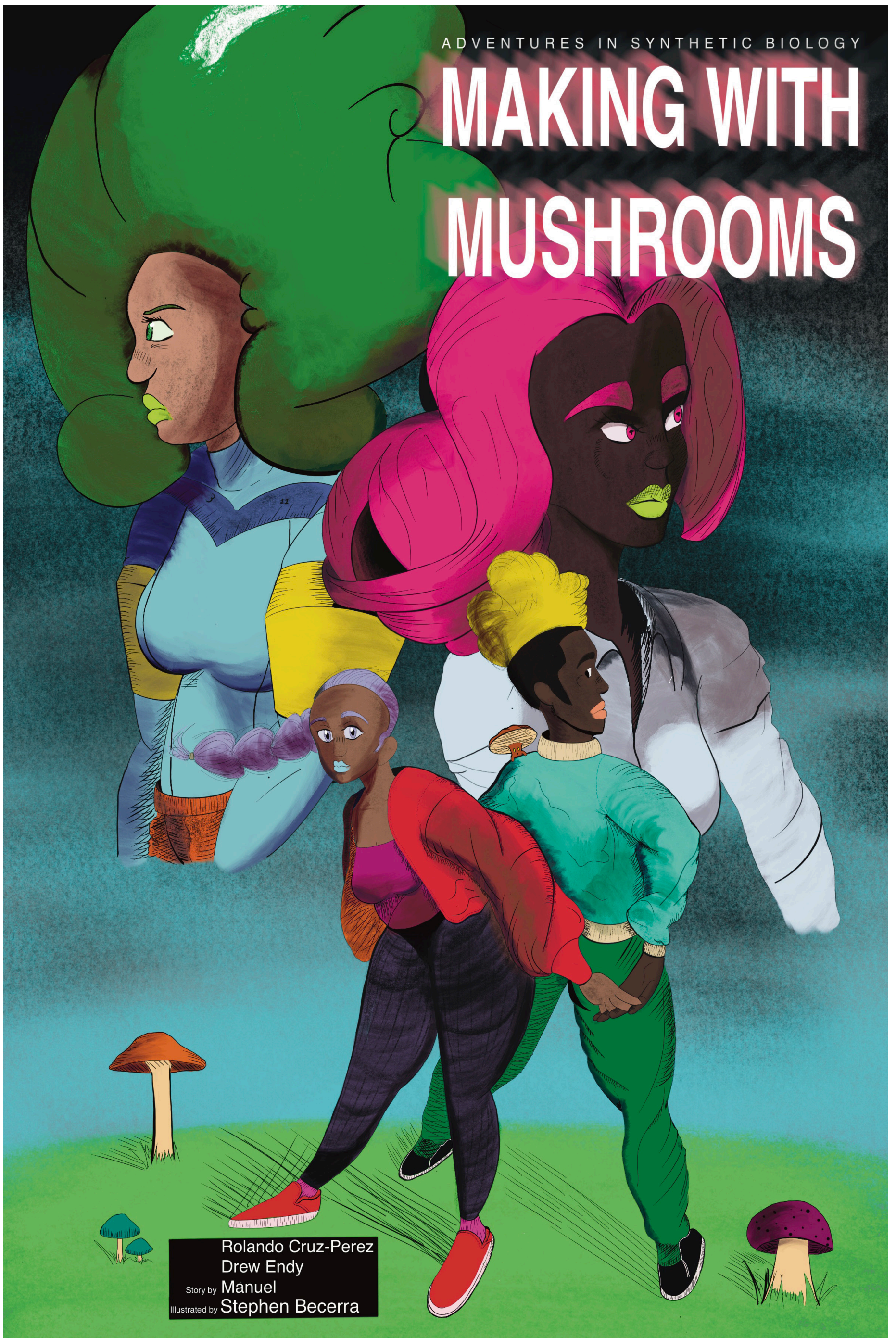


ADVENTURES IN SYNTHETIC BIOLOGY

MAKING WITH MUSHROOMS



Rolando Cruz-Perez
Drew Endy
Story by Manuel
Illustrated by Stephen Becerra

Adventures in Synthetic Biology: Making With Mushrooms

Story: Rolando Perez, Drew Endy & Manuel
Art: Stephen Becerra

We give thanks to:
Our colleagues Corinne Takara, Callie Chappell, Kabir Peay and Phil Ross for
their time, critical thought and comments.

Rated A: All Ages

- **McCloud, Scott, 1960. Understanding Comics: the Invisible Art. New York: HarperPerennial, 1994.**
- **Endy, Drew, et al. Adventures in Synthetic Biology. OpenWetWare and Nature Publishing. 2005.**
<https://dspace.mit.edu/handle/1721.1/46337>. Accessed April 2022.
- **Perez, R., Luccioni, M., Kamakaka, R. et al. Enabling community-based metrology for wood-degrading fungi. Fungal Biol Biotechnol 7, 2 (2020).** **<https://doi.org/10.1186/s40694-020-00092-2>**
- **Meyer, V., Basenko, E.Y., Benz, J.P. et al. Growing a circular economy with fungal biotechnology: a white paper. Fungal Biol Biotechnol 7, 5 (2020).** **<https://doi.org/10.1186/s40694-020-00095-z>**
- **Jones, M., Gandia, A., John, S. et al. Leather-like material biofabrication using fungi. Nat Sustain 4, 9–16 (2021).**
<https://doi.org/10.1038/s41893-020-00606-1>
- **Siegel, Noah, Schwarz, Christian. Mushrooms of the Redwood Coast: A Comprehensive Guide to the Fungi of Coastal Northern California. Ten Speed Press. 2016. ISBN 9781607748175.**
- **Moore, David, et al. 21st Century Guidebook to Fungi. 2nd ed., Cambridge University Press, 2020.**
- **McCoy, Peter. Radical Mycology: A Treatise on Seeing and Working with Fungi. Chthaeus Press, 2016. ISBN 9780986399602.**
- **A message from 10+ Indigenous leaders: Regenerative Agriculture & Permaculture offer narrow solutions to the climate crisis.** **<https://greendreamer.com/journal/indigenous-regenerative-agriculture-permaculture>. Accessed April 2022.**
- **Blanchette, Robert A., Haynes, Deborah Tear, Held, Benjamin W., Niemann, Jonas & Wales, Nathan. Fungal mycelial mats used as textile by indigenous people of North America, Mycologia, 113:2, 261-267. 2021.**
DOI: 10.1080/00275514.2020.1858686
- **Kiers, Toby. “Lessons from Fungi on Markets and Economics.” YouTube video. 16:09. November 22, 2019.**
https://www.youtube.com/watch?v=NjwvaF3P_5Q.
- **Tsing, Anna Lowenhaupt. The Mushroom at the End of the World. Princeton University Press, 2017.**
- **A History of Craniology in Race Science and Physical Anthropology. Penn Museum.**
<https://www.penn.museum/sites/morton/craniology.php>. Accessed April 2022.
- **Haraway, Donna. “A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century.” In Simians, Cyborgs and Women: The Reinvention of Nature. New York: Routledge, 1991, pp.149-181.**
- **Before the Melting Pot: Pre-Columbian Weights and Measures. NIST.**
<https://www.nist.gov/blogs/taking-measure/melting-pot-pre-columbian-weights-and-measures>. Accessed April 2022.
- **Gamble, Lynn H. The origin and use of shell bead money in California. Journal of Anthropological Archaeology. Volume 60, 2020, 101237, ISSN 0278-4165, <https://doi.org/10.1016/j.jaa.2020.101237>.**
- **Could Future Homes on the Moon and Mars Be Made of Fungi?. NASA Ames. <https://www.nasa.gov/feature/ames/myco-architecture>. Accessed April 2022.**
- **Adamatzky, A., Gandia, A. & Chiolerio, A. Towards fungal sensing skin. Fungal Biol Biotechnol 8, 6 (2021).**
<https://doi.org/10.1186/s40694-021-00113-8>
- **Liu, Yi , Srivilai, Prayook , Loos, Sabine , Aebi, Markus, Kües, Ursula. An Essential Gene for Fruiting Body Initiation in the Basidiomycete Coprinopsis cinerea Is Homologous to Bacterial Cyclopropane Fatty Acid Synthase Genes, Genetics, Volume 172, Issue 2, 1 February 2006, Pages 873–884, <https://doi.org/10.1534/genetics.105.045542>**
- **Fungal life cycles - spores and more. Science Learning Hub Pokapu Okoranga Putaiao.**
<https://www.sciencelearn.org.nz/resources/2664-fungal-life-cycles-spores-and-more>. Accessed April 2022.
- **Mushroom cultivation: the place of the mushroom in the vegetable kingdom. The Mushroom Office.**
<https://www.mushroomoffice.com/mushroom-cultivation/>. Accessed April 2022.
- **Coprinopsis cinerea as a Model Fungus to Evaluate Genes Underlying Sexual Development in Basidiomycetes. Science Alert.**
<https://scialert.net/fulltext/?doi=pjbs.2009.821.835>. Accessed April 2022.
- **Molecular Art | Molecular Science, Home Page of David Goodsell. <https://ccsb.scripps.edu/goodsell/>. Accessed April 2022.**

Chapter 1:
Making With
Mushrooms



WOW! JACK! LOOK-- THERE'S COMPANIES THAT MAKE JACKETS AND SHOES OUT OF MUSHROOMS. BUT IT DOESN'T LOOK LIKE THEY'RE FOR SALE JUST YET...



