



## Dancing with the Human Microbiome: Embodying the Research, Researching the Body

### Anne Burnidge

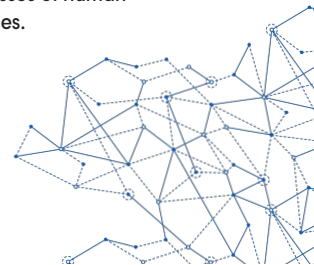
Director of Graduate Studies  
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Monday, March 27  
4:00 pm  
203 Diefendorf Hall  
UB South Campus

Join us for an informal discussion about the process of creating the new choreography piece, "What We Leave Behind." This work explores themes of symbiosis, resistance and mutation, as well as positing the metaphoric possibilities of microbiota as a microscopic community that mirrors the structures, interactions and processes of human communities.



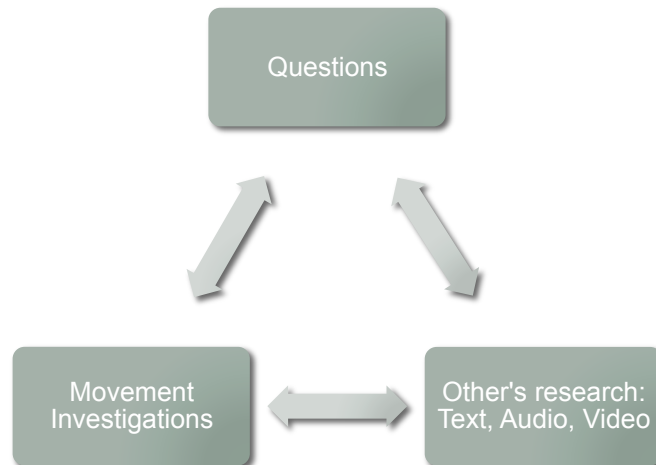
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# ***What We Leave Behind***

## **Non-Linear Approach to Creative Inquiry**

Our research process involved considering different questions, gathering source material, looking at other's research and creating movement and text material. We moved back and forth fluidly between the three steps. Using different starting points as we went.



# 4 Themes

*Symbiosis*



*Diversity*



*Resistance*



*Mutation*



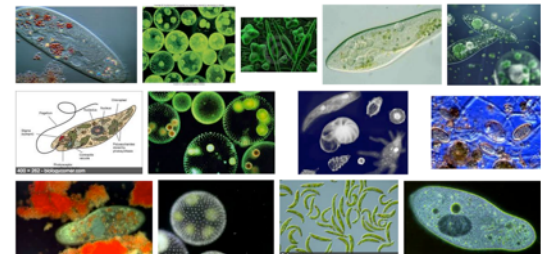
# Research

- Created an ongoing list of research questions
- Looked at concepts related to biomes that correspond to relationships of movement—including the “4 Themes”
- Experimented with how to translate microbial interactions, relationships, and other processes to the human relationship of dance



# Research Questions

- *What happens in a biome?*
    - Processes, interactions...
  - *What are some agents of change?*
    - Antibiotics/Probiotics
    - Introduction of new microbes
    - Keystone species?
  - *How is the microbiome impacted by the environment?*
    - Age
    - Diet, lifestyle
    - External environment
  - *What are active relationships?*
    - Between different biomes.
    - Between organisms and other organisms
    - Between organisms and “host”
    - Conflicts, synergists, positive facilitators...
  - *What are qualities of the microbes themselves?*
    - What are specific characteristics?
    - How do they move, communicate, procreate...
    - How do they interact?
  - *What happens when a biome is out of balance?*
    - Resiliency to return to homeostasis
    - Evolution to a new balance
    - Disease
  - *How does the health of the human microbiome affect the health of the human and vice versa?*
- 



# External Research Sources

- Discussion with GEM community member Lixin Zhu PhD, Assistant Professor, Department of Pediatrics
  - Keystone species theory
  - CRISPR—gene editing
  - Quorum sensing
- “Viral Video Shows How Frighteningly Fast Bacteria Can Evolve,” Professor Roy Kishony of Harvard Medical School with video by Michael Baym:
  - Bacterial resistance
  - Mutation
  - Competition
  - <http://www.wbur.org/hereandnow/2016/09/16/viral-video-bacteria>
- “Learn Genetics” Website from University at Utah (Information and music)
  - Human ecosystem
  - Antibiotic resistance
  - Symbiosis
  - Microbial friends
  - Changes in microbiome
  - Microbiome and disease
  - <http://learn.genetics.utah.edu/content/microbiome/>

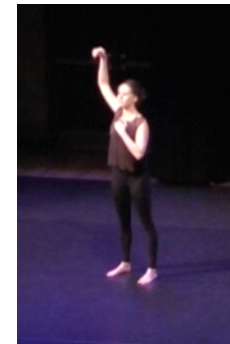
- Other research
  - Architectural Design Drives the Biogeography of Indoor Bacterial Communities  
<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0087093>
- Other art/biome work:
  - The Eden Project: Invisible You – The Human Microbiome exhibition  
<http://www.edenproject.com/visit/whats-here/invisible-you-the-human-microbiome-exhibition>
  - Microbe music—Peter Larsen and Jack Gilbert, Argonne National La  
<http://blogs.plos.org/toothandclaw/2012/10/03/the-music-of-microbes/>
- Educational videos and books
  - I Contain Multitudes by Ed Young
  - NPR: The Invisible Universe Of The Human Microbiome:  
<https://www.youtube.com/watch?v=5DTrENdWvvM>
  - TED-ed: You are your microbes - Jessica Green and Karen Guillemin:  
<https://www.youtube.com/watch?v=1X8p0vhsWRE&t=40s>
- Issues from the news
  - “Microbes a Love Story”  
[https://www.nytimes.com/2017/02/10/opinion/sunday/microbes-a-love-story.html?\\_r=0](https://www.nytimes.com/2017/02/10/opinion/sunday/microbes-a-love-story.html?_r=0)
  - “Can the Bacteria in Your Gut Explain Your Mood?”  
<https://www.nytimes.com/2015/06/28/magazine/can-the-bacteria-in-your-gut-explain-your-mood.html>
  - “Does Dirt Make You Happy?”  
<http://modernfarmer.com/2014/08/dirt-make-us-happy-getting-hands-ground-better-prozac/>
  - “Mapping the Bacteria in New York’s Subways”  
[graphics.wsj.com/patho-map/?sel=stn\\_311](http://graphics.wsj.com/patho-map/?sel=stn_311)



# Bringing it to rehearsal

## SECTIONS

1. *The Origins of Life/"RNA World"*
  - Making the RNA chain
  - Folding and copying
  - DNA Folkdance—weaving and twisting
  - CRISPR-2 breakaway--mutation
2. *Duet*
  - Symbiosis (duet)--mutualistic, commensalistic, parasitic
  - Resistance
  - Mutation
  - Evolution/Sustainability
3. *Solo "Under the Skin"*
  - Exploring the microbial landscape
4. *Group/Diversity of species*
  - Is Elyssa a virus, a facilitator, a human mirror?
  - Exploring ways to travel
  - Triggers for change—speed, direction, pathways, movements, “runners”
  - Gathering of like microbes for tasks—inside/outside





## SECTIONS (Continued)

### 5. *Reduction of species*

- Organism adapting?
- Keystone species disappearing?

### 6. *System in distress*

- Everyone in to rescue
  - Biological medicine?
  - Antibodies?
  - Antibiotics?



### 7. *From Mutation to Cooperation—Finding a new balance*

- Working to come together in agreement.
- Resiliency, can be stable through the change

### 8. *Homeostasis*

- Flowing and going and changing together

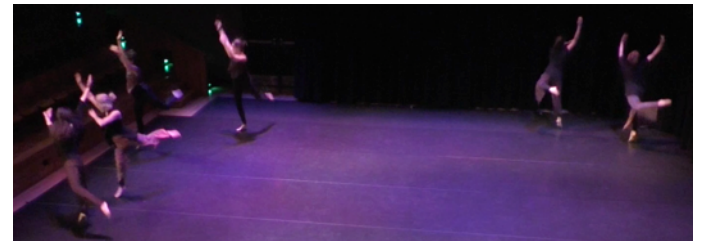
### 9. *End*

- Balance and strength
- Can be caught and rebound even when things get hard



# Where are we now?

- We've considered some relationships and characteristics:
  - Conflict, synergists, facilitators
  - Qualities of Movement of the microbes—Protists: Amoeba, Ciliates and Flagellates
  - Microbe interactions
  - Qualities of space—constricted vs spacious
  - Microbes never stop moving
- We've considered change:
  - Mutation, adaptation, biodiversity
  - Antibiotics, resistance
  - Internal and external motivators



# Continuing our artistic questioning

## Questions to refine the work:

- How does this all come together to reveal a story? (Like the plot of a book)
  - Is this a coming of age story...?
    - As the microbiome goes through transitions, what do the transitions represent?
- What is the lifecycle of the microbiome in relation to the life cycle of the human—how does it change over time?
  - Is this an overarching theme of the work?
  - If yes, do I want to make it more clear, or leave it ambiguous?
- Are the dancers microbe or person?
  - What is being represented--the internal or external environment (a view from inside the gut or outside the human being)?
    - What is the value of revealing both?
    - How are they related?
    - How and should this be clarified for the audience?

# More reflective questions

- How does interaction with other humans impact our individual and collective microbiota?
  - Do our biomes become more similar to the people we spend the most time with? (children, partners, people we live/work with?)
  - Biome compatibility: Do we choose relationships based on the unique make up of our ecto- or endo-biome?
- What can we learn about human communities and our earth from making art about microbiota?
  - What are the implications for community and eco-sustainability?
  - How might these three scales of relationship be related?
  - How does/can dance serve to reflect and participate in these discussions moving forward?

# What are the next steps?

- Ideally find scientific collaborators
- Invite dramaturge
- Add interactive components
  - Set design
  - Costume design
  - Lighting design
  - Sound design
  - Video design
- Find other performance/presentation venues
  - Buffalo Science Museum
  - Buffalo performance venues??
  - Other universities??



**Thank you!**

***Questions??***