Fungal Genetics Asilomar 2009

Schedule for Education and Public Outreach Session, March 20, 2009

Pat Pukkila and Pietro Spanu, Session Co-Chairs

3:00 Mimi Zolan, Indiana University, *How do we prepare future faculty*?

3:20 Scott Gold, U. Georgia, *DelsGate, a robust deletion method used as a tool for undergraduate teaching in fungal genomics*

3:40 Roundtable discussion led by Pietro Spanu, Imperial College, *Innovations in Education and Public Outreach*

4:20 Break

4:40 Joan Bennett, Rutgers University, *Lessons learned from building a program for women in science*

5:00 Gloria Turner, U. California at Los Angeles, *Neurospora genetics and genomics summer research institute: An introduction to research*

5:20 Pat Pukkila, U. North Carolina at Chapel Hill, *Undergraduate research in the state capital: Helping your State Legislators understand and appreciate higher education*

5:40 Tom Volk, U. Wisconsin-LaCrosse, *Plant pathology vs. medical mycology: Battle of the fungi*

How Do We Prepare Future Faculty?

Mentored Teaching Seminar

Mimi Zolan

Indiana University

Inspiration

- Indiana’s Freshman Learning Project (FLP)
  - My own first introduction to aspects of the scholarship of teaching and learning
  - Two-week faculty seminar
  - Each participant identifies a learning bottleneck and designs a lesson to address it
- Observations of my own Associate Instructors
  - Feeling they would benefit from formal introduction to and hands-on guidance in teaching

Mentored Teaching Course Goals

- Introduction to some of the current scholarship about teaching and learning - topics most notable for me and other FLP participants
- How to be in front of a classroom? How does a good teacher lead a class?
- Hands-on, practical experience in designing a lesson and teaching it

Mentored Teaching Course Process

- An introduction to topics in SoTL - Scholarship of teaching and learning (reading, discussion, guest instructors, interviews)
- "Field trips" to observe experienced teachers, attend campus SoTL events
- Design, practice, and "road test" a lesson for freshman/sophomore students

Course Topics - first nine weeks

- **Learning bottlenecks - interviews with students and teachers of introductory courses**
- **Naïve misconceptions (Leah Savion)**
- **CATs - Classroom assessment techniques (Katie Kearns)**
- **Decoding the disciplines and inquiry - explicitly teaching students the "tools of the trade," disciplinary thinking, asking questions**
- **Discussion of Field Trips**
- **Critical thinking, Perry's stages of development (Craig Nelson)**
- **Collaborative learning**

Course Topics - first nine weeks

- **Using SOTL to become a reflective teacher; problem-based learning and case studies course design (Whitney Schlegal)**

- **Backwards course design to accomplish critical thinking goals - choosing content to guide the development of critical thinking skills rather than structuring course around content - what do you want students to be able to do at the end of the course? What skills do you want them to have? (Craig Nelson)**

Bottlenecks

- **Bottlenecks - concepts or processes that can be difficult for students, sometimes due to naïve misconceptions, sometimes to failure of teachers to explicitly model disciplinary thinking**

Bottleneck concepts

- My students found both content bottlenecks and process bottlenecks
- Content: meiosis, central dogma, ploidy
- Process: reading history, writing English papers

CATS - Classroom Assessment Techniques

- Formative assessments - little or no effect on students' grades, provide timely feedback
- Exercises themselves are good learning tools - lead to active engagement with the material
- Help instructor to monitor student understanding
- Help students to monitor their own understanding

CATS

- Think, Pair, Share (can include classroom response systems - "clickers")
- Pipecleaner models for chromosomes
- Human Tableau
  - Pool noodle mitosis and meiosis (Locke, J and H. E. McDermid. Genetics 170: 5–6)
  - Party-hat tRNA

Bottleneck lessons: some guidelines

1. Make the actual presentation about 30 minutes long.
2. Each presentation must include some type of pre-test and some type of post-test assessment of student understanding.
3. Each presentation must include at least one (and usually more than one) CAT.
4. Each presentation must include some type of active, preferably collaborative, activity, which can be one of the CATs.
5. After the presentation, write an evaluation and reflection, including a discussion of students' comments.

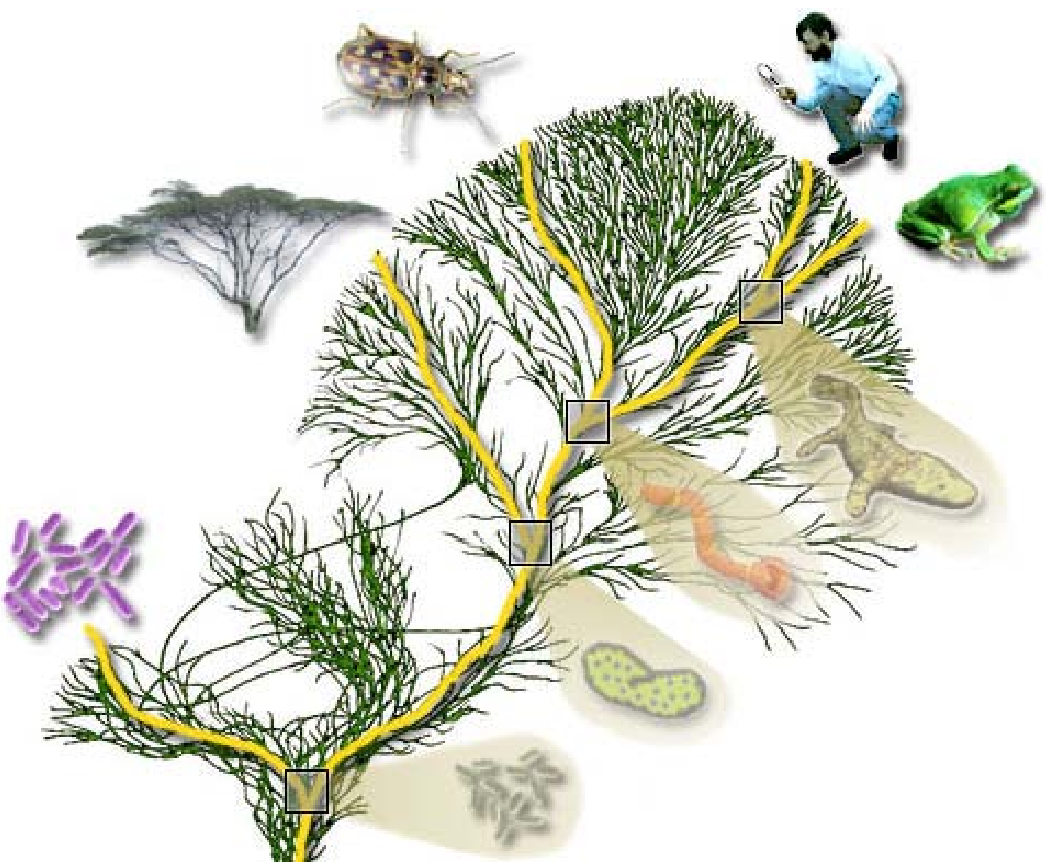
Each student gives a practice for students in the class (and me), and then a presentation to undergraduates. Students may be recorded if they so choose.

Bottleneck lessons 2008

- Hardy Weinberg: it's not just p's and q's
- X Chromosome Inactivation in Development
- The Prokaryotic and Eukaryotic Cell: What's the Difference?
- The Importance of Hydrogen Bonding
- Introduction to Phylogenetics (T,P,S)

Introduction to Phylogenetics

Casey McGrath



Outline

- What is phylogenetics?
- How to build a phylogenetic tree
- Molecular phylogenies
- Why phylogenetics?

Maximum Parsimony

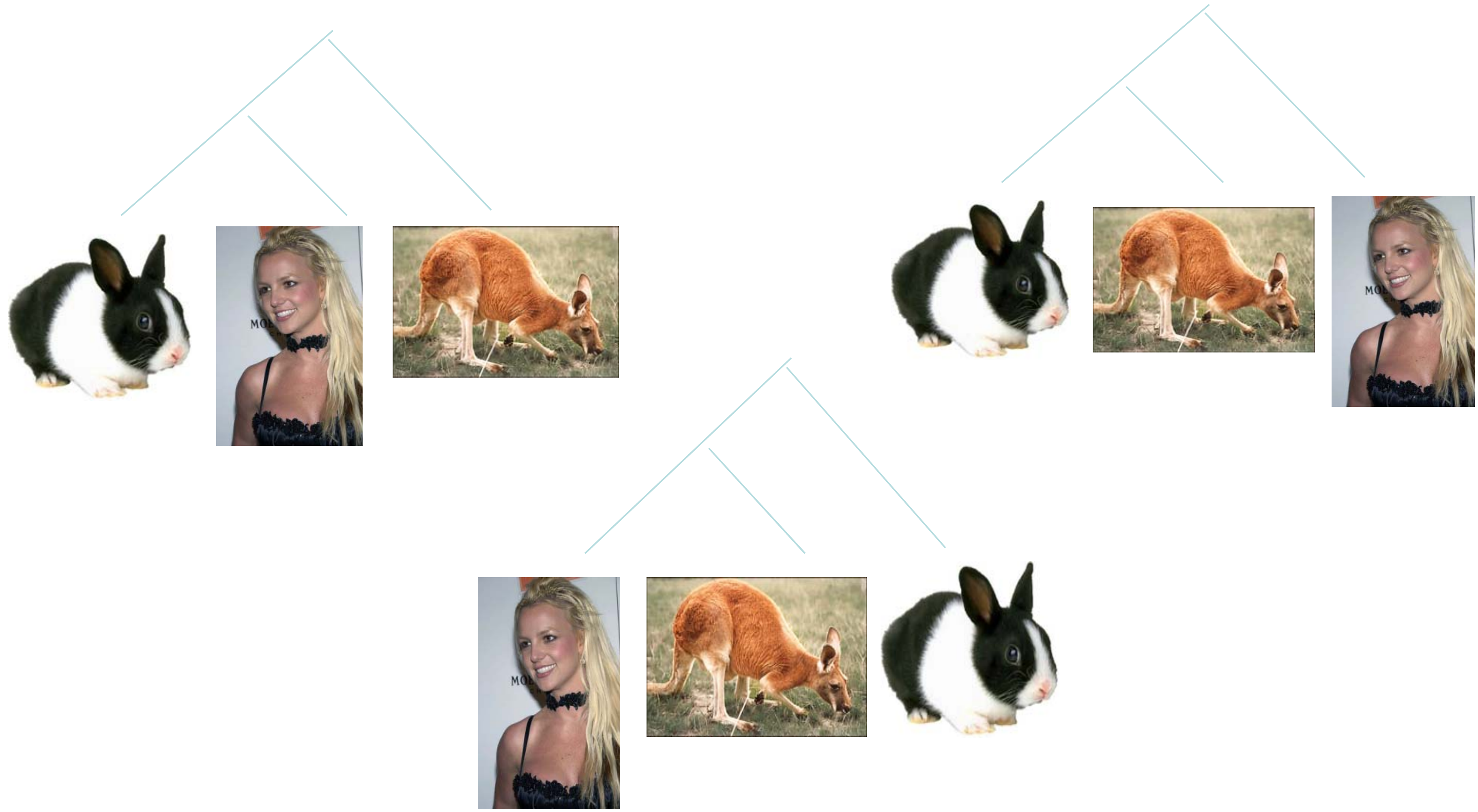
1. What traits will be used to build the tree?