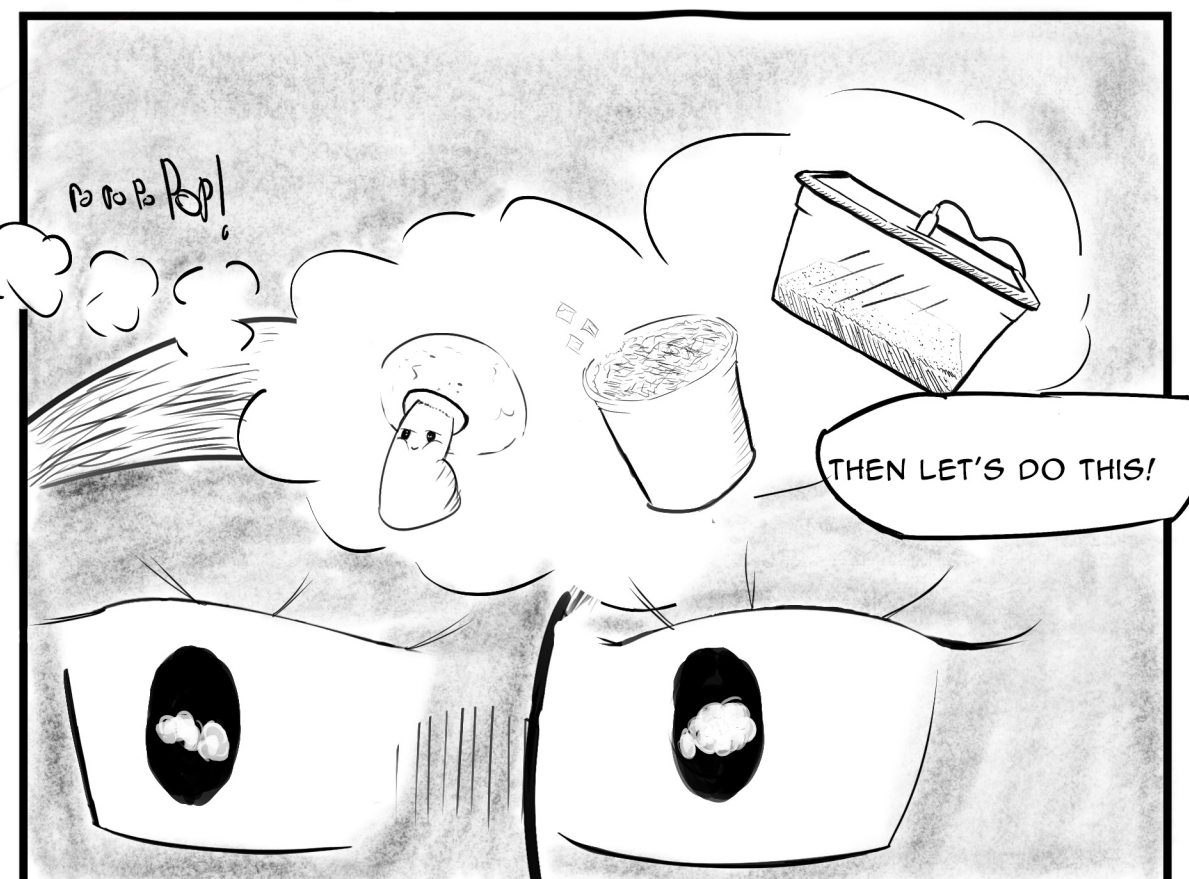
AH, BUMMER...

THEN HOW ARE WE SUPPOSED TO GET ONE?

WE COULD GROW OUR OWN, TOGETHER.



THIS SITE SAYS WE JUST NEED SOME FUNGI, A FEEDSTOCK, A FORM, AND A WAY TO CONTROL THE GROWTH ENVIRONMENT.



PoP PoP!

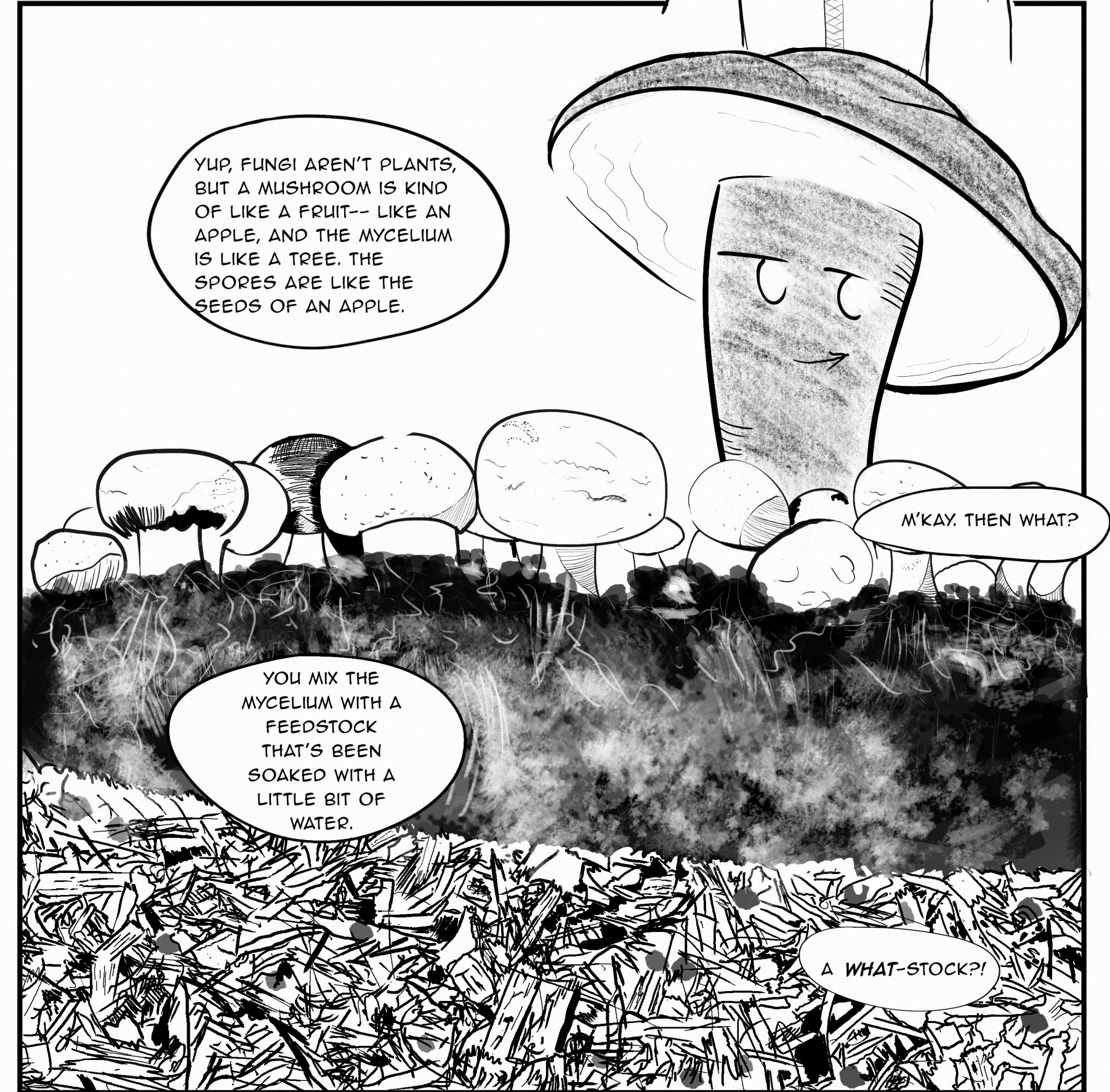
THEN LET'S DO THIS!



SO... BASICALLY, YOU TAKE THE...

MY-CE-LI-UM

THE VEGETATIVE TISSUE OF A FILAMENTOUS FUNGUS?



YUP, FUNGI AREN'T PLANTS, BUT A MUSHROOM IS KIND OF LIKE A FRUIT-- LIKE AN APPLE, AND THE MYCELIUM IS LIKE A TREE. THE SPORES ARE LIKE THE SEEDS OF AN APPLE.

M'KAY. THEN WHAT?

YOU MIX THE MYCELIUM WITH A FEEDSTOCK THAT'S BEEN SOAKED WITH A LITTLE BIT OF WATER.

A WHAT-STOCK?!