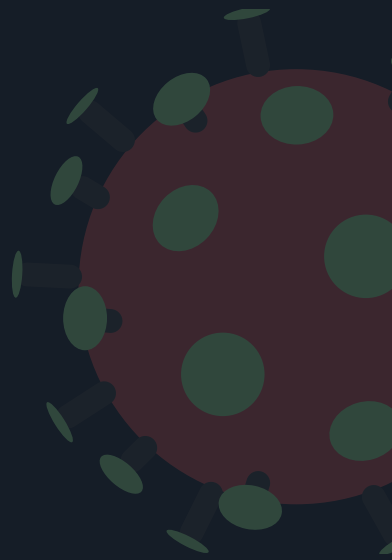
- ◆ During this phase, the players will be given a list of **events**. Each event has some pros and cons, and it is corresponding to some period of game time, which is referred as "**GHR = Game Hour**". One level has 24 GHR.
- ◆ The events are referred as "Scheduled events". In this phase, the players are asked to select and arrange the events so that these events can **maximize their abilities to defend against pathogens** during their typical "day" of gameplay.
- ◆ When the player confirms the schedule for the current level, the game will begin.

◇ Phase III. *Game Play*

- ◆ During this phase, the players will be playing on a map, consisting of grids that allow players to plant **allied units (chess)** and passages that allow the **enemy** to flow. The players will use **energy** gained from different ways to spawn new chess. Then, the chess will start to attack the enemy with their individual special skills. The enemy may also attack our allied units with their skills.
- ◆ During the special "**go to supermarket**" event, players will pause from the primary interface and shop for game items, such as masks, gloves, and sanitizers, to improve their defense against pathogens and thus chances of survival.
- ◆ The goal for this game is not to kill all the enemy, but to reduce the total number of enemy. Each enemy may have different weights, and once the total weight exceed a threshold, the game is over.
- ◆ The only winning condition is to pass the whole day schedule without exceeding the threshold.

◇ Phase III. *End Game*

- a. Win**
 - ◆ The **winning** is assured when you successfully survived till the end of the final event you arranged in your daily schedule.
 - ◆ When the victory is shown, you are doing good in this level. You can then choose to replay the current level, or you can choose to continue to next level.
- b. Defeat**
 - ◆ If the total weight of the enemy exceed the level threshold, the current level is considered **defeated**.
 - ◆ The players may choose to replay the current level with restored coin, initial energy, or they may also quit the game.



PRIMARY INTERFACE HIGHLIGHTS



Light blue arrow guides players to take actions step by step, following the instructions.



Now put it on any **blue square** of the grid map. Immune cells have different attack ranges, so put it **close** to the pathogen route (such as where the arrow points to).

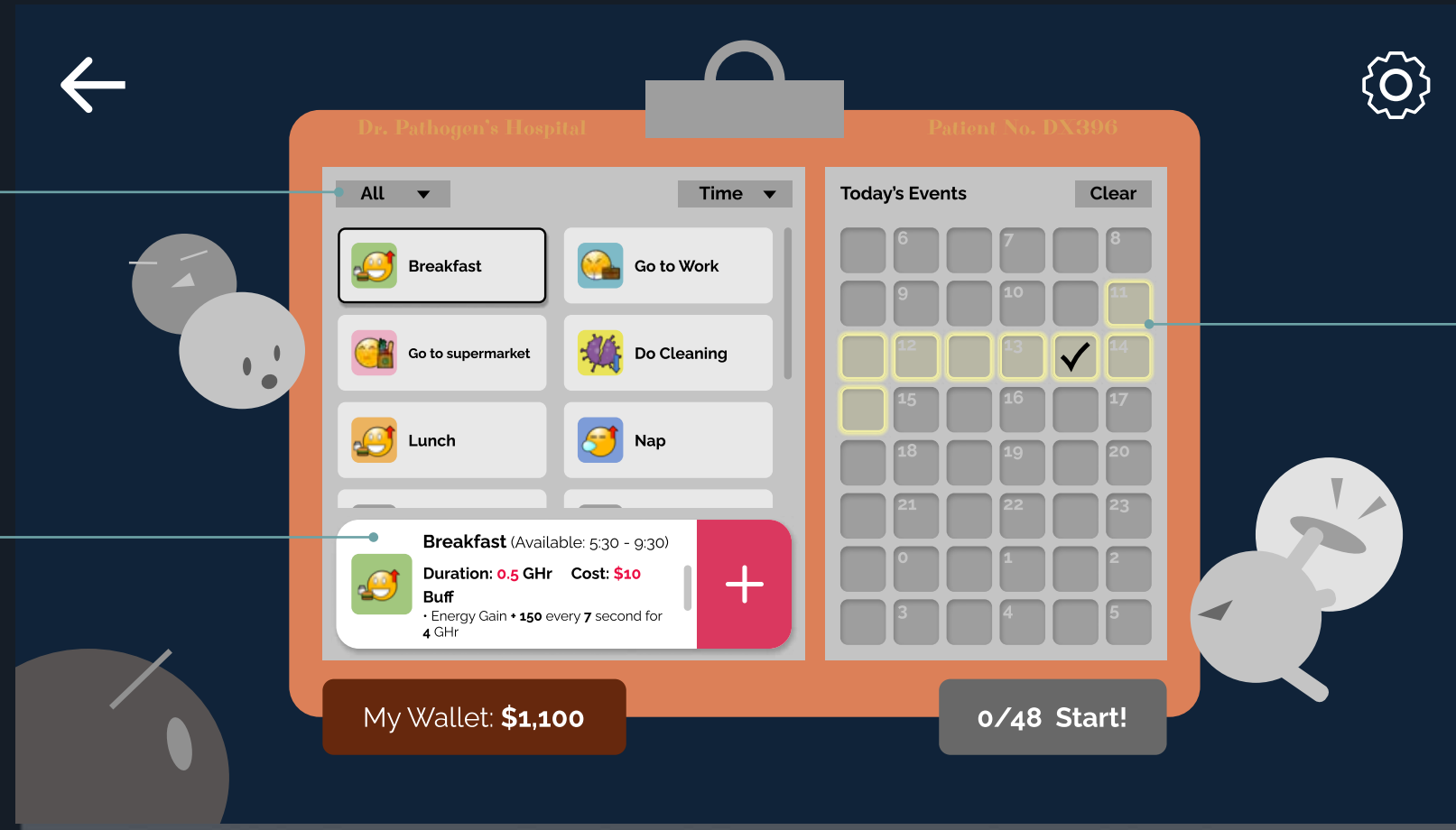
Clicking on the cute "cell icon" will show the level descriptions. Then click the green arrow to start the current level.

"Dr. Pathogen" gives detailed descriptions and instructions on how to play this game. Background voices help enhance the experience.

Primary Interface Highlights

Filter events based on category: Energy supply, HP restore, enemy debuff, special events, fool events.

Detailed description of the available time slots, duration, cost, and effects of the event, with an icon that illustrates this. Simply click on the red "plus" to add event to the event table on the right.