Warm-blooded, placenta, big teeth

Warm-blooded, placenta, superior brainpower

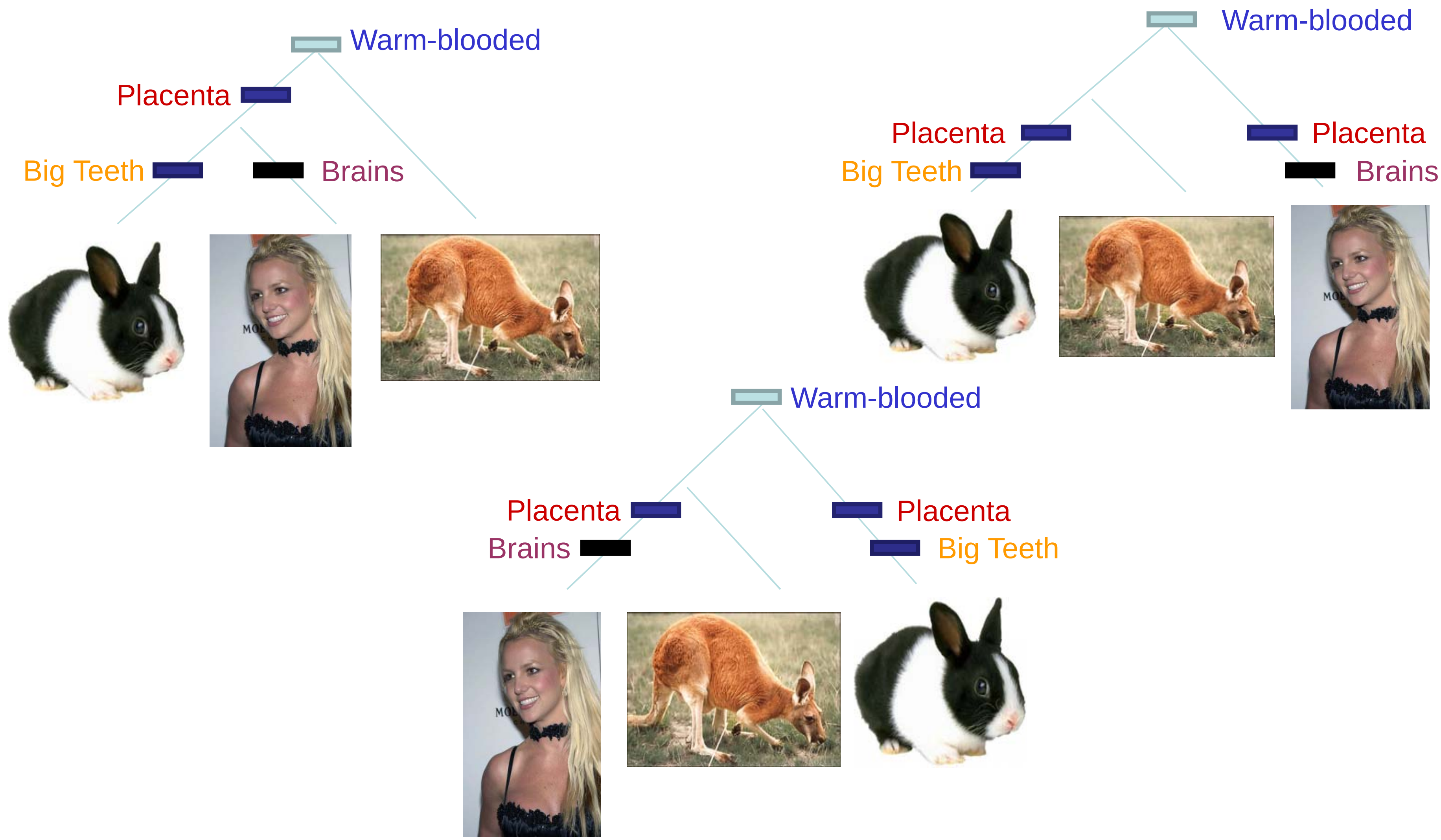
Warm-blooded

Maximum Parsimony



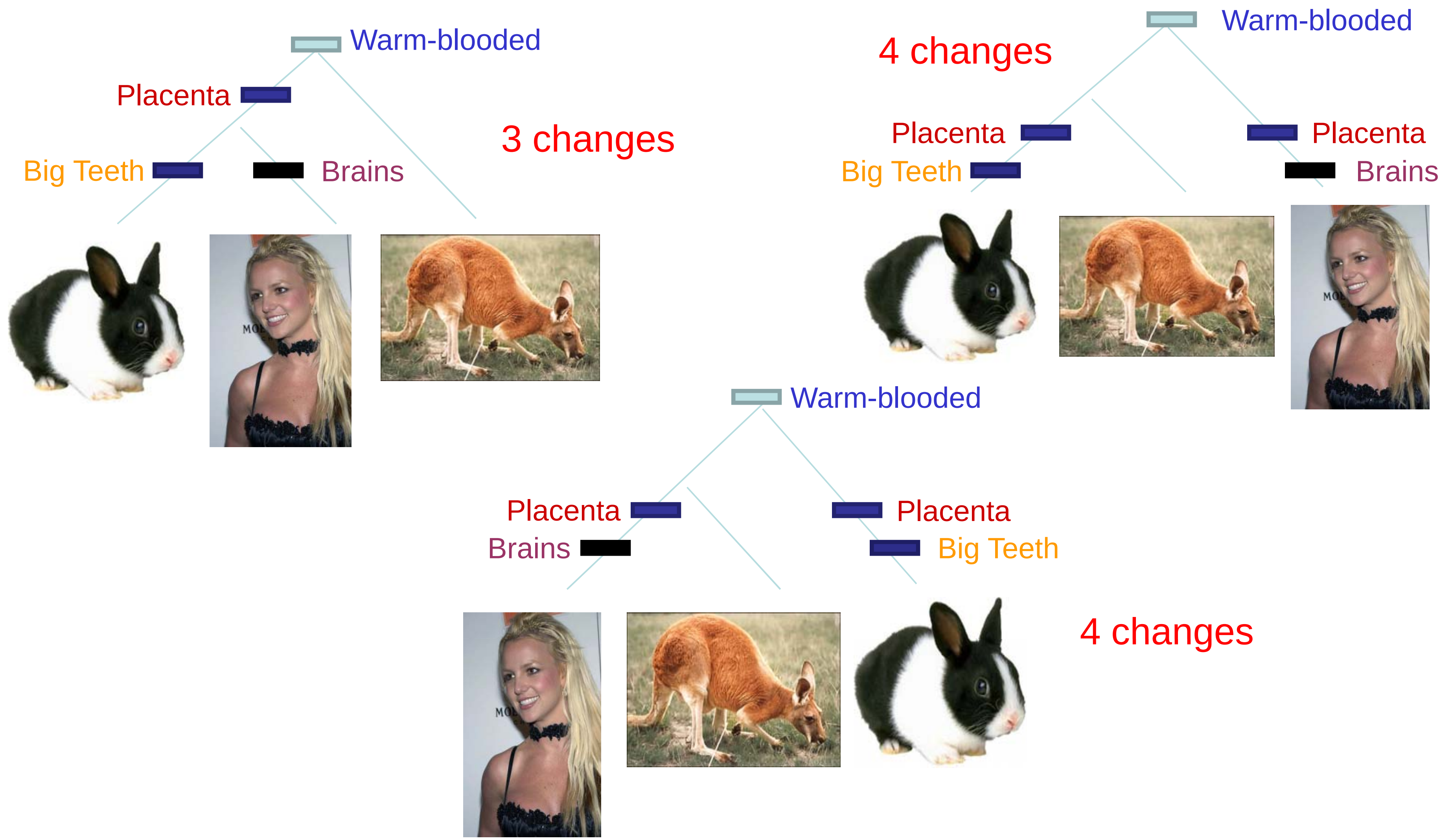
2. Build all possible trees

Maximum Parsimony



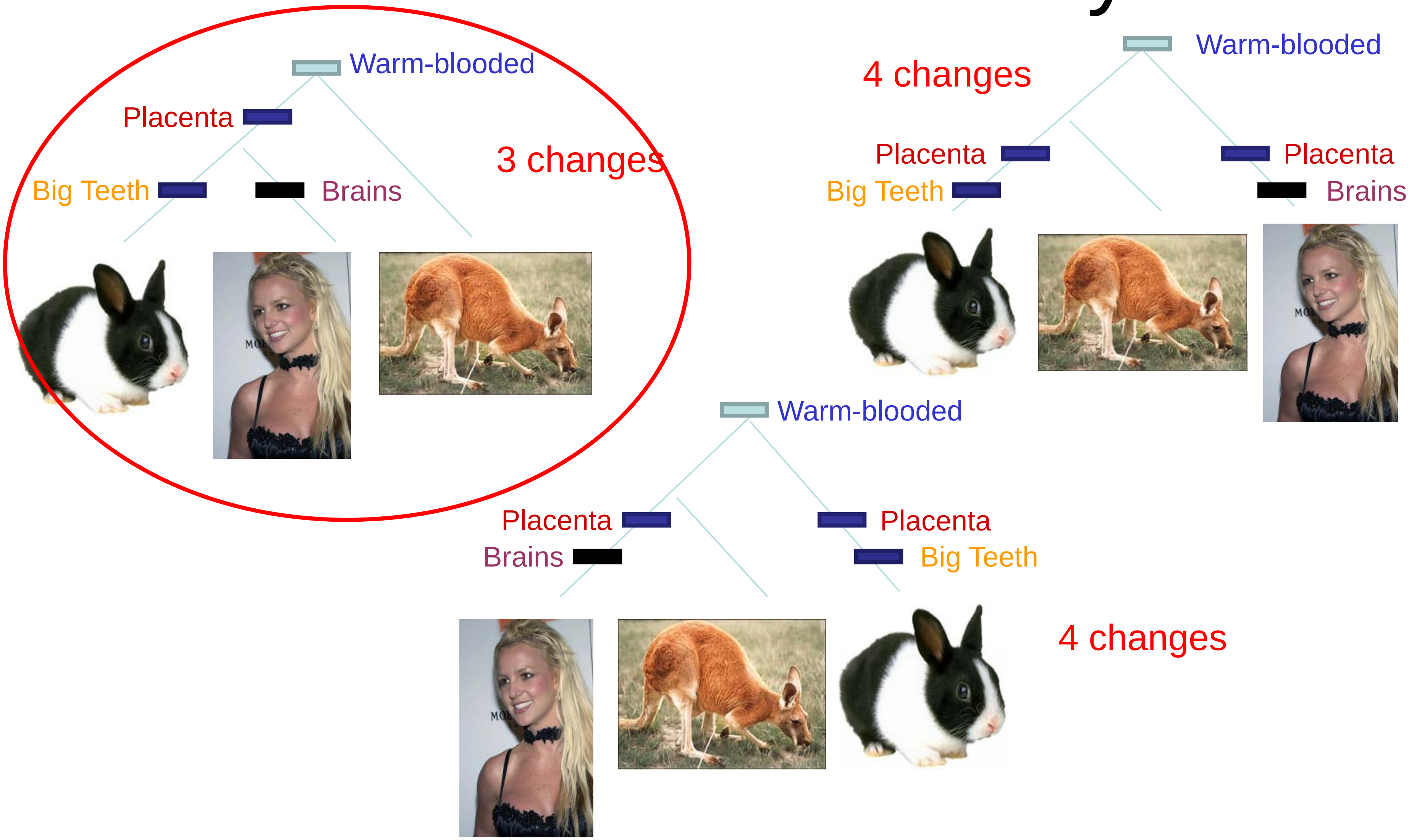
3. Add changes along branches

Maximum Parsimony



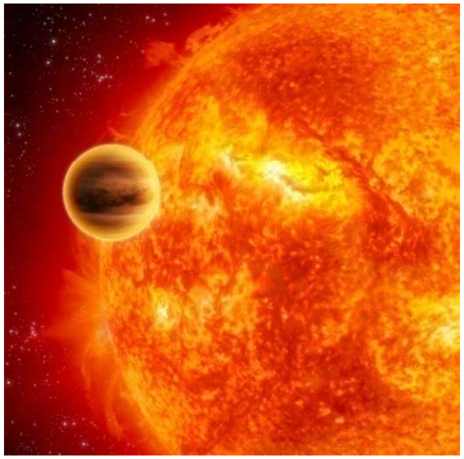
4. Count up number of changes

Maximum Parsimony



5. Choose most parsimonious tree (fewest changes)

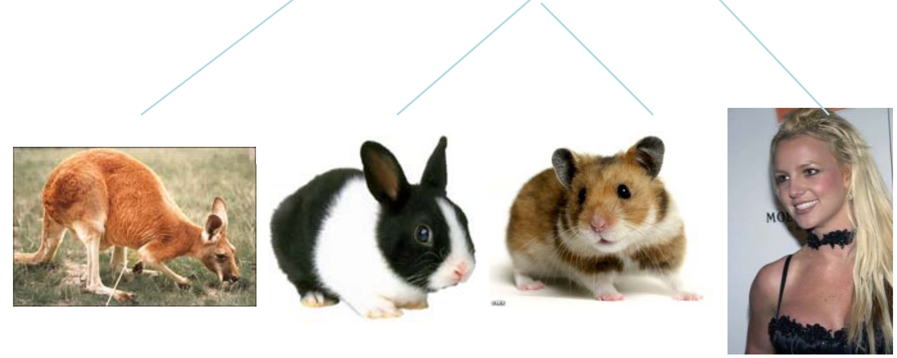
Class Activity



It is the year 2250. A new planet with suspected alien life has been discovered, and you have been chosen to accompany the first mission to the planet. Your job is to study any new life forms you encounter and to build a phylogeny of these creatures for research purposes back on Earth.

Class Activity

1. Decide what traits are important
2. With a partner, draw a possible tree (hint: place more similar organisms closer together)
3. Place changes on branches
4. Count up all changes within your tree
5. As a class, choose which tree(s) require fewest changes



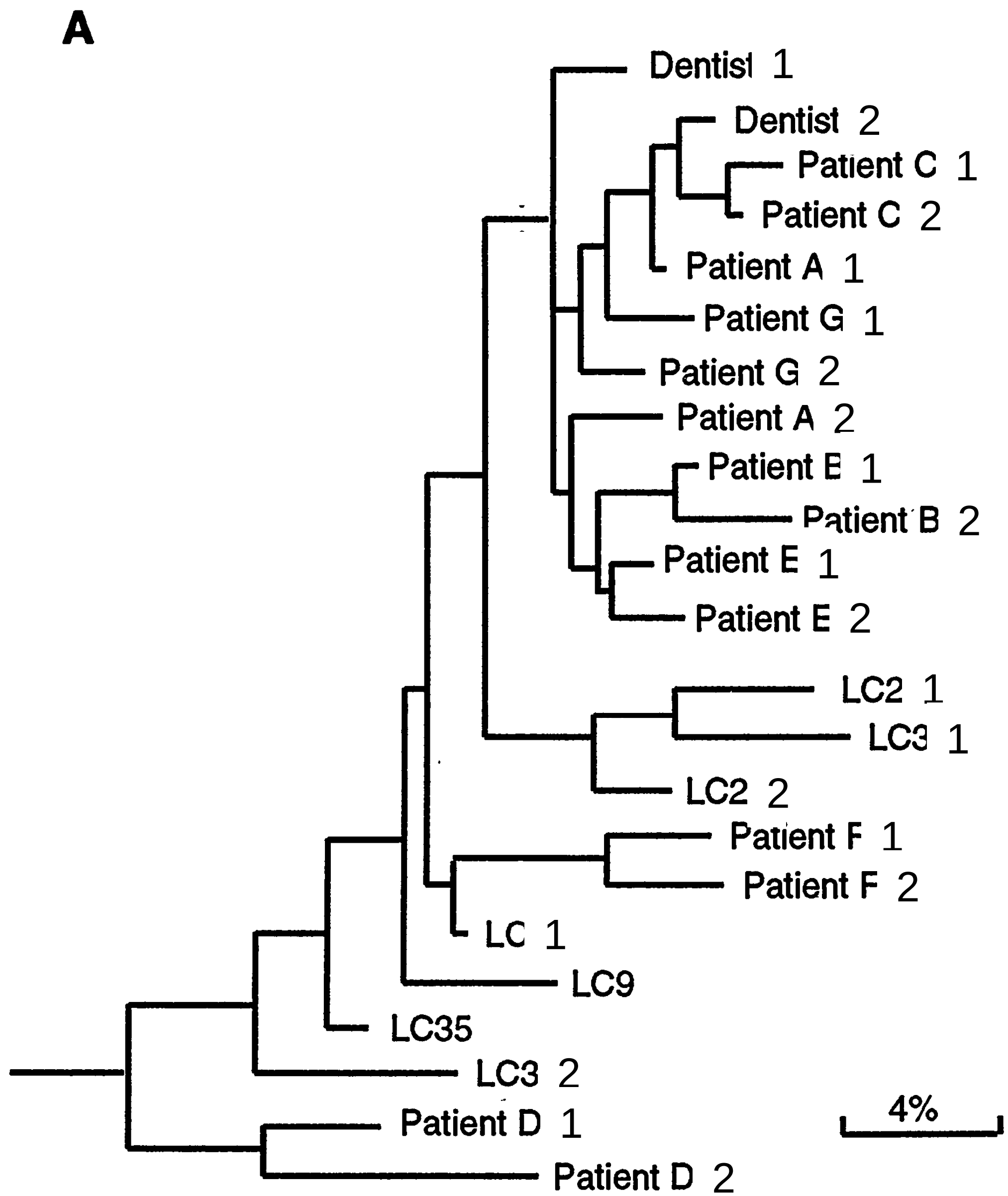

Class Activity
CAITLIN

How can we use phylogenetics?

- Relatedness
- Evolution/Speciation
- Molecular Clocks
- Infectious Disease

HIV Case Study

In 1990, a Florida dentist, Dr. David Acer, died from complications of AIDS. Within a few years of his death, several patients of his were diagnosed with HIV, some of whom had no risk factors for contracting the disease. A phylogeny was created using molecular sequences of the virus from the dentist and seven of his patients (Patients A-G), as well as several local control patients who had no contact with the dentist.



Do you think any of the patients contracted HIV from the dentist? If so, which ones? What is the evidence?

Reflections and Feedback

- First of all, I want to say that I took this class because I was terrified of teaching…I chose my topic (Phylogenetics) because it's important to me as an evolutionary biologist and because it's a concept that I think all biologists need to be familiar with on some level. The idea originally came to me because I overheard one of my professors trying to explain some of the concepts to a couple of his undergraduates during office hours and it seemed to be a real bottleneck for them.

Reflections and Feedback

- **I was immensely grateful for the opportunity of the practice lesson and all of the comments and improvements that came out of it. It really made me start imagining what it would be like to be a student hearing my lesson for the first time, and I think that was invaluable…I loved reading the emails the students sent later that day. I was impressed with how well they grasped the material and seemed to really understand what I was trying to convey.**

Reflections and Feedback

- **One student said, "while I did not 'learn' anything new, the perspective on the difficulty of making phylogenetic trees was brought to my attention by the exercises she had us do in terms of making a tree, as well as discussing why the Tree of Life is an unrooted tree. I had essentially heard all of the facts about phylogenetics before, but never really had to sit down and think them through first hand, and the experience from doing that is definitely what I would say I walked away with, at the end of the presentation."**

Reflections and Feedback

- **I was worried about the student responses to the activities (Would they just think the activities were stupid?), but I received lots of positive feedback overall about the activities...In summary, this experience has made me feel much more prepared to be an AI in future years and to one day teach my own class. It's also made me think more about my teaching philosophy and style and provided me with a good toolkit for preparing lessons and activities in the future.**

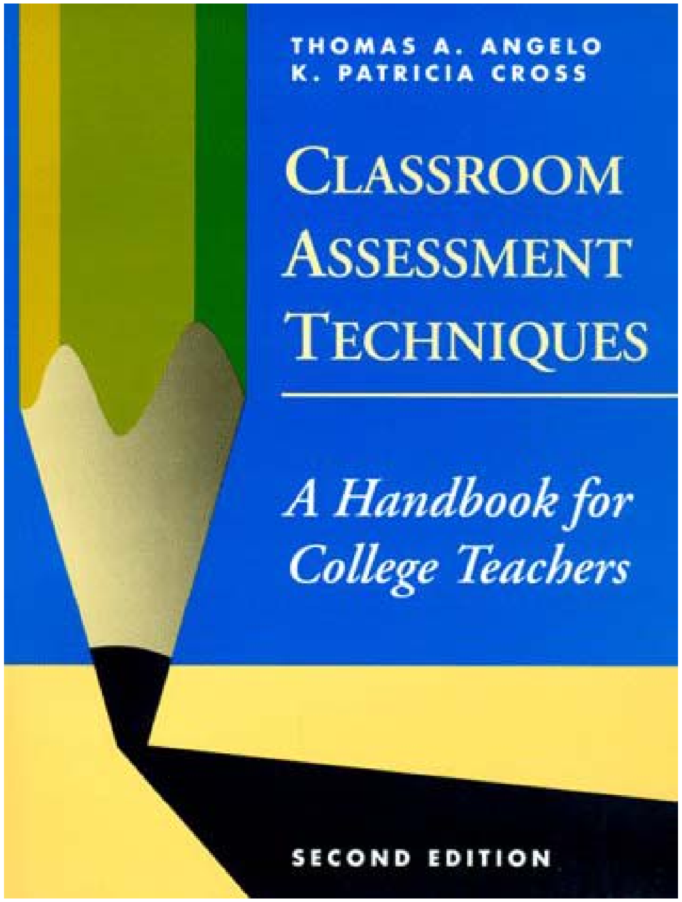
What comes next?

- For students: Teagle Colloquium: an interdisciplinary working group for the development of graduate students' teaching. Funded by the Teagle Foundation.
  - Students from three departments (Biology, Communication and Culture, and Anthropology) study student learning and signature pedagogies in the Fall semester, and then use the Spring semester for course-wide implementation of ideas.
  - Students also develop teaching portfolios, suitable for inclusion in job applications.

What comes next?

- For me: develop assessment of long-term effects (benefits) of the course on graduate students’ future teaching

CATS Resource



Bottleneck lessons 2009

- We're not out of the woods yet – building and understanding phylogenetic trees
- It's all in the family – a totally awesome intro to systematics
- Game theory, or how I learned to stop worrying and love the math
- Of Science and Pseudoscience: a distinction that matters

THE UNIVERSITY OF GEORGIA
COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES

DelsGate, a robust deletion method used as a tool for undergraduate teaching in fungal genomics

Scott Gold,

Maria Garcia-Pedrajas,

Emir Islamovic, David Andrews

FGC 25
3/20/2009

Structure

1) BTEC4000L
2) *Ustilago maydis* background
3) DelGate methodology
4) DelsGate, in the undergraduate classroom

BTEC4000L

- Methods in Applied Biotechnology
  - Laboratory: 5.5 hrs/week
  - Lecture: 50 min/week

- Offered each Spring 4 units
  - current enrollment 12

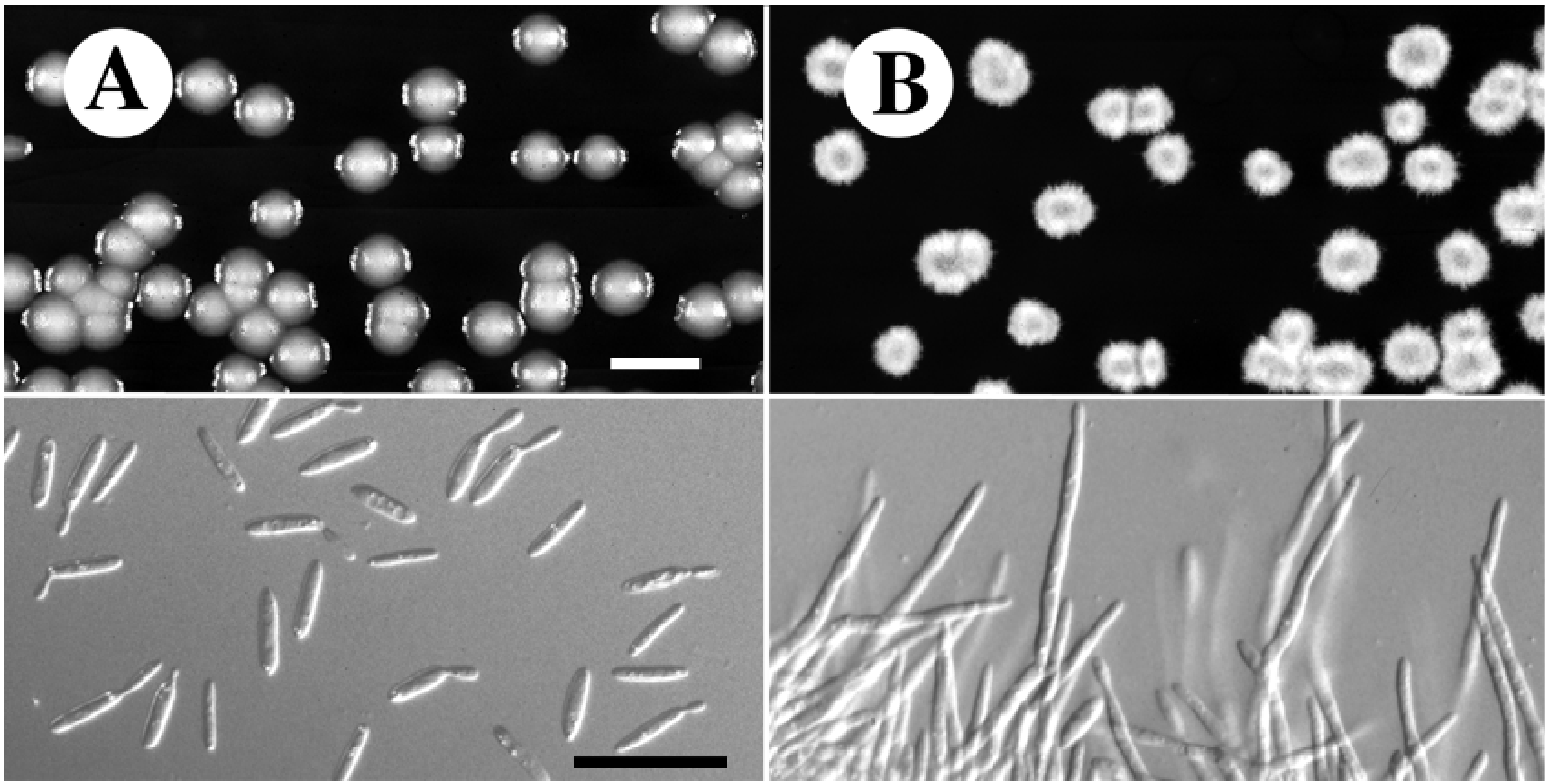
- Team taught with

  Mike Deom and Robert Beckstead

Syllabus/ topics

- Mol. Biol. tool use: accurate pipetting, media, gel prep. PCR, recombinant proteins, etc.
- Manipulation of *E. coli*, culturing, plasmids, ect.
- Plant transformation
- Chicken egg antibody production
- DelsGate and fungal functional genomics

Corn smut and dimorphism



Ustilago maydis biology

Central hypothesis

- In *U. maydis* the filamentous growth form is tied to pathogenicity, therefore we predict that genes that are required for regulation of dimorphism will impact pathogenicity and may represent targets for control.

DelsGate Methodology

Search for potential regulatory sequences upstream of filament downregulated genes

- **Search putative promoter region:**
  1000 bp 5' end from the starting codon

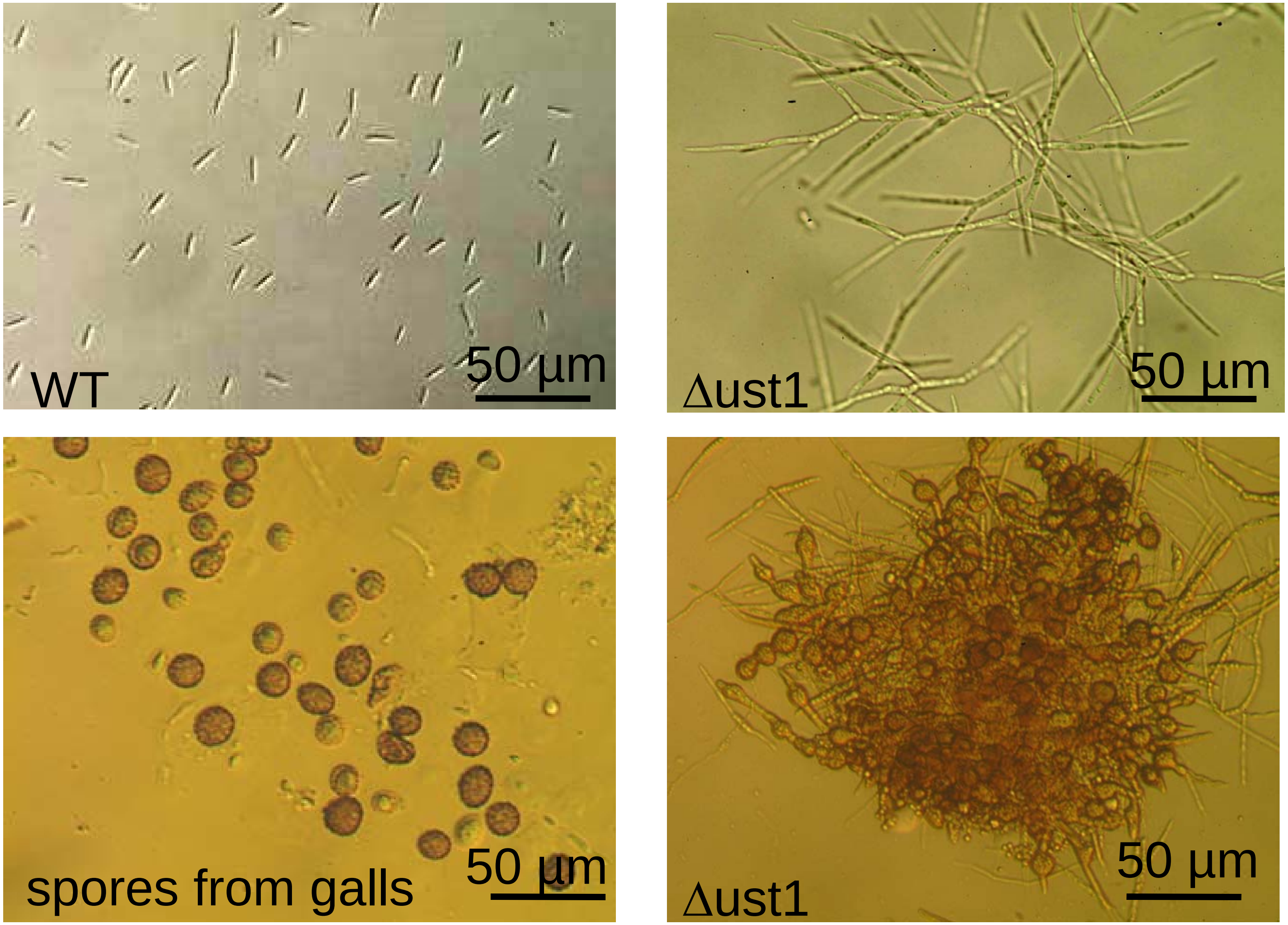
Binding sequence for *A. nidulans* transciption factor StuAp found in 13 of 37 genes

$$({}^{A}/_{T}CGCG{}^{T}/_{A}N{}^{A}/_{C})$$

Alignment of StuA *(A. nidulans)* and Ust1 *(U. maydis)* APSES Transcription Factor Domains

```
                Helix 1                         Helix 2
StuA  RVTATLWEDEGSLCYQVEAKGVCVARREDNGMINGTKLLNVAGMTRGRRDGILKSEKVRNV  61
      RVT TLWEDEG+LC+QV+A+GVCVARR DN MINGTKLLNV GM+RG+RDGILK+EK R V
Ust1  RVTTTLWEDEGTLCFQVDARGVCVARRHDNNMINGTKLLNVCGMSRGKRDGILKNEKERIV  61

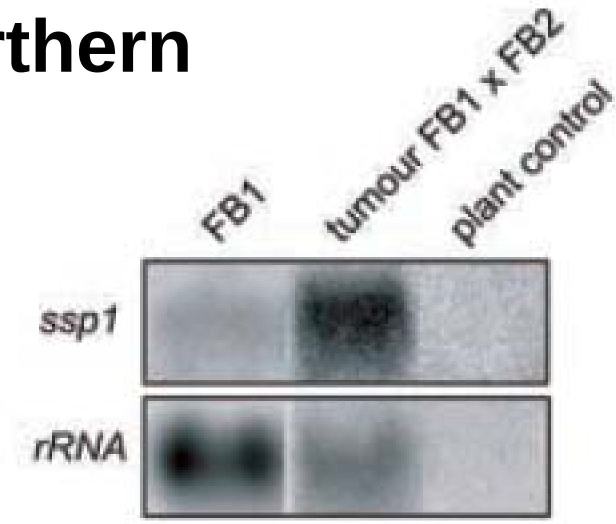
                       Helix 3
      VKIGPMHLKGVWIPFDRALEFANKEKITDLLYPLFVQHISNLLYHPANQNQRNMTVPDSRR  122
      VK+G MHLKGVWI F RA + A +  I D LYPLF  +I + LYHP N  +    +  ++
      VKVGAMHLKGVWISFARAKQLAEQNGIADALYPLFEPNIQSFLYHPDNYPRTAAVIAAAQE  122
```



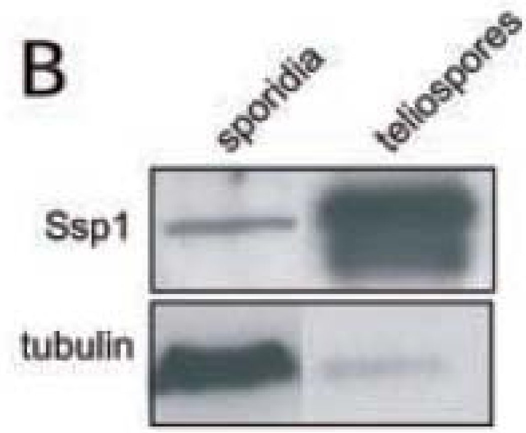
Ustilago maydis biology

Validation of microarray based on previously published data

Northern

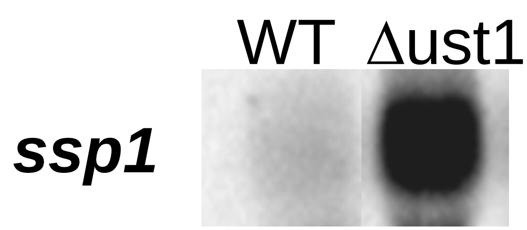


Western

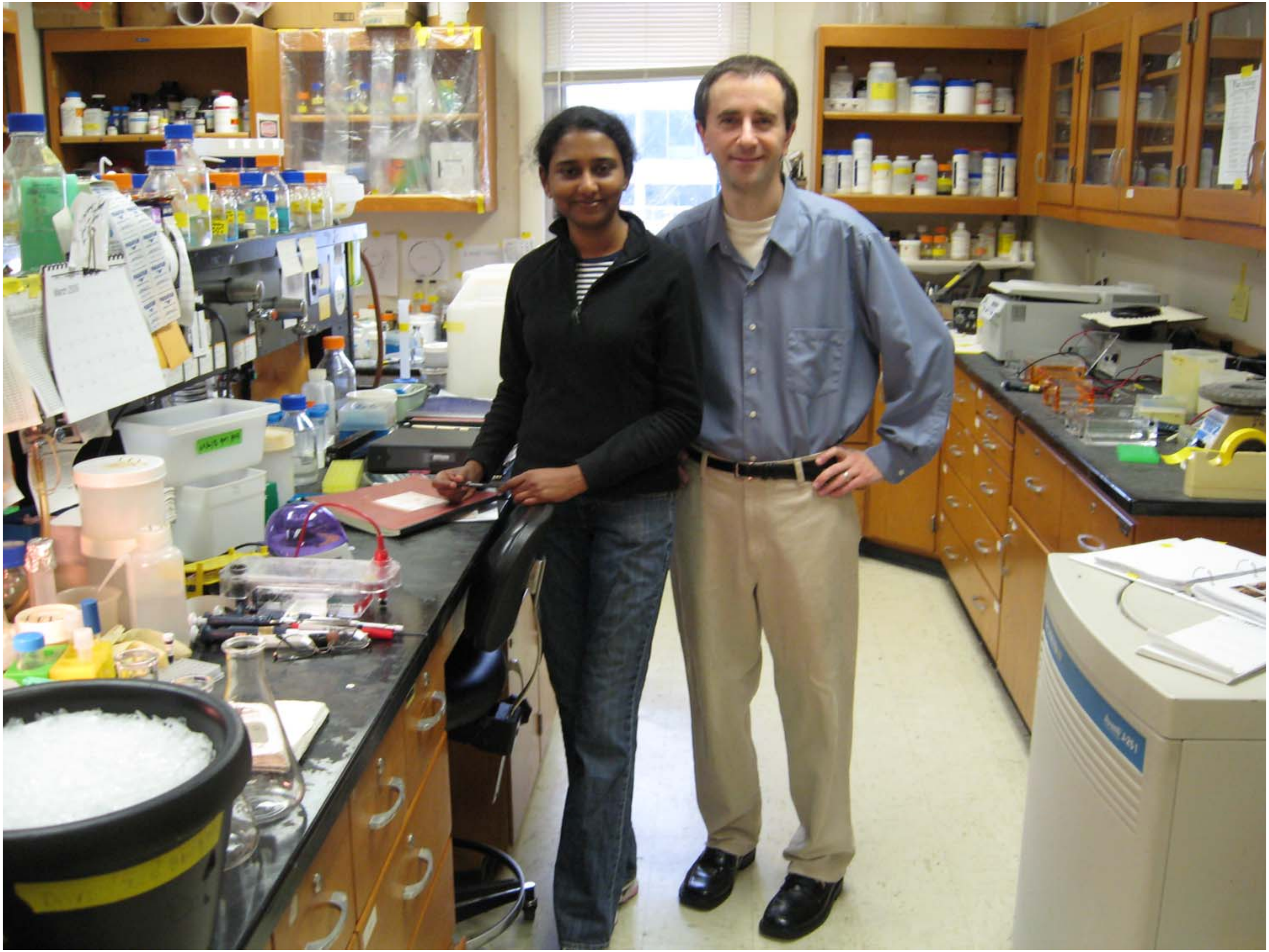


Mol Genet Genomics (2002) 267: 757–771

Northern

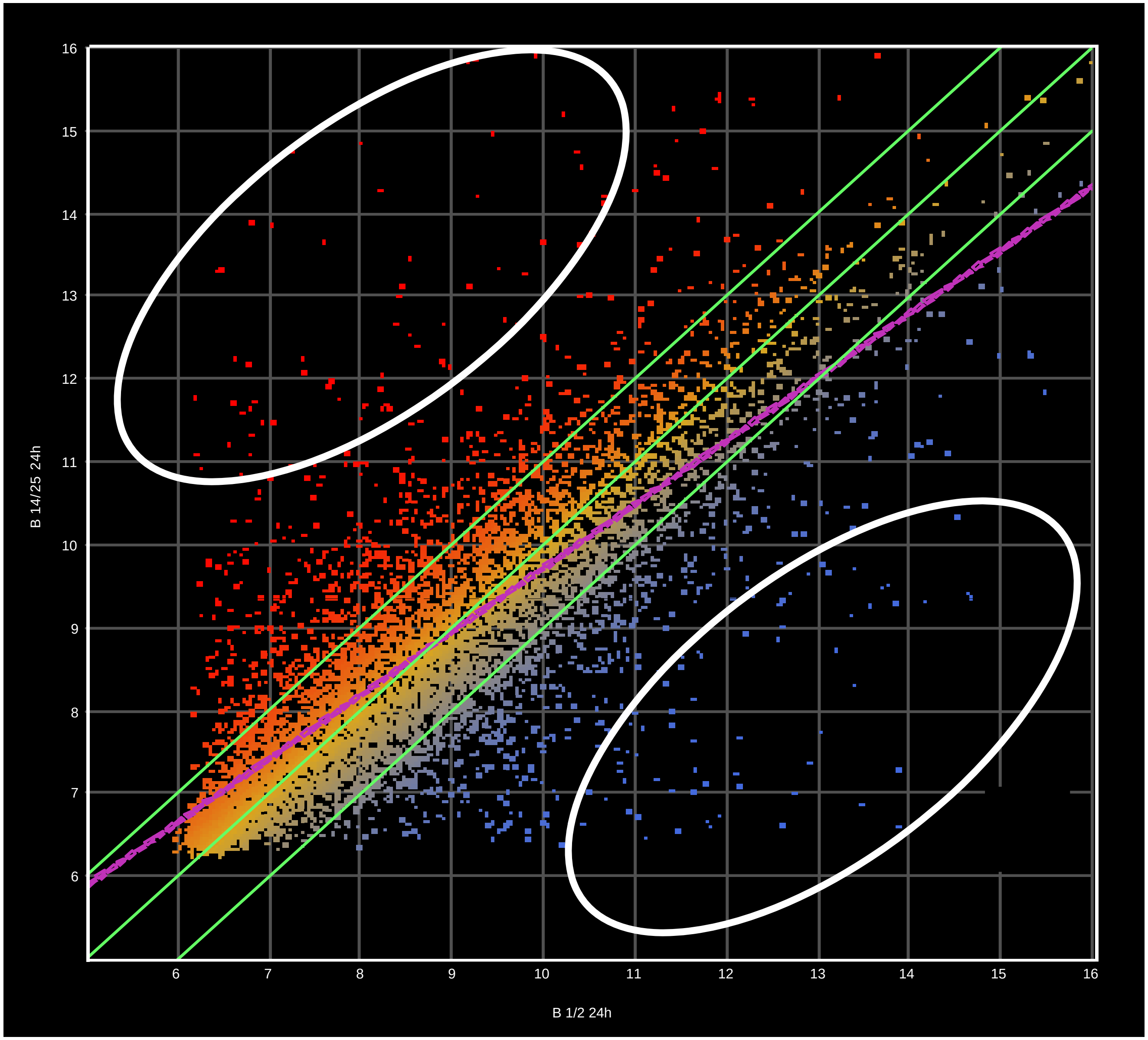


Ustilago maydis biology



NimbleGen Array results wt vs *ust1* mutant

Δ*ust1* 24h Group 1



WT 24h Group 1

Scatter-plot signal intensities from microarray

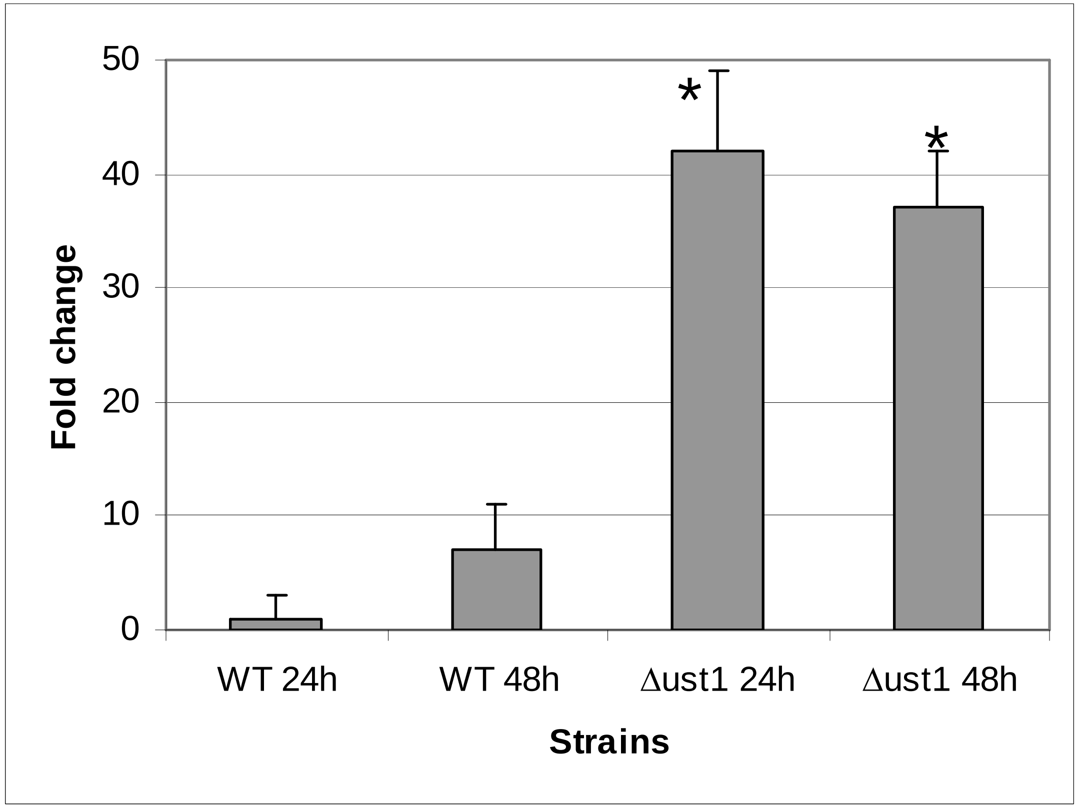
6869 GENES
184 8-FOLD> CHANGE
111 UPREGULATED
73 DOWNREGULATED

Ustilago maydis biology

33 UPREGULATED GENES IN Δ*ust1* MUTANT

gene expression in ust1 mutant (fold change)	MUMDB gene call	gene description
187.049 up	um05439	(10360-9380 (C)) - related to Chitin-binding protein
140.122 up	um06414	(26052-32417 (W)) - related to Polyketide synthase
121.175 up	um06370	(52046-51976,51893-50837 (C)) - conserved hypothetical protein
119.482 up	um05361	(94943-91077 (C)) - related to Laccase I precursor
119.229 up	um06418	(50036-48795,48682-44009 (C)) - related to polyketide synthase
116.451 up	um12304	(65324-65104,65016-64753,64657-64385,64311-63891 (C)) - hypothetical protein
103.612 up	um03138	(27013-27633 (W)) - hypothetical protein
98.866 up	um05436	(380-1741 (W)) - conserved hypothetical Ustilago-specific protein
68.537 up	um02489	(435686-436038,436161-436240,436318-437591 (W)) - putative protein
68.207 up	um12271	(37344-37367,37484-40675 (W)) - putative dioxygenase Ssp1 ←
65.618 up	um00466	(169381-168296 (C)) - hypothetical protein
50.771 up	um12303	(63669-63152,63067-62971,62884-62156 (C)) - hypothetical protein
49.443 up	um03821	(2839-761 (C)) - hypothetical protein
47.548 up	um05861	(28064-30196 (W)) - related to FET5 - multicopy oxidase
43.598 up	um03523	(117934-116369 (C)) - probable aldehyde dehydrogenase
35.413 up	um00148	(333939-334935,335036-335160,335260-336312 (W)) - hypothetical protein
32.792 up	um00827	(162-581 (W)) - hypothetical protein
31.692 up	um11874	(17621-16731 (C)) - conserved hypothetical Ustilago-specific protein (C-terminal fragment)
31.397 up	um04703	(28067-27631,27546-27168 (C)) - probable phosphomannomutase
30.667 up	um02625	(23675-23598,23485-21410 (C)) - probable DUR3 - Urea permease
30.628 up	um12336	(25412-24809,24707-24393,24254-24005,23923-23812,21930-20887 (C)) - related to meiosis-specific MutS homolog
30.475 up	um06419	(51389-51542,51622-52424 (W)) - conserved hypothetical protein
30.358 up	um00102	(213236-214162 (W)) - conserved hypothetical protein
29.956 up	um02423	(236352-236305,236185-235488,235370-235211,235097-234120 (C)) - hypothetical protein
26.902 up	um05103	(28188-29912 (W)) - probable sulfate adenylyltransferase
26.273 up	um03524	(119444-121894 (W)) - related to peroxisomal amine oxidase (copper-containing)
26.185 up	um02753	(13723-13529,13419-12972,12879-12764 (C)) - conserved hypothetical protein
25.804 up	um10640	(21328-21218,21053-20802 (C)) - conserved hypothetical protein
24.720 up	um05452	(45257-46354,46431-46501,46583-46653,46754-47250 (W)) - related to TPO3 - Polyamine transport protein
24.067 up	um03522	(114144-112363 (C)) - related to UGA4 - GABA permease - also involved in delta-aminolevulinate transport
23.772 up	um06371	(54149-52701 (C)) - conserved hypothetical protein
22.372 up	um02035	(5248-5660,5735-6632 (W)) - related to yellowish-green 1 (ayg1)
21.690 up	um10726	(91075-91061,90345-89803 (C)) - related to YPD1 - two-component phosphorelay intermediate

ssp1 qRT-PCR



n=4, *p<0.001

33 >20-fold UPREGULATED GENES IN Δ*ust1* MUTANT

gene expression in ust1 mutant (fold change)	MUMDB gene call	gene description
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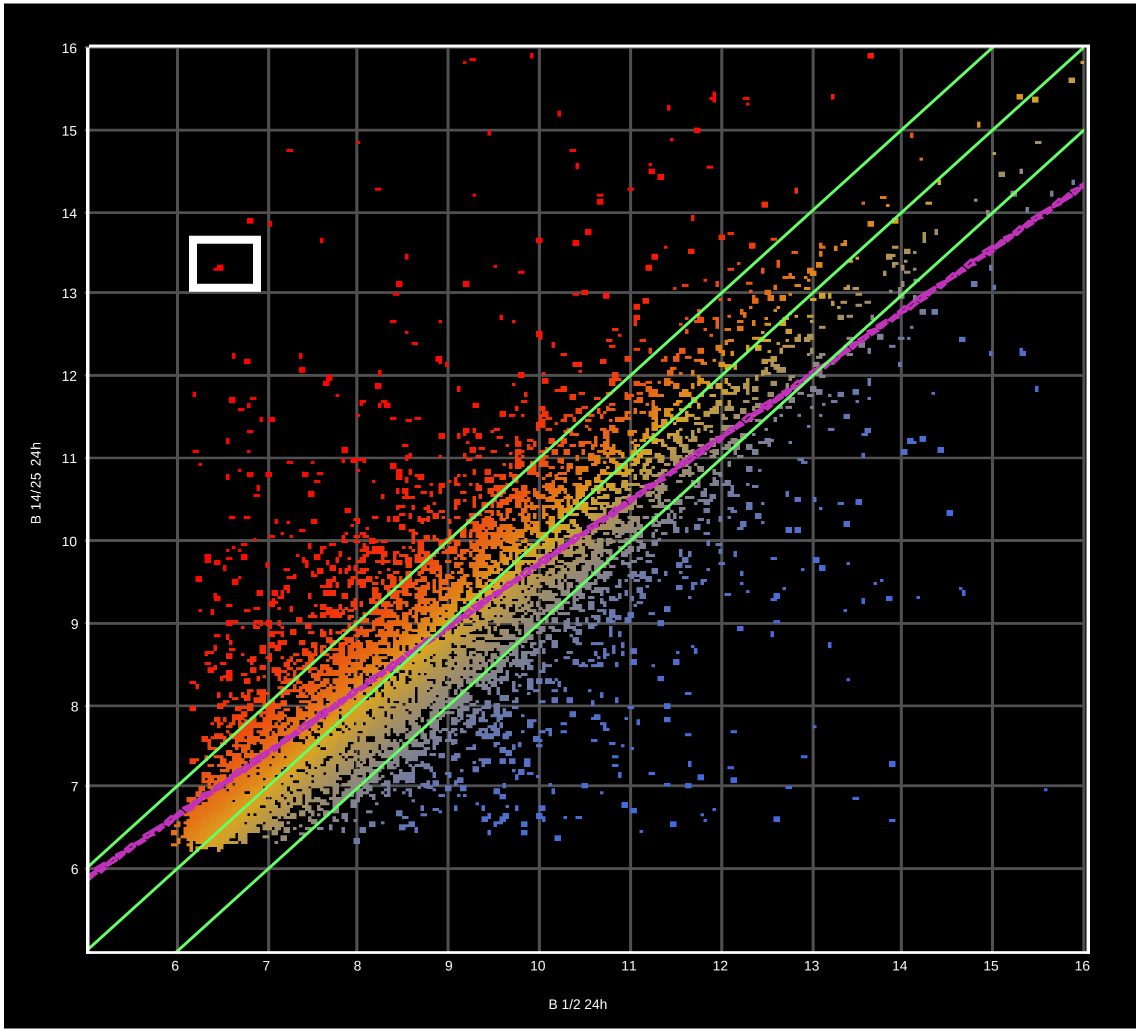
Ustilago maydis biology

Laccase (*lac1*)

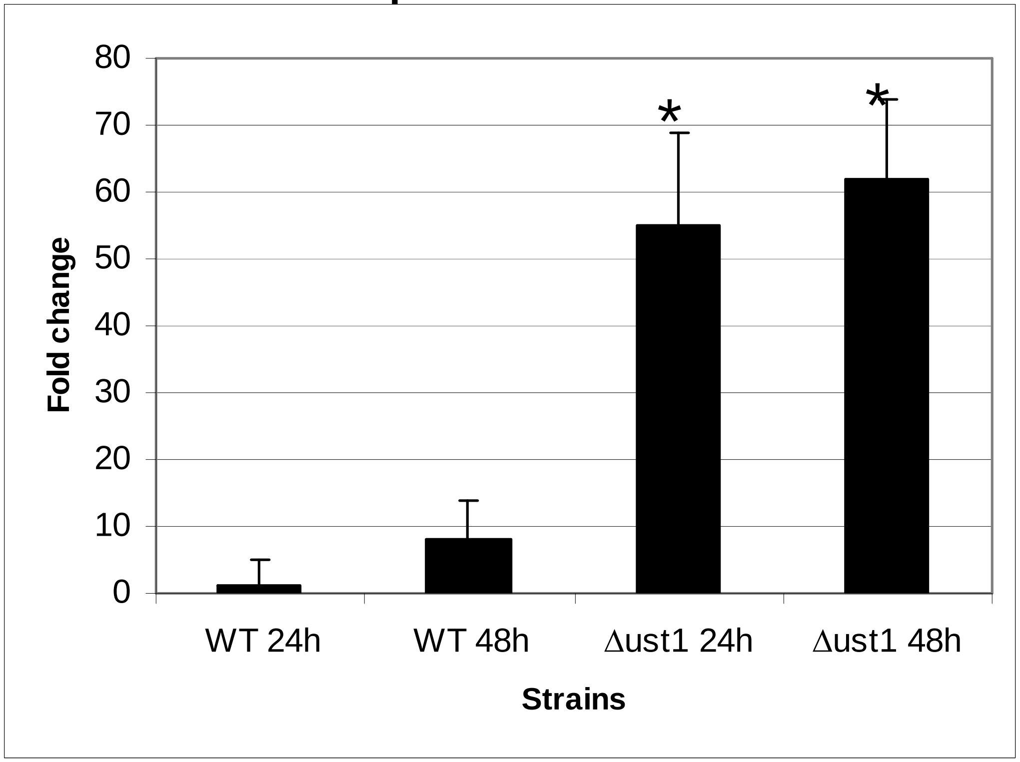


Δ*ust1* 24h Group 1

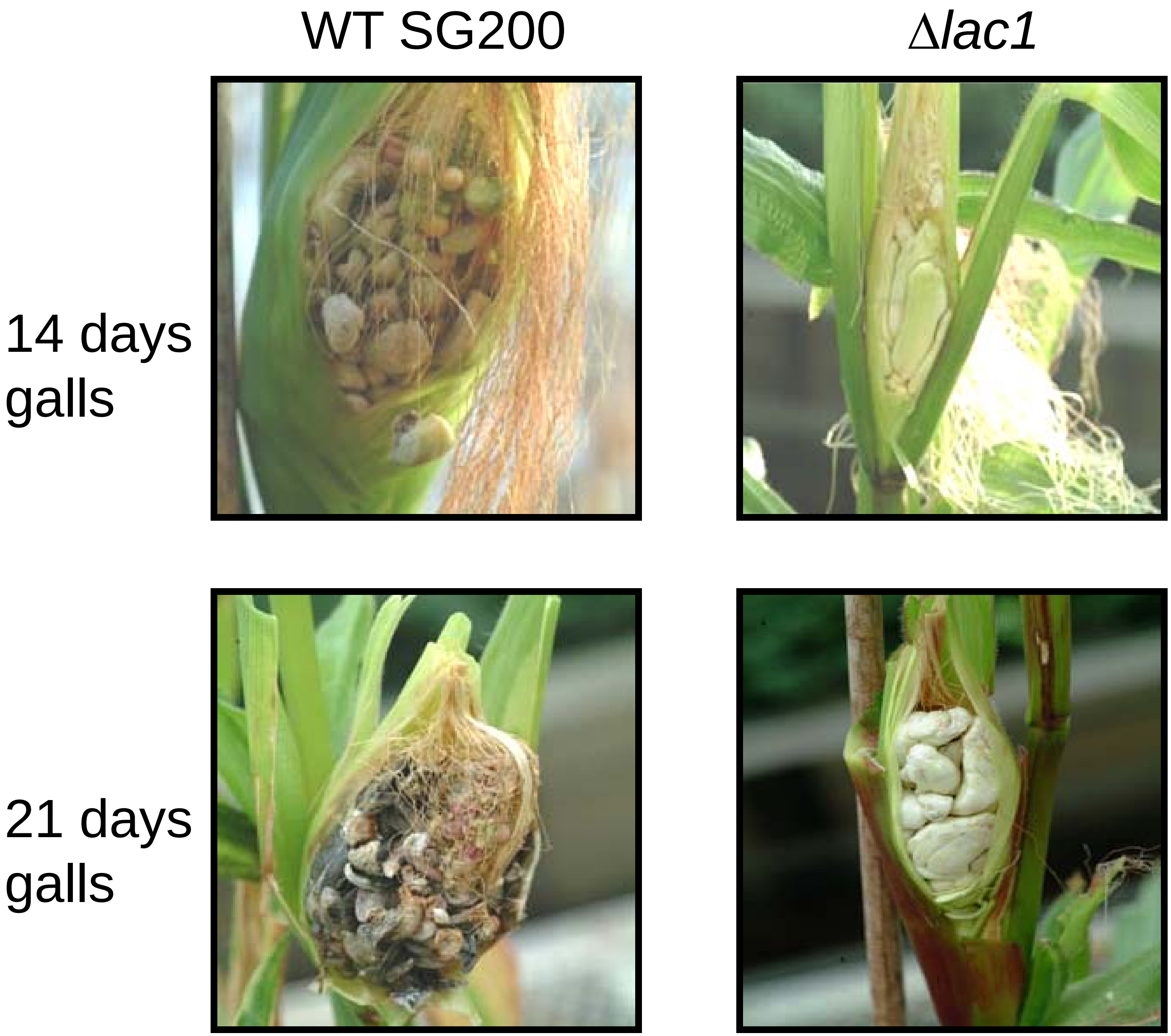
WT 24h Group 1

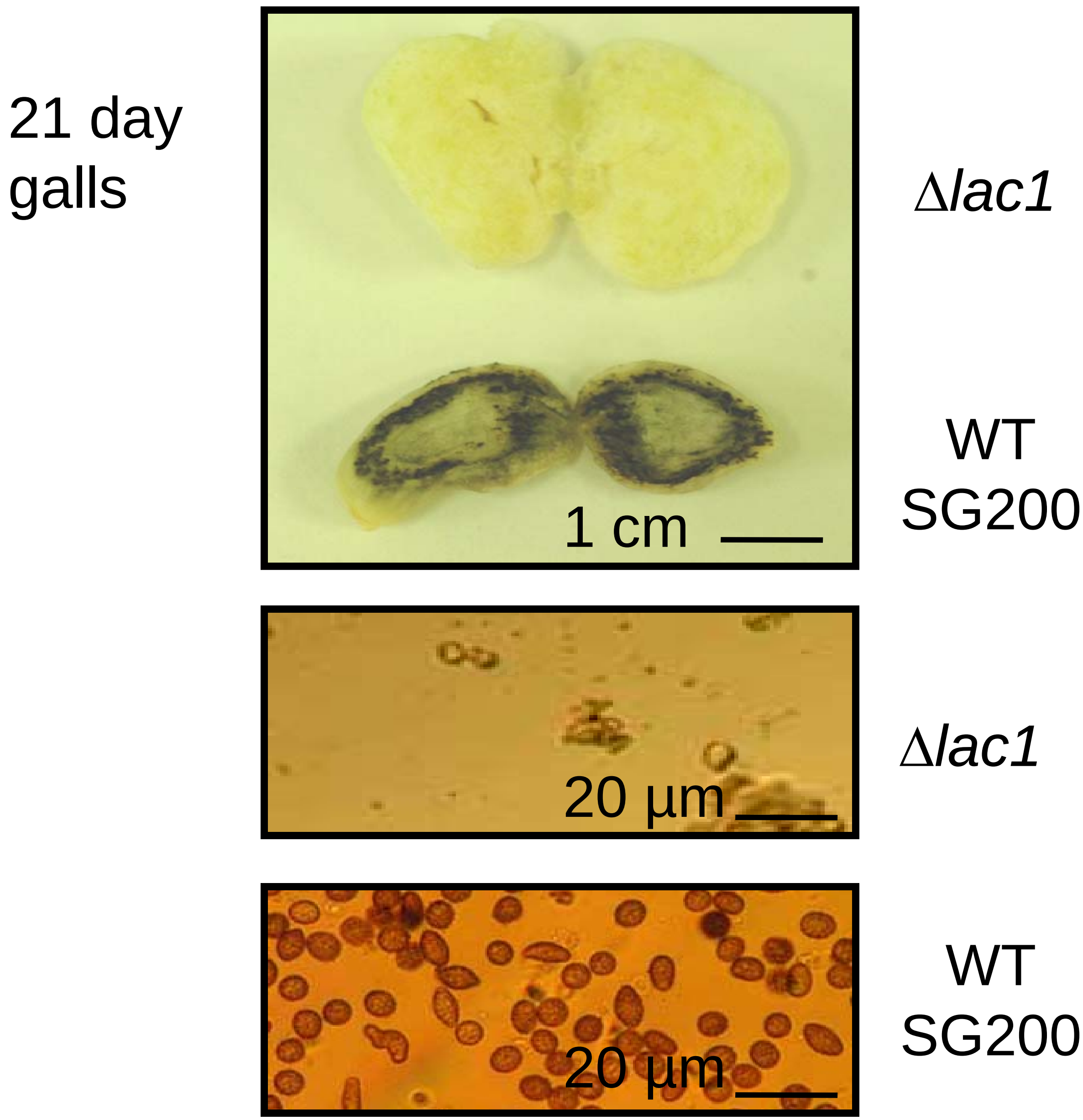
Ustilago maydis biology

lac1 qRT-PCR

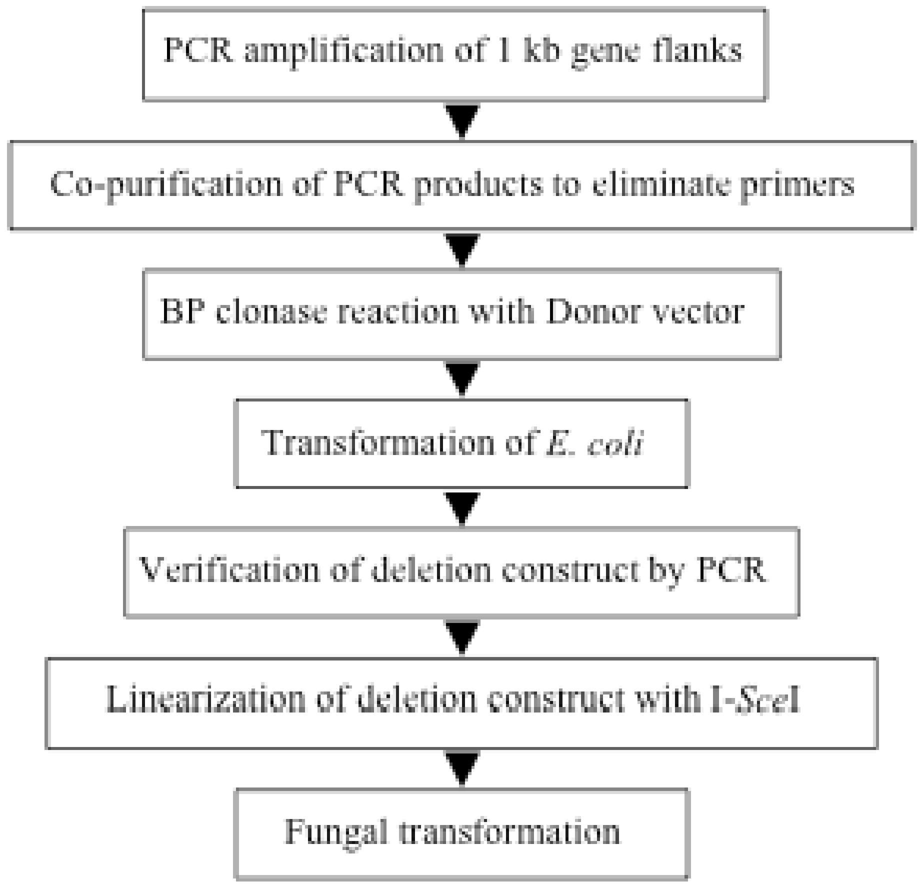


n=4, *p<0.001


WT SG200
Δ*lac1*
14 days galls
21 days galls

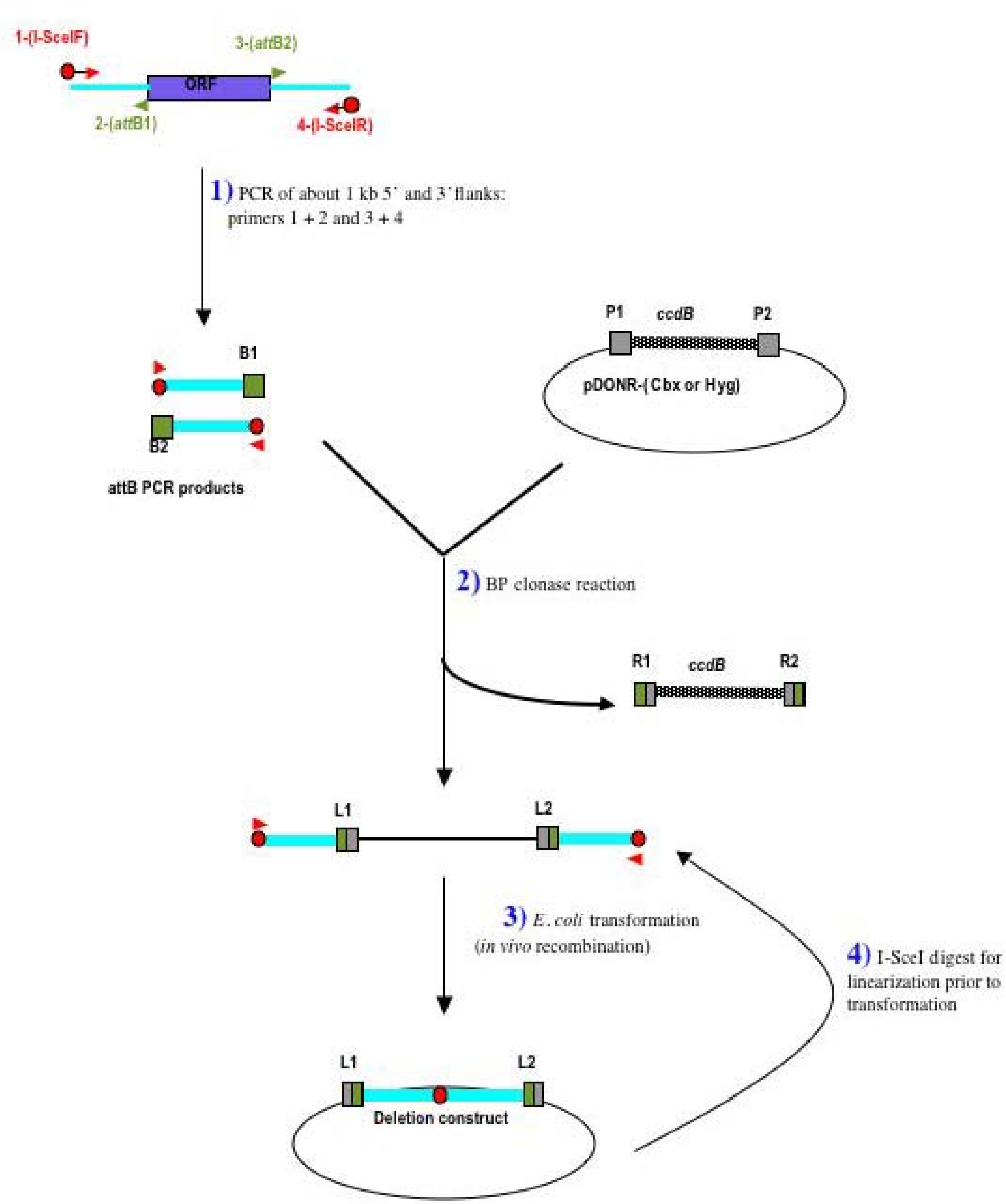

21 day galls
Δlac1
WT SG200
1 cm
Δlac1
20 µm
WT SG200
20 µm

DelsGate Procedure Flowchart



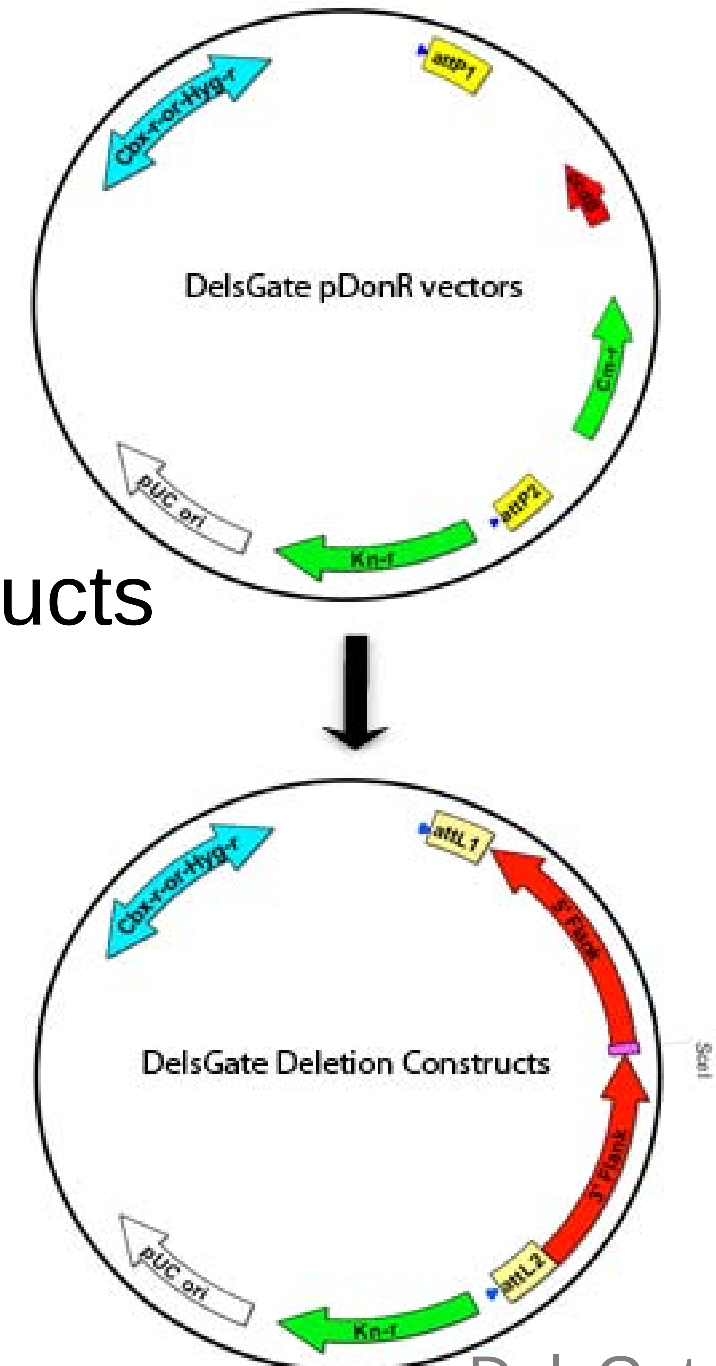
DelsGate Methodology

Diagram of DelsGate Construction Process



DelsGate Methodology

DelsGate Vectors and Deletion Constructs



DelsGate Methodology

Genes for 2009

Student		um #	Researcher		
	1	um10056	Emir		
	2	um04796	Emir		
	3	um03016	Emir		
	4	um02717	Emir		
	5	um00551	Emir		
	6	um00264	Emir		
	7	um02301	Emir		
	8	um11825	Emir		
	9	um03678	Emir		
	10	um06140	Emir		
	11	um03588	Nadia		
	12	um01397	Brijesh		

Caleb um03678

Caleb um03678

DelsGate in the undergraduate classroom

DelsGate in the undergraduate classroom

Table 2. Software used by students to carry out DelsGate and explore gene function.

Software Name	Purpose	URL/Producer
MUMDB	Annotated *U. maydis* genome	http://mips.gsf.de/genre/proj/ustilago/
IDT PrimerQuest	Primer design	http://www.idtdna.com/Scitools/ Applications/Primerquest/Default.aspx
Lasergene	DNA manipulation	DNASTAR
NCBI BLAST	Identify related genes	http://blast.ncbi.nlm.nih.gov/Blast.cgi
SMART	Conserved domain identification	http://smart.embl-heidelberg.de/

Instructions for downloading and manipulating gene sequences

Note that my description is for a Mac. Not sure if exactly the same with the PC.

1. You will be provided with an accession designator for your personal gene of interest. ~~CF541424, CF541439, U28655, um01166, um04909, um05922~~
2. Collect the nucleotide (partial, cDNA) sequence of your gene of interest. If you have a CF or U number go to NCBI (http://www.ncbi.nlm.nih.gov/) and select *nucleotide* under search and enter your accession number. This should return a window with your accession in blue. Click on the accession # and a sequence file including nucleotide and maybe amino acid sequence should appear. Bookmark the page. Capture the nucleotide sequence into a word document. If you have a um# you are already past this point and will rejoin the process at step 4.
3. Determine the predicted open reading frame of your protein. To do this use the cDNA sequence to BLAST against the MUMDB database (http://mips.gsf.de/genre/proj/ustilago/). You should identify a um# for your protein. If you do not identify a um# discuss this with me.
4. Enter the um# designation in the "Search Gene/ORF/Descr." box. Click on the blue um# that appears near the top of the resulting window, under "entry".
5. Record the um# and copy the protein and nucleotide sequences to your word doc. Additionally copy and paste the information in the upper left box with your um# and location.
6. On the right side of the screen you will see a diagram box of the genomic region in which you will find you um#. Click on your um# protein. This opens another window with your gene placed in the middle of a pretty big expanse of the contig. Print this screen and book mark it.
7. Put your cursor on top of your um# and it will tell you the coordinates of the gene. Note if your protein is running left to right (forward) or right to left (reverse). Note the location coordinates Contig and location.

Instructions for primer design

DELSGATE GENE DELETION METHOD

Primer design

Design pirmers to amplify 1kb of the 5' flanking region of your specific gene using PRIMER 1 + PRIMER 3 and 1 kb of the 3' flanking sequence using PRIMER 2 + PRIMER 4. Primers 1 and 2 contain the I-SceI recognition site in the forward and reverse orientation, respectively. Primers 3 and 4 contain the *att*B1 and *att*B2 sequences, respectively.

Primers for 5' flank:

PRIMER 1 (Forward, SceI primer): 5'- TA GGG ATA ACA GGG TAA T-(gene-specific sequence, N_{25}, approximately 1 kb before the starting codon)-3'

PRIMER 2 (Reverse, *att*B1 primer): 5'-GGGG ACA AGT TTG TAC AAA AAA GCA GGC TAA-(gene-specific sequence N_{22} right before the starting codon and "out", reverse primer to amplify the 5' flanking region)-3'

Primers for 3' flank:

PRIMER 3 (Forward, *att*B2 primer): 5'-GGGG ACC ACT TTG TAC AAG AAA GCT GGG TA-(gene-specific sequence, right after the temination codon, primer to amplify the 3' flanking sequence)-3'

PRIMER 4 (Reverse, SceI primer): 5'- ATT ACC CTG TTA TCC CTA-(gene-specific sequence, N_{25}, approximately 1 kb after the stop codon)-3'

- **PCR**

In this step the 1 kb flanking 5' and 3' sequences are amplified separately.
Use genomic DNA from strain 1/2 as template

PCR reaction mix for each reaction (50 µl):

dH_2O	37.0 µl
10X buffer	5.0 µl
dNTPs 10 mM	1.0 µl
Primer SceI (20 pmoles/µl)	2.5 µl
Primer attB (20 pmoles/µl)	2.5 µl
Taq polymerase	1.0 µl
DNA (2ng-100ng)	1.0 µl

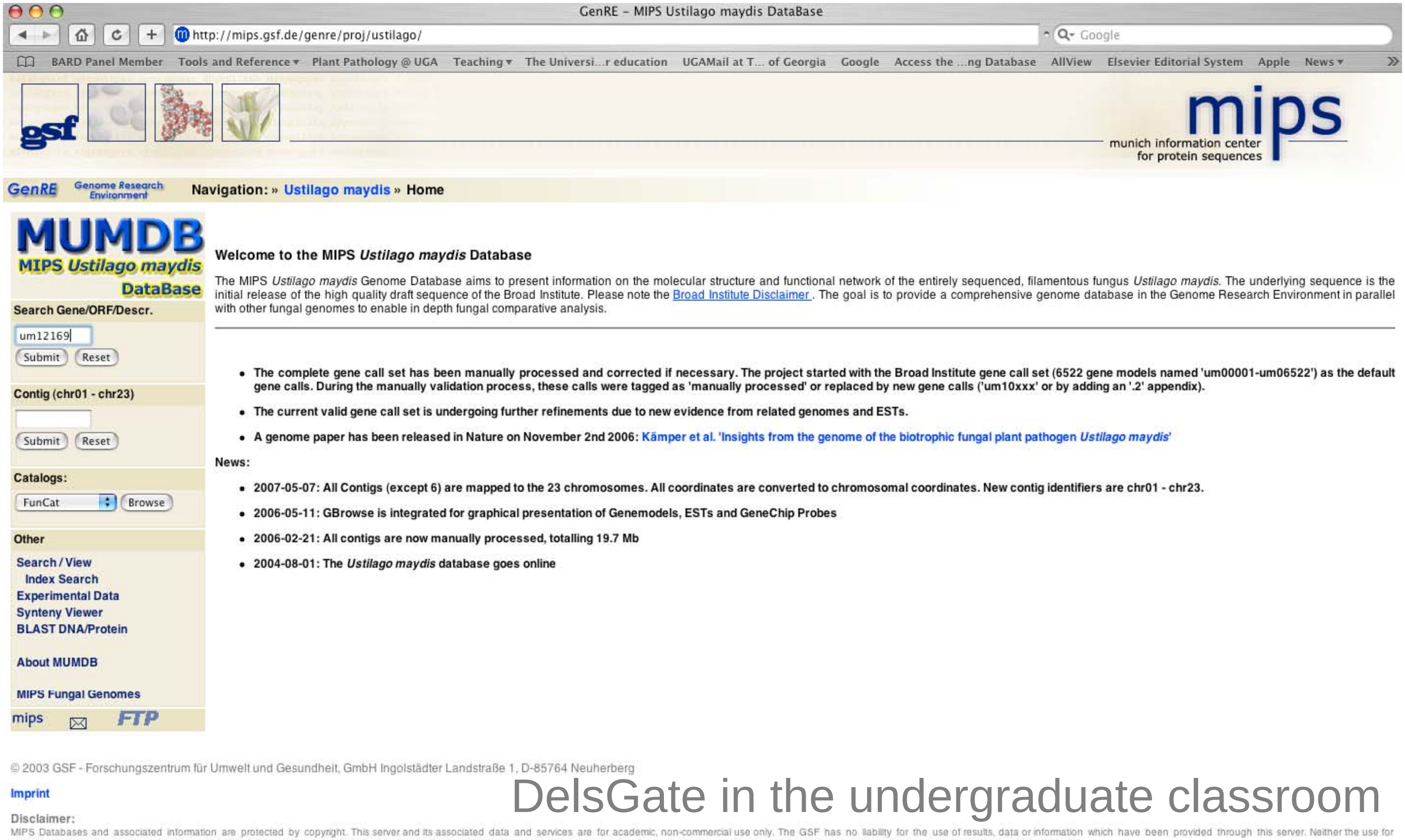
Amplification conditions:

94° C 1 min

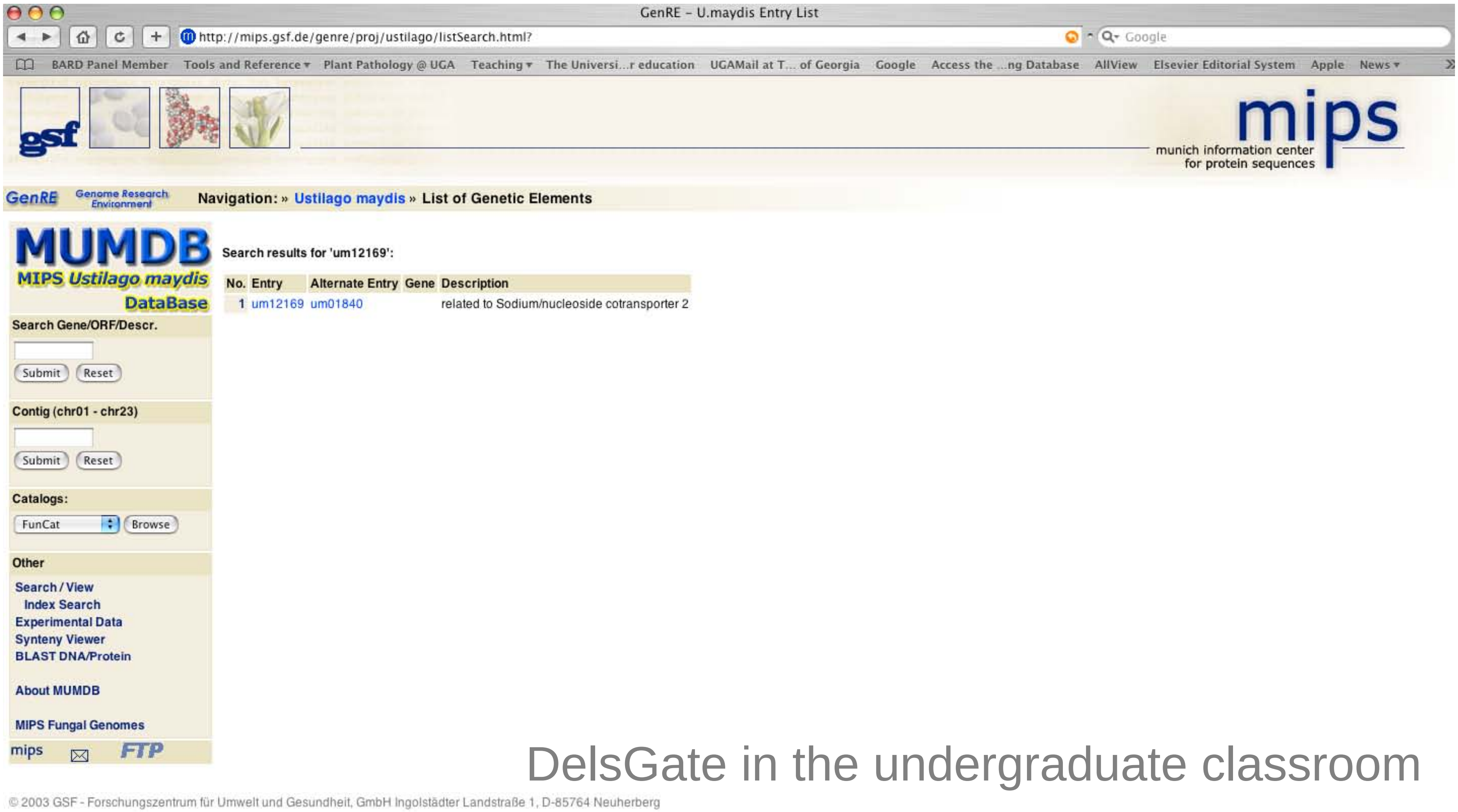
30 cycles: 94° C 30 sec, 60° C 30 sec, 72° C 1 min

72° C 5 min

Retrieving their gene from the database

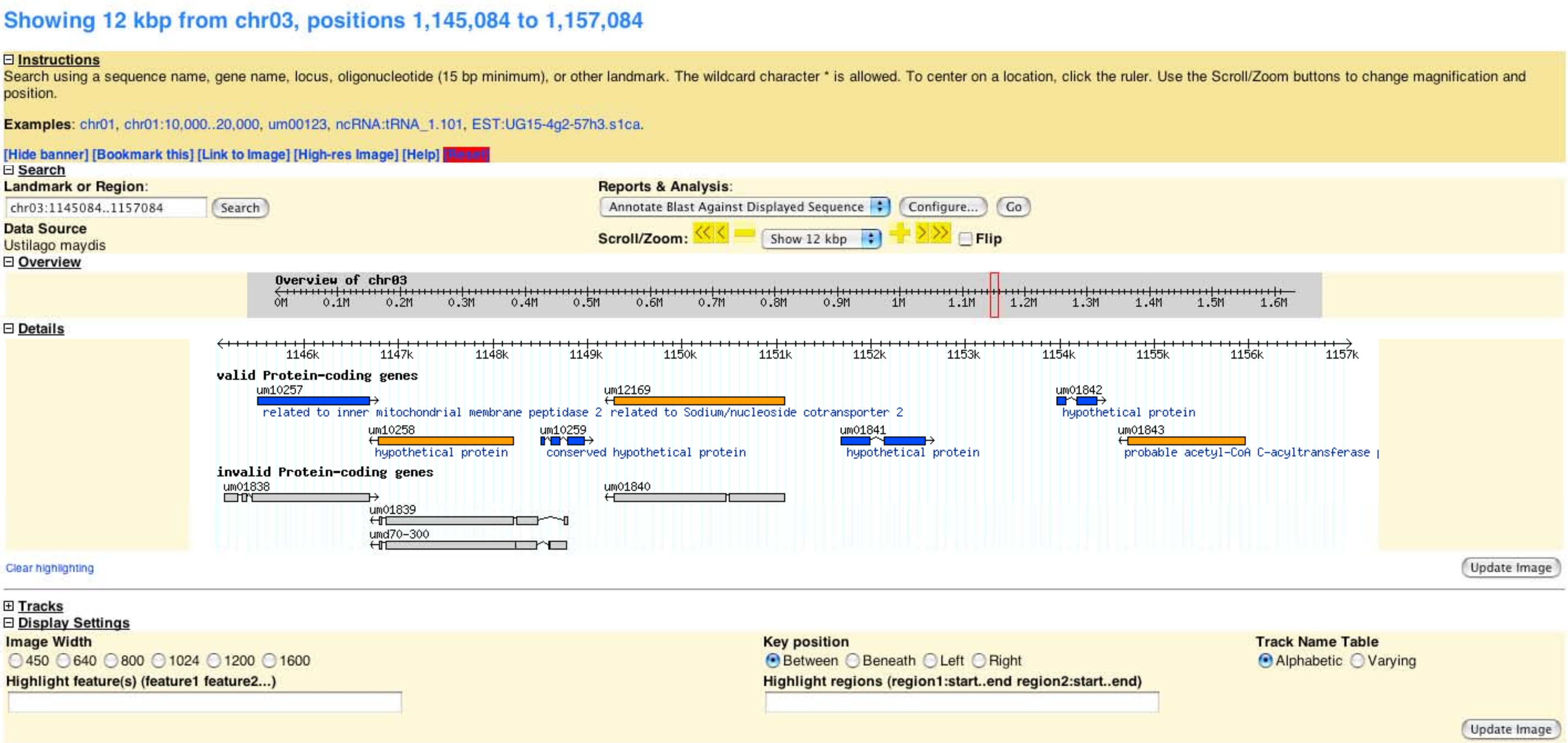


Retrieving their gene from the database



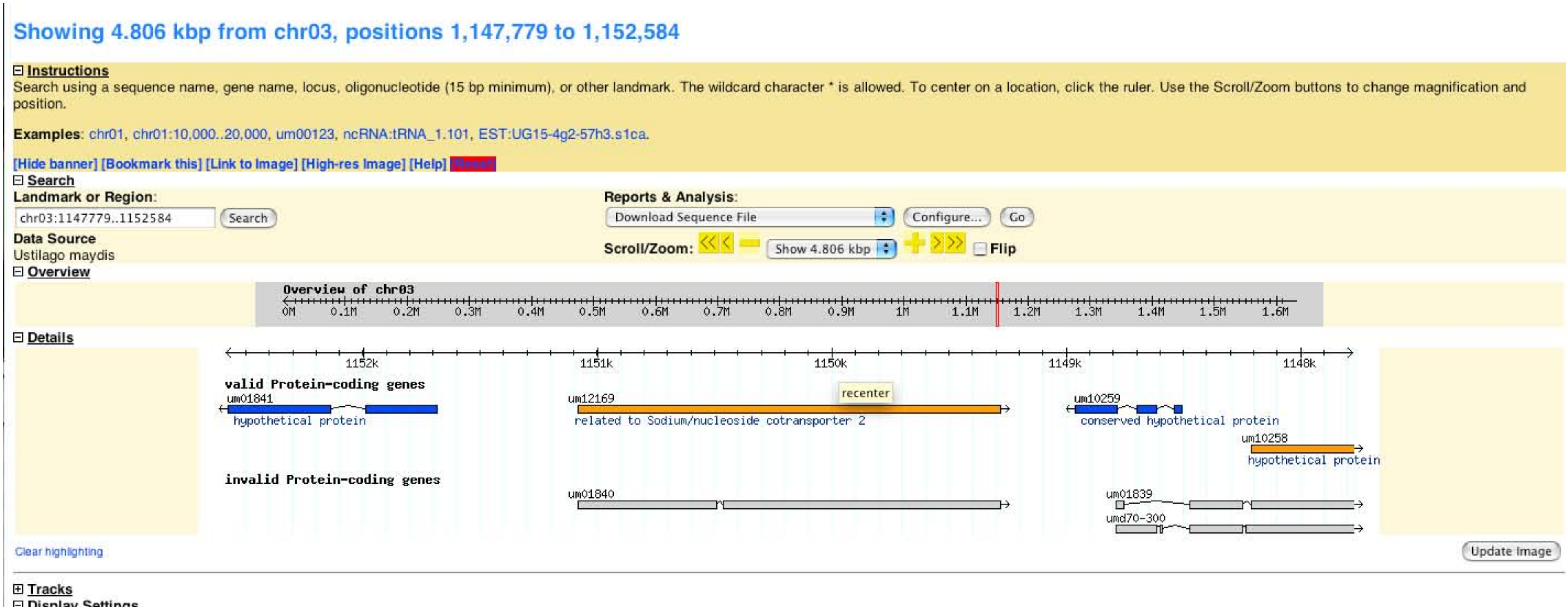
Retrieving their gene from the database

Retrieving their gene from the database



DelsGate in the undergraduate classroom

Capturing ORF +1500 bp flanks



Retrieving gene from the database

chr03:1147779,1152584 (reverse complemented)

```
>chr03 chr03:1147779,1152584 (reverse complemented)
TGACATGAGTCAGCTGGAGTTGGACATCTGTAAAAGTGTGAGAGCGCTGAAAAGGAGTGA
GAAGTTTGTTGATAACATCATTAACAAGGATAATTTGATTACGGCGGTGGATTGCCCAGG
TTTGGTCGGCTCGCTTGATTCGACACCTGCTTCGGAAGACGTTGCTCCTTGTAAATTAGA
TTTCGCTTCGTCTTCCGTCGCATCCAGCCTAGTACAAAGCTTTCCTGTTTCCGTGCGACG
CAGTTTCCAAGCTTCCCAGCCTCTGAACCTGTCGGTGGCGATTCTCTGCCCAAGTGCCGG
TCTGATAACCACGCCCACAGTGTCTGGTGACAACTCGGCCAGGTGTTCCTCGATGTTGCT
ACATACCCTCCTCTCACTCAAGCTGTTTCGTACCAGACCCGACTGGATGGCAAATGATAT
GCTCTCTTTCTCACGCCCCCATTCACTCTAGCGGCATATATGCTCGGTTGTTGCCCATAG
AGATACGGAGGGGTCTCGAGGCGATACTTTCCTGGCTTCTCGTGAGTGCACTTGCCTTCC
CACCGGTTCGGACCTGACTTTCTGTGTCGCGACCGGCTCTTGCCCCGCTCTTACCTCTGT
CTGTCGCGCTGTGGTCCAATTGCTTTTCAACGTCTCATTGGCTGCCTTGCTGCTGCCTCT
GCCTCTGCCTTTCTTGTTCCTGATTTCCAATTGGATACCTCCACCACTTCGAACTCCTTT
GAACCTGCACTTGATTATGTTTGTGTCTGTCTTGCTