CROSSTIMBERS:
A Graphic Score + Sonification of Oklahoma Soil Microbes

Made by

Anne Yoncha, artist
with Shari Feldman, vocalist

and top 22 microbial collaborators
(by phylum and genus):

Verrucomicrobia Cthoniobacter, Actinobacteria Gaiella, Acidobacteria Aridibacter, Actinobacteria Conexibacter, Proteobacteria Bradyrhizobium, Proteobacteria Rhodoplanes, Verrucomicrobia Pedosphaera, Actinobacteria Solirubrobacter, Actinobacteria Mycobacterium, Bacteriodetes Terrimonas, Proteobacteria Chondromyces, Proteobacteria Reyranella, Cercozoa Gymnochlora, Ascomycota Penicillium, Ascomycota Cladophialophora, Mucoromycota Mortierella, Cercozoa Bigelowiella, Ascomycota Trichoderma, Ascomycota Acremonium, Ciliophora Neobalantidium, Xanthopyceae Vacheria, Chytridiomycota Maunachytrium

The collaboration begins in Ada, Okahoma, part of the Crosstimbers region of the US mid-South.

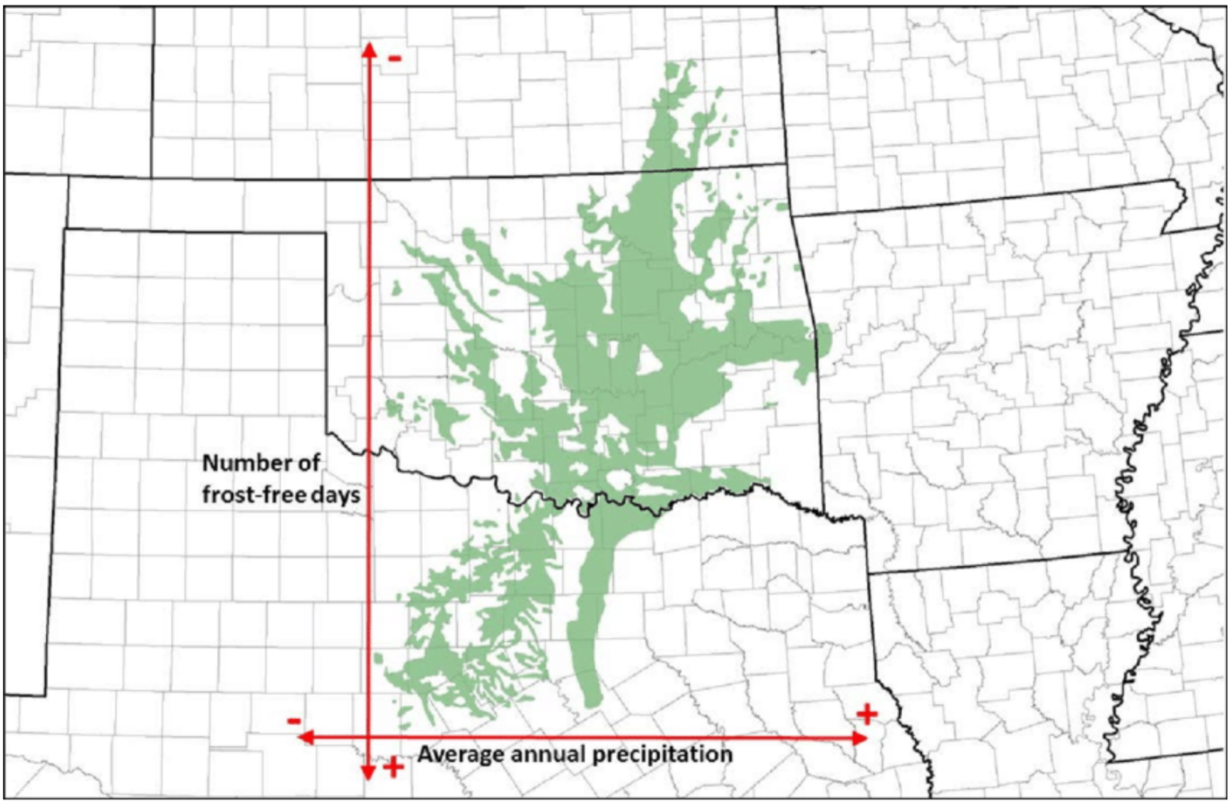


Image © Oklahoma Biological Survey

Here at the boundary of forest and prairie, wetter eastern ecosystems meet drier western ones.

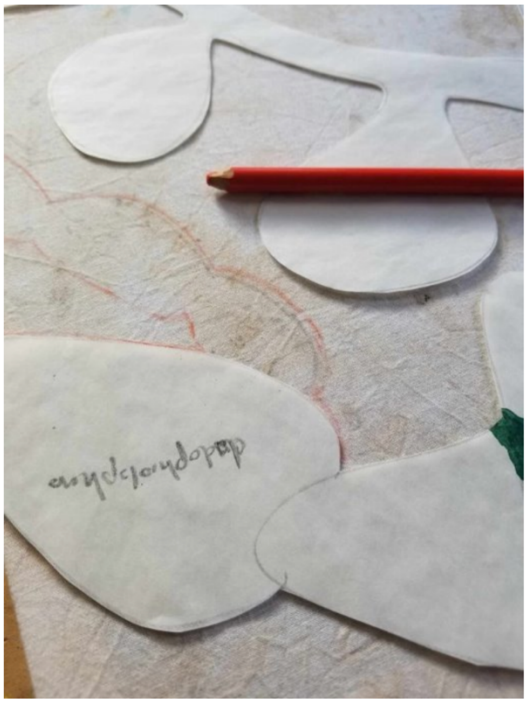
I buried 6 pieces of 22”x22” cotton cloth for one month at Wintersmith Park, so the first marks on these canvases could be made by our neighbors in the soil.

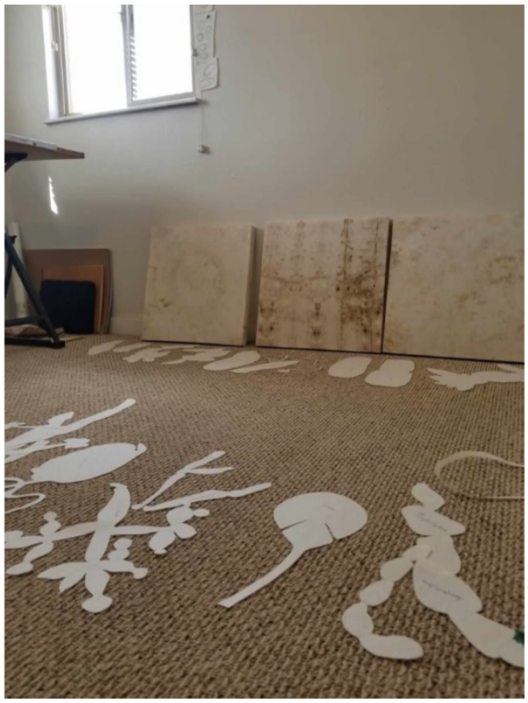
I also sent a small soil sample to MR-DNA Lab in Shallowater, Texas to try to find out these microbes’ names*.

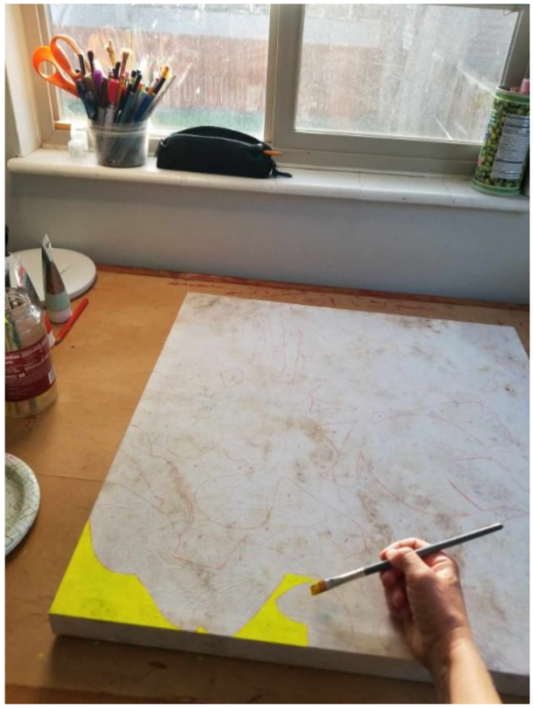
**thank you Dr Rhonda Janke and Ecoartspace for this idea and the possibility to sequence genetic information this way*

After a month, one fabric piece had been almost entirely decomposed, and one was gone completely. But I was able to recover four partially-completed “paintings”:

Reacting to the marks made by the microbes, I started painting around their forms, playing with scale so they become many times larger than life.







And I began thinking, if we can’t see these collaborators, could we hear them?

Could we experience, via sound, the teeming life in a few grams of soil, and the tension between types of microbes meeting in the Crosstimbers region?

The images in the paintings can indicate for a musician what types of sounds to make.

The forms of the microbes can determine the shape of the sound.

The microbes can become composers, and we as humans can perform the score they write.

The video you see is the visual score.

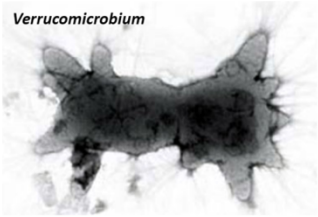
The following pages are the key.

Verrucomicrobium chthoniobacter

Gram negative - diderms (thinner cell wall, additional lipid membrane) → sound modified 2x or filtered 2x, or surround sound with 2 other sounds or beats

Rod (bacilli) → elongated sound

"cthonic" = of the underworld
"verruca" = warty! → Distorted sound
Swollen, growing sound

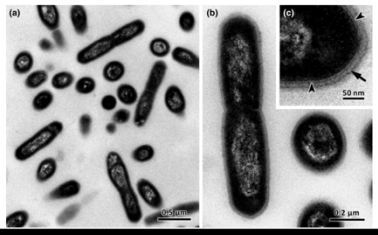


Actinobacteria Gaiella

Gram negative - diderms (thinner cell wall, additional lipid membrane) → sound modified 2x or filtered 2x, or surround sound with 2 other sounds or beats

Rod (bacilli), filamentous → elongated sound, but stringy

Named after Gaia, Greek goddess of the earth.
"Actino" = ray, beam, radial form → Earthy, underground sound
Beaming, shooting sound

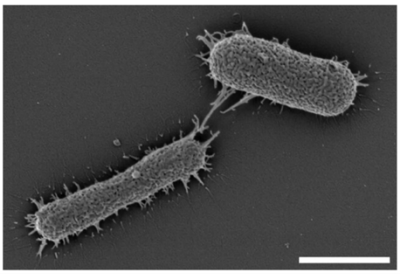


Acidibacteria Aridibacter

Gram negative - diderms (thinner cell wall, additional lipid membrane) → sound modified 2x or filtered 2x, or surround sound with 2 other sounds or beats

Rod (bacilli) → elongated sounds

Can grow in dry, clayey conditions → Dry, or staccato, sound

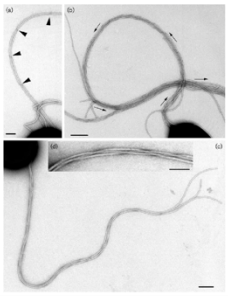


Actinobacteria Conexibacter

Gram positive – monoderm (thicker cell wall) → sound modified 1x or filtered 1x, or surround sound with 1 other sound or beat

Rod (bacilli) → elongated sound

Motile because of many flagella → Walking melodic line



Proteobacteria Bradyrhizobium

Gram positive – monoderm (thicker cell wall) → sound modified 1x or filtered 1x, or surround sound with 1 other sound or beat

Rod (bacilli), with nodulating stem and shoot → elongated sound, branching into chord

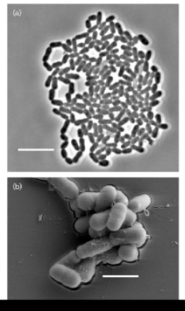
"proteo" = capable of assuming many shapes, after Proteus → dynamic, changing sound
Chord that begins dissonant and resolves

Actinobacteria Solirubrobacter

Gram positive – monoderm (thicker cell wall) → sound modified 1x or filtered 1x, or surround sound with 1 other sound or beat

rod, forms long chains, sometimes wrapping around each other → Elongated, tangled sounds

Non-motile but spore forming → Sounds are each static but a sense of echoing, each sound generating a new version of itself

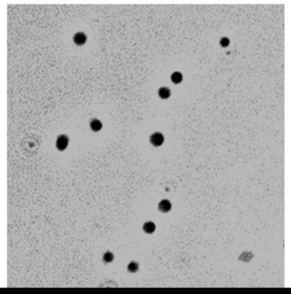


Verrucomicrobia Pedosphaera

Gram negative - diderms (thinner cell wall, additional lipid membrane) → sound modified 2x or filtered 2x, or surround sound with 2 other sounds or beats

Rod (bacilli) → elongated sound

"pili" allow it to walk and wander over a surface, can form a biofilm → walking melodic line, smooth coverage of sound



Proteobacteria Rhodoplanes

Gram negative - diderms (thinner cell wall, additional lipid membrane) → sound modified 2x or filtered 2x, or surround sound with 2 other sounds or beats

Rod (bacilli) → elongated sound

"planes" = wanderer; motile because of flagella → dynamic, changing sound, walking melodic line

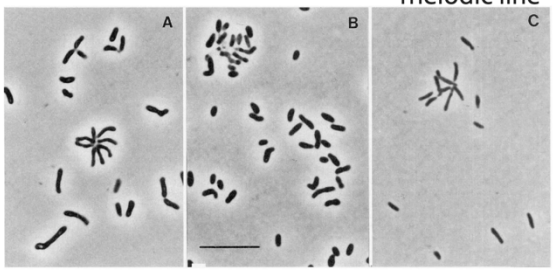


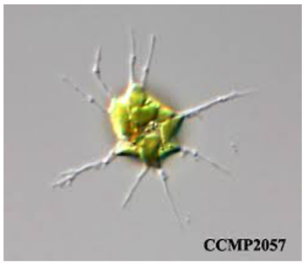
FIG. 1. Phase-contrast micrographs showing cell morphology of strain AS130 (A), *R. rosea* 941^T (B), and *R. palustris* ATCC 17001^T (C). Bar

Cercozoa Gymnochlora

Motile → Moving melodic line

Flagellate → Wiggly sounds

Marine algae species → Sound is watery, oceanic, flowing

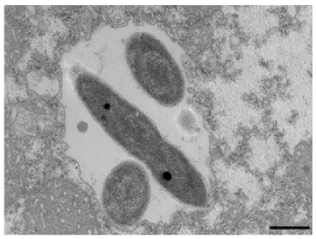


Proteobacteria Reyranella

Gram negative - diderms (thinner cell wall, additional lipid membrane) → sound modified 2x or filtered 2x, or surround sound with 2 other sounds or beats

rod → Elongated sounds

Non-motile → one held tone

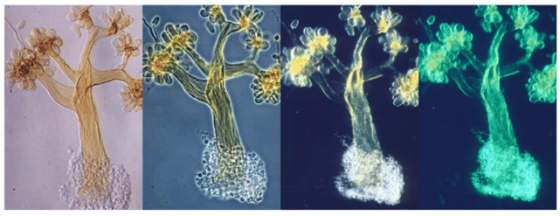


Proteobacteria Chondromyces

Gram negative - diderms (thinner cell wall, additional lipid membrane) → sound modified 2x or filtered 2x, or surround sound with 2 other sounds or beats

rod → Elongated sounds

according to NIH they have "extraordinary social" lives because they can move around by sliding around on each other (!) → Antiphonal or "call and response" sounds, like a conversation



Bacteriodetes Terrimonas

Gram negative - diderms (thinner cell wall, additional lipid membrane) → sound modified 2x or filtered 2x, or surround sound with 2 other sounds or beats

rod → Elongated sounds

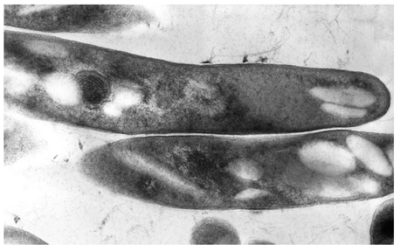
among the most abundant bacterial groups in rhizosphere, also part of symbiotic gut system in humans → Droning sound, present across whole

Actinobacteria Mycobacterium

Gram positive – monoderm (thicker cell wall) → sound modified 1x or filtered 1x, or surround sound with 1 other sound or beat

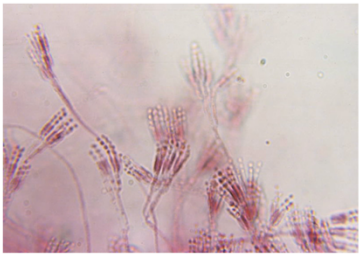
rod → Elongated sounds

"Myco" = fungus, referring to look of colony surfaces as "mold-like" → Fuzzy-edged, threaded sounds



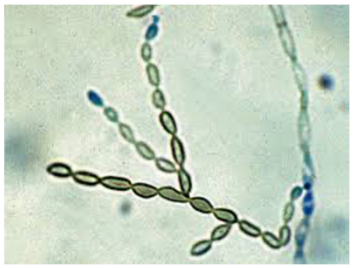
Ascomycota Penicillium

Filamentous	→	Delicate, legato sounds
Spore shooter	→	Sense of echoing, each sound generating a new version of itself, but sharply and crescendoing
Branching hyphae	→	Chords emerge from single sounds



Ascomycota Cladophialophora

Produce own melanin – defense against other microbes	→	Musical "rest" or space, before and after
Spore shooter	→	Sense of echoing, each sound generating a new version of itself
Branching hyphae	→	Chords emerge from single sounds



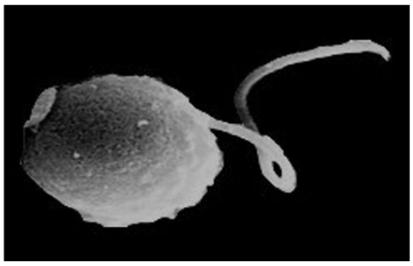
Mucoromycota Mortierella

Filamentous	→	Delicate, legato sounds
Two bacteria live within its hyphae	→	Intimate, overlapping sets of tones or intertwining melodic lines
Branching hyphae	→	Chords emerge from single sounds

Cercozoa Bigelowiella

Motile → Walking melodic line

Remnant of green algae nucleus (nucleomorph? prey?) is a vestigial part inside it, providing photosynthetic energy! → Overlapping sets of tones or intertwining melodic lines start at odds, dissonantly, and gradually resolve into harmony and coordination

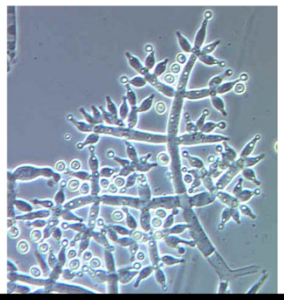


Ascomycota Trichoderma

Filamentous → Delicate, legato sounds

Spore shooter → Each sound generating a new version of itself, but sharply and crescendoing

Can activate "transcriptional memory" in plants it colonizes, so plants can recognize threats → Repeated motifs

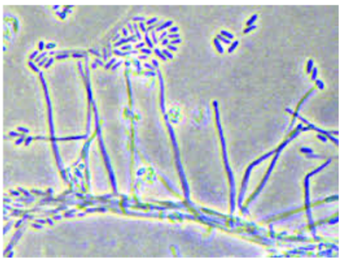


Ascomycota Acremonium

Filamentous → Delicate, legato sounds

Spore shooter → Each sound generating a new version of itself, but sharply and crescendoing

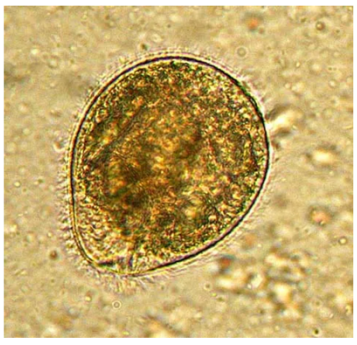
Glassy hyaline cell appearance, slimy conidia appearance → Reflective sounds – lots of reverb/echo?



Ciliophora Neobalantidium

Ovoid, name comes from Greek word for bag or sac → Round, held sound

Ciliated - small vibrating hair-like structures around the outside can propel it → Vibrato with sudden movement after



Xanthophyceae Vaucheria

Filamentous → Delicate, legato sounds

Motile spores → Separate legato notes

Thin-walled filaments with chloroplasts inside: a "siphonous" alga, so a long connected tube! → Long, hollow sound

Chytridiomycota Maunachytrium

Single flagellum → One moving melodic line, maybe like a glissando

"chytrium" = Greek for "earthen pot", the structure holding unreleased zoospores → Full-bodied sound