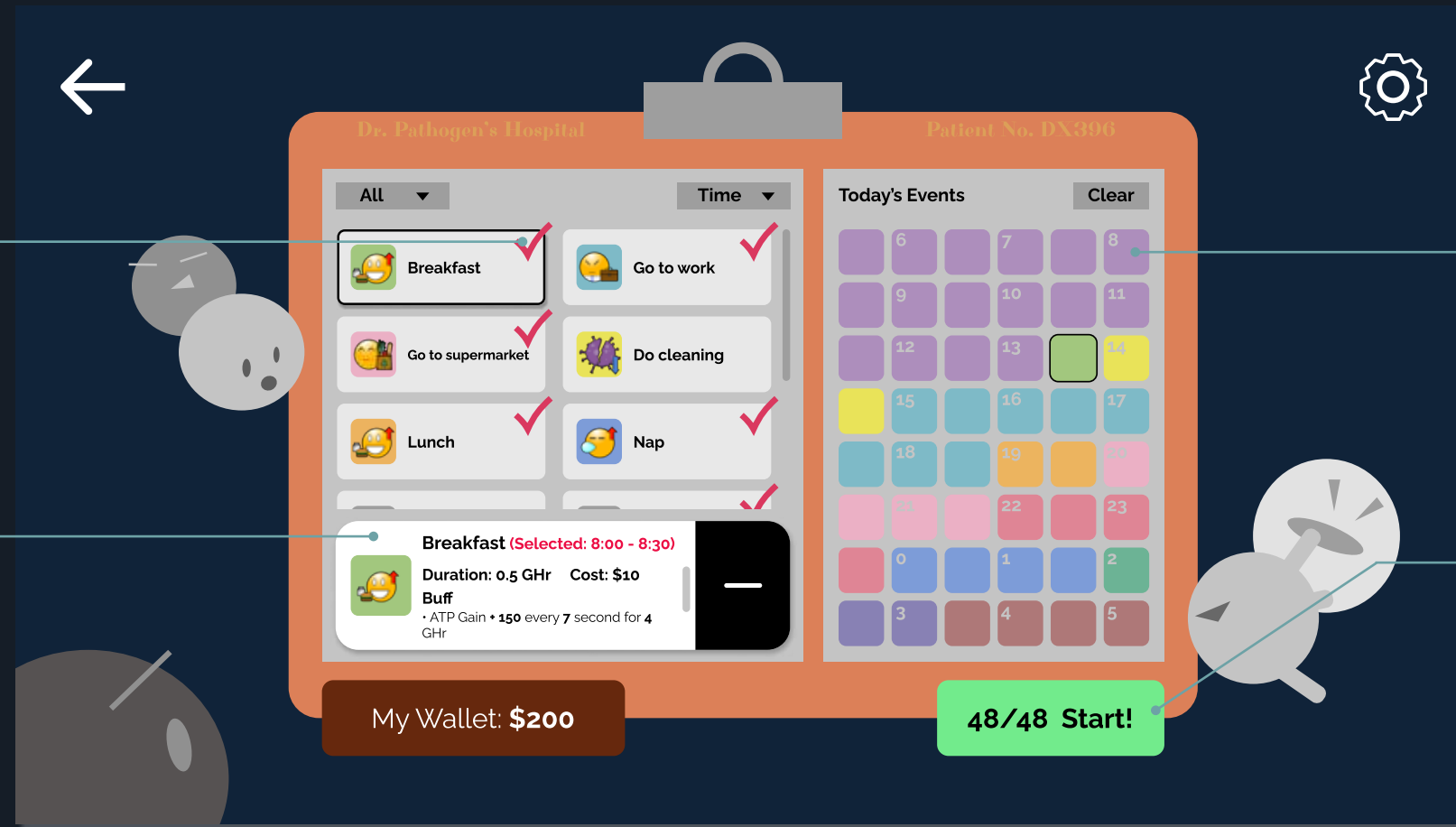


Select Event Interface

When an event is selected, grids that correspond to the available time slots of the event will be highlighted, and players need to click on the exact number of grids as required by the event duration to add the event.

Added events will be highlighted with a red check on the top right.

After the event is added, the "available time slots" will be changed to "selected slots", and players can simply click on the black "minus" to delete it from the event table.



Occupied time slots will be filled with the color of the added event, which is the color in the event icon.

The number at the bottom right keeps track of the number of occupied slots. Players need to fill a certain number of slots (at least 24) in order to start game.

Primary Interface Highlights

Primary Game Interface (Hard)

All pathogens enter here, then diverge into the respiratory or digestive track depending on the attributes of pathogens.

Click the chess on board and a little "x" will appear. Then simply click the cross to remove the chess.

Click on the right arrow near the chess icon, and a detailed description of the chess pops up. Players may refer to it to select which chesses to place on board.

Chesses have their respective Cool-Down time. Chesses done CD will be lighted up and ready for use.

Simply click the item icon and the "use" button will pop up. Then click "use" if sure to apply the item.

Clicking the left arrow near the item icon shows the detailed description of the item.

This is the total weighted HP of player, depending on 2 factors: the HP of each organ in the route and number of enemies on the map. Players will lose if the total HP drops to 0.

Pathogens exit here. They don't have to be killed before exit (unlike pvz). This is to reflect that our body gets rid of pathogens by secreting them as urine.

Bottom right shows the current event as well as the event bar (green bar indicates current progress of the event).

ATP
450

100

75

300

200

75

200

300

500

Natural Killer Cell
Health: ★★ ★
Attack: ★★ ★
Consume: 100 ATP
Skill:
-<Attack!> Detect nearby foreign units and kills it
-<Now you see me!> Uncloak the camouflage effect of passed-by enemy units

Hand Sanitizer
Effect:
Reduce bacteria generating speed on skins
Prevent parasites
Note:
In some levels costs more or out of stock

75
Go to gym: 1/4

Primary Interface Highlights

Supermarket Interface

When an item is selected, focus light will be on to highlight the item.

The background is an abstraction of an actual supermarket--items laid on stock shelves, shopping carts going through, signs and labels hanging from top--this gives players a lively feeling.

When items are added, costs are directly deducted from their wallet, and whenever an item is removed from bag, the money will automatically return to their wallet.



When an item is selected, the board will switch to a detailed description of the effects of the item. Players are encouraged to read it carefully as to learn how to apply the items in real life. Then simply click on "add to bag" to add the item.

"View map" function allows players to review their map while shopping, hence knowing which items to buy to improve chances of winning.



Added items will be displayed on the shopping bag, with number bars to easily change the number of items purchased.

Players can end shopping at end time during the "go to supermarket" event, as long as they get everything needed.