INSIDER TIPS to Maximize Research Benefits from Microbial Culture Collections

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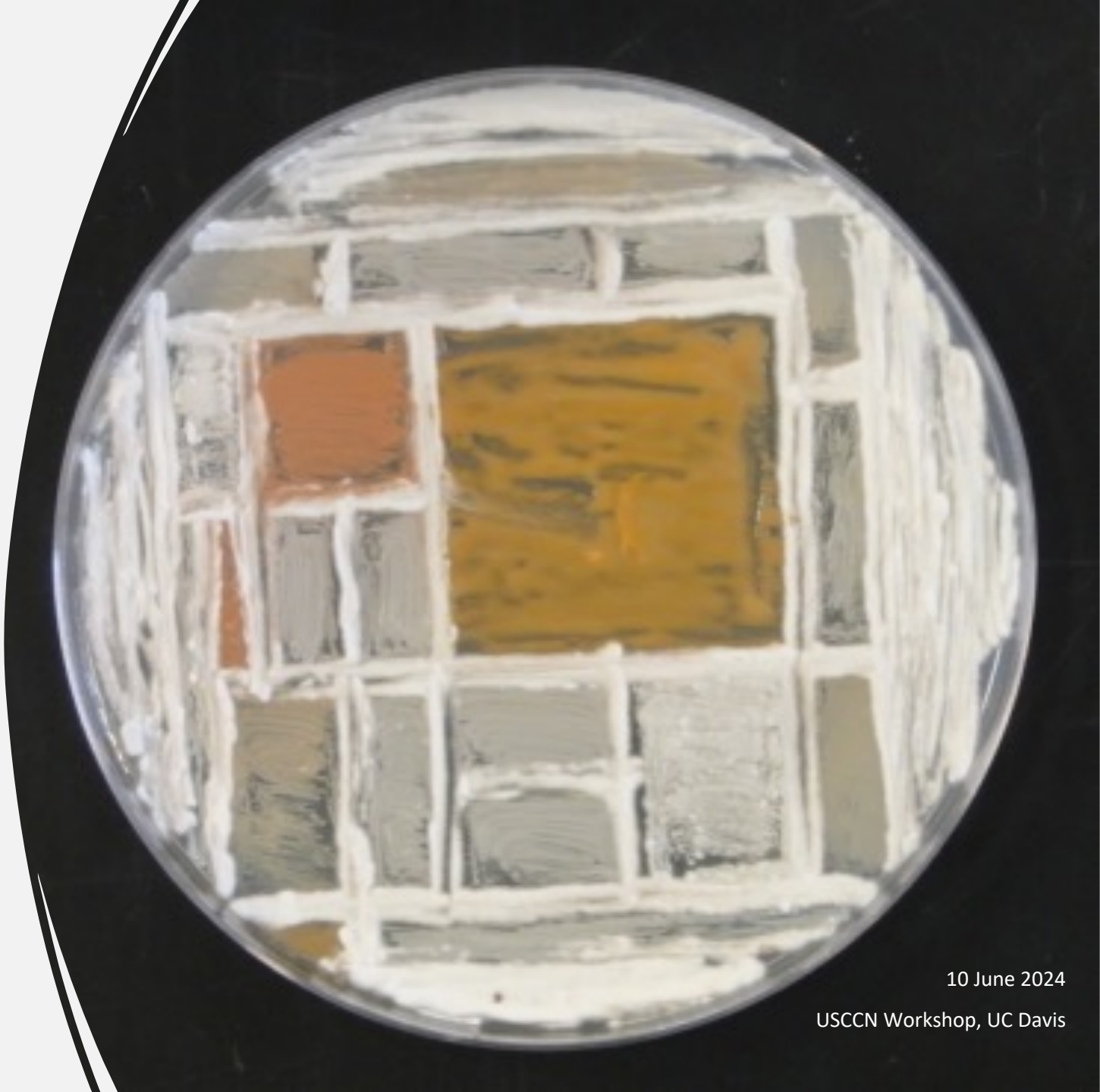


10 June 2024

USCCN Workshop, UC Davis

Q: Why obtain microbes from culture collections?

Quality control
- Viability
- Purity
- Identity

Reproducibility, Comparison
- Previous publications
- Genome sequences

Compliance
- APHIS, IATA shipping
- Nagoya Protocol
- Intellectual property

Data
- Genotype
- Phenotype

TIP:
Collection databases include non-public data

Selection
- Decades of deposits
- Database of properties
- Curator expertise

TIP:
Curators love to help select strains!

Q: Why are there so many different microbe culture collections?

A: Different uses require different strains, data, products

Basic research

- Cell: biochemistry, genetics, molecular biology
- Organism: taxonomy, physiology
- Population: ecology

Applied R&D

- Cell: starter cultures, expression hosts, fermentation
- Products: enzymes, lipids, pigments, anti-microbial compounds
- Genes: metabolite production pathways, feedstock utilization, stress tolerance

Types of Microbe Culture Collections

Many kinds of institutions

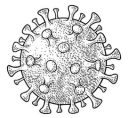
Universities

Government agencies

Companies

Non-profit organizations

Many kinds of microbes



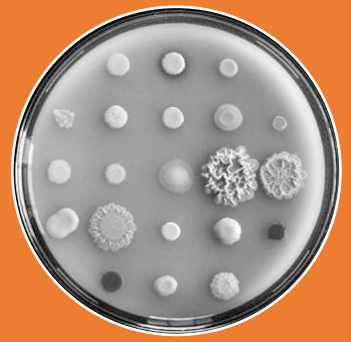
Viruses

Bacteria

Microalgae

Fungi, Yeasts

Taxonomic range; GMO



Biodiversity collections

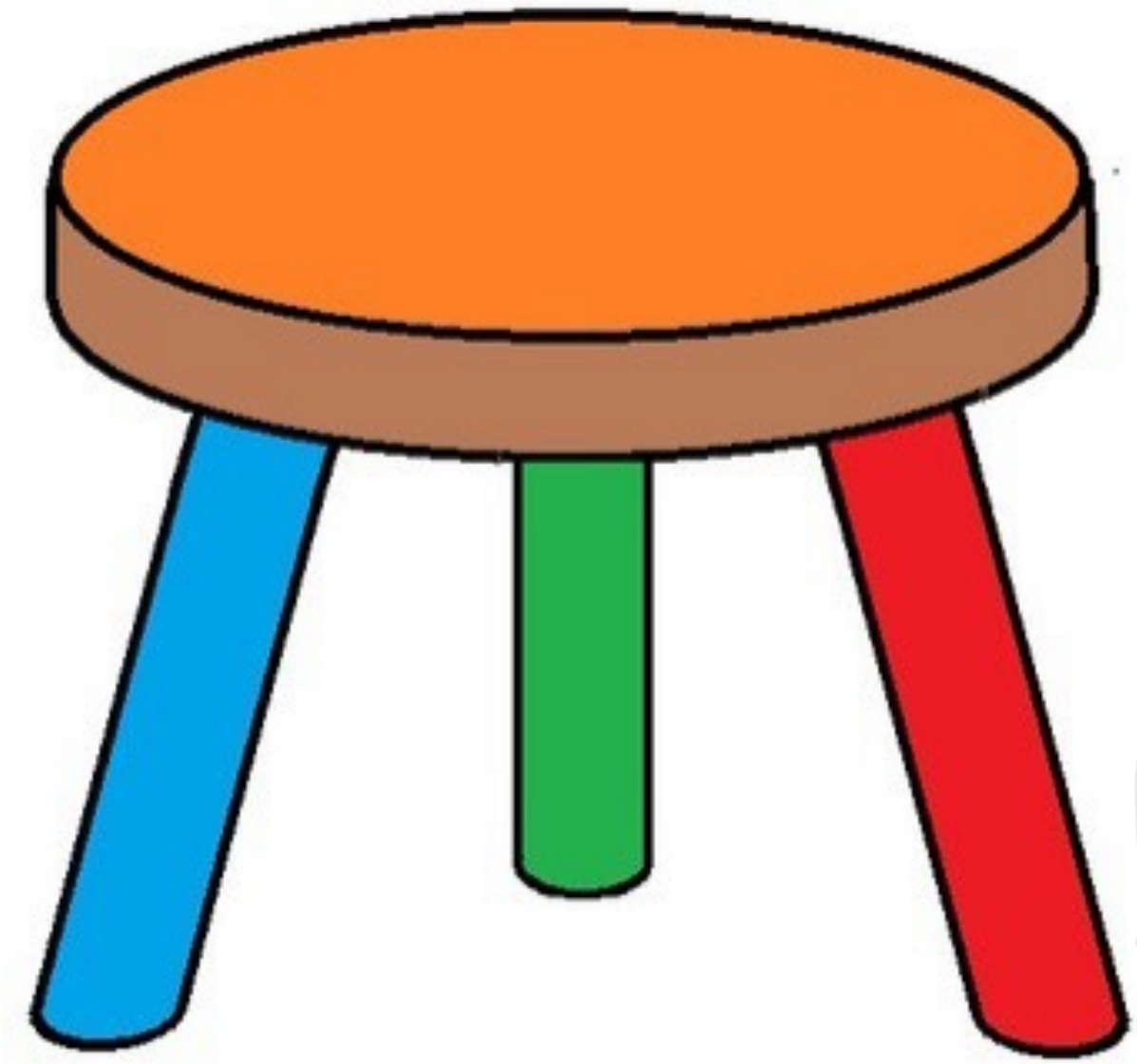
- Wild-type
- Hundreds or thousands of species

Germplasm collections

- Wild-type
- Narrower range of species

Genetic stock centers

- Model organisms
- Genetically modified
- One or few species



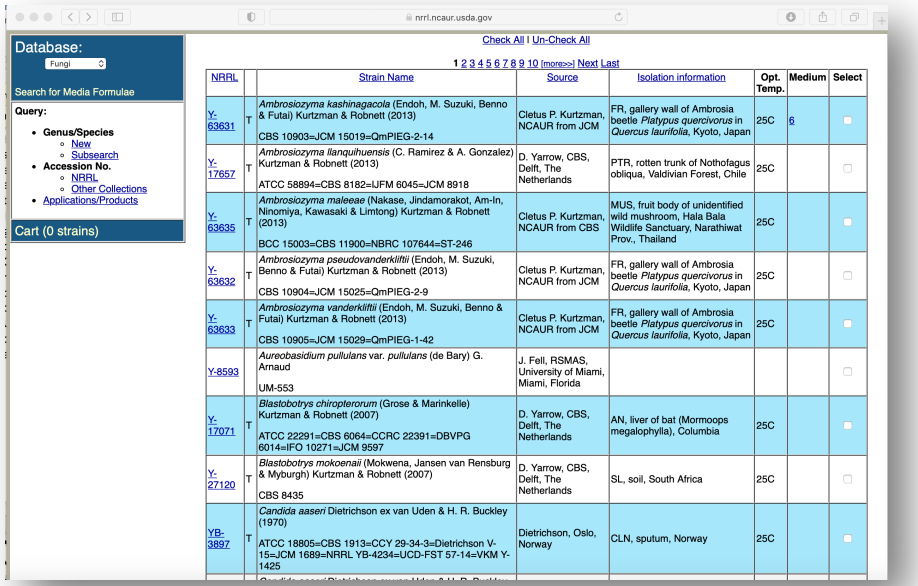
Resources of culture collections

- Strains
- Data
- Curator

Example of data: Ecology, microbiome

USDA NRRL collection

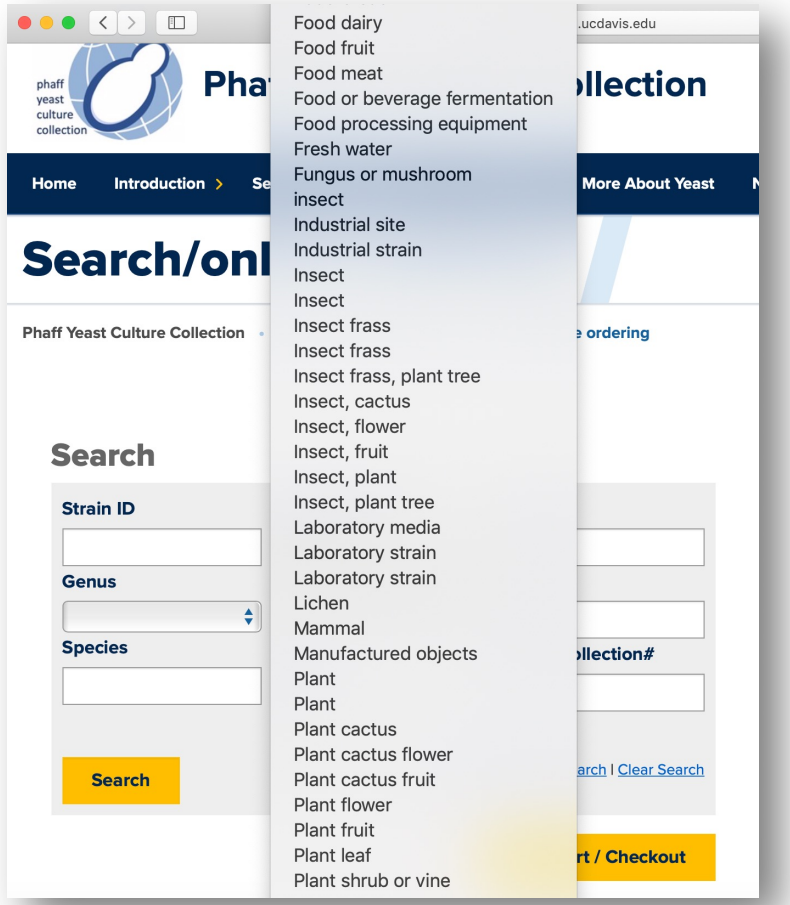
- Source habitat codes



AIR, air
AGO, ag crops
AGW, ag wasts
AN, animal source
BEV, beverage
BFD, bakery good
BN, beans
BR, beer
BWA, bracing water
CAC, cactus
CIT, citrus,
CL, cloth
CLN, clinical
CON, lab contaminant
CN, corn
DFD, dairy product
DG, dung, feces
DI, distillery yeast
DPM, decayed plant materia
FD, food
FFD, fermented food
FLO, flowers/pollen
FR, frass
FRT, fruit
FWA, fresh water
FX, slime flux
GM, gums
GRN, grain
HTR, hardwood trees, angiosperms
IFM industrial fermentations
IN, insects
IW, industrial waste
LI, lichen
LV, leaves
MFD, meat product
MUS, mushroom
PET, petroleum
PLT, plants
PP, pulp and paper
PT, paint
PTR, pine and coniferous trees
SA, sake yeast
SD, salad dressing
SED, seeds
SEW, sewage
SFD, seafood
SI, silage
SL, soil
SOF, soft drink, soda
SWA, salt water
SWP, swamp/marsh
TNF, tanning fluid
TR, tree, unknown type, wood lumber, sawdust
VEG, vegetable
VGO, veg oil
WA, water
WH, wheat
WN, wine, cider, fermented juice

Phaff Yeast Culture Collection

- Source habitat fields



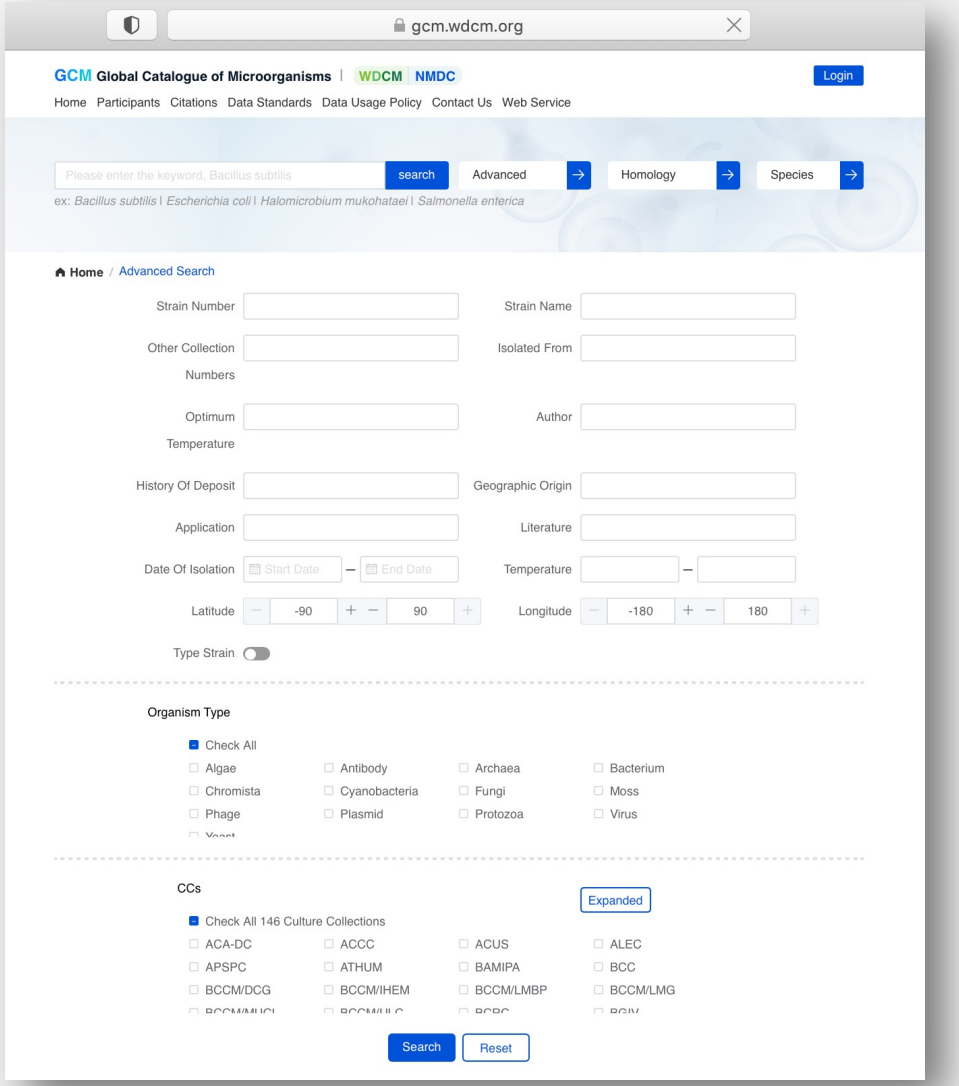
Q: How can I quickly find a specific microbe?

WFCC

WDCM

Global Catalog of Microorganisms

- 140 microbe culture collections
- Species, strain
- Geographic region
- Application



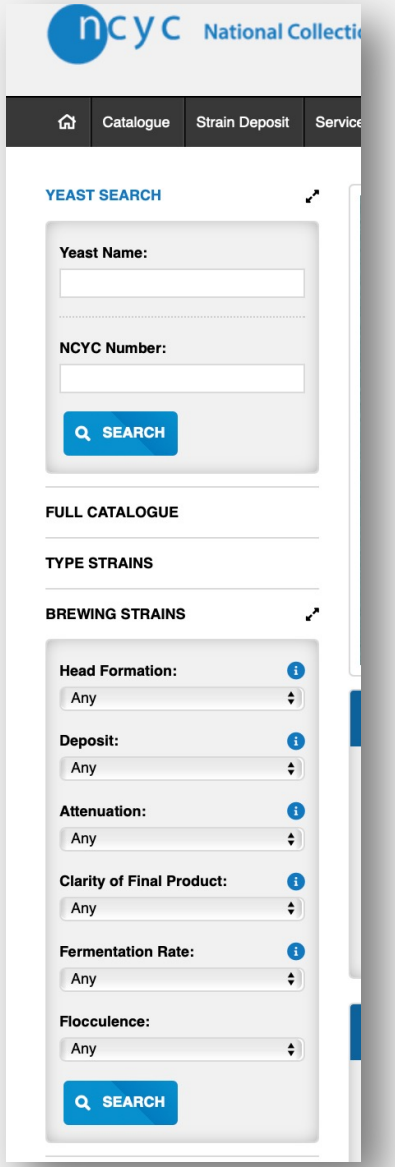
Q: What other data, products and services do microbe collections provide?

Westerdijk Institute (CBS), Netherlands

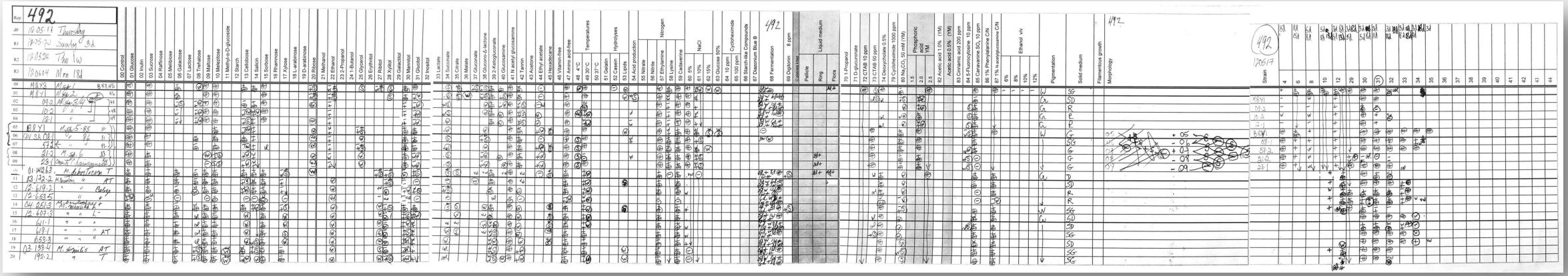
- Strain data: physiology, morphology, DNA sequences
- Photos of cells, colonies
- Literature references
- Link to taxonomy
- Workshops

NCYC, UK

- Brewing properties
- Arrayed strain sets
  - Brewing strains
  - Re-sequencing strains
- Up-front license terms



Yeast data mining opportunity: Phenotype data sheets



- Assimilation of C, N compounds
- Fermentation
- Killer activity
- Enzymes
- Morphology

Stress tolerance:

- High, low temperatures
- High, low pH
- High sugar, salt
- Growth inhibitors

phaff yeast culture collection

Q: I have a bunch of microbes. Which ones should I consider depositing in a public collection?

Criteria:

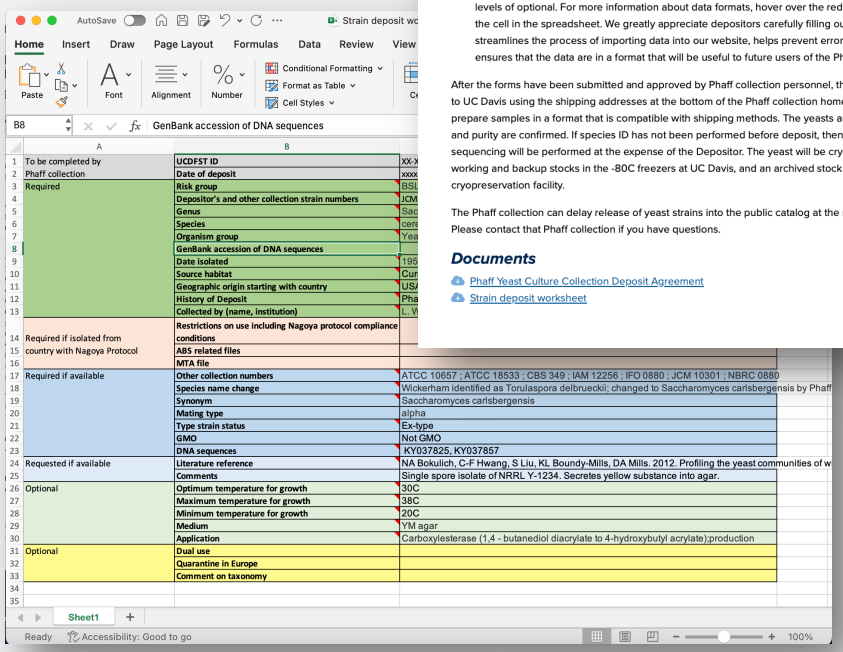
- Important discoveries
  - Cited in publications
  - Type strain of new species
- Investment in data
  - Genome sequenced
- Immediate access needed
- Costly or impossible to replace
  - “Moon rocks”
  - Classical mutations, habitat destroyed

Adapted from: Flattau, P. E., M. Boeckmann, R. d. l. Cruz, P. Lagasse, N. Mitchell, M. Patterson, and D. Singpurwalla. 2007. Scientific collections: Mission-critical infrastructure for federal scientific agencies. Science and Technology Policy Institute.

Tips for researchers

2019 publication by USCCN

- Organize specimens
  - Cull duplicates; assign unique ID
- Database
  - Source, genotype, phenotype, documentation
  - Share database
- Preserve
- Long-term plan
  - Future home; funding



Deposit Agreement and strain data spreadsheet

Boundy-Mills, K., K. McCluskey, P. Elia, J. A. Glaeser, D. L. Lindner, D. R. Nobles Jr, J. Normanly, F. M. Ochoa-Corona, J. A. Scott, T. J. Ward, K. M. Webb, K. Webster and J. E. Wertz (2020). "Preserving US microbe collections sparks future discoveries." Journal of Applied Microbiology **129**(2): 162-174.

Acknowledgments

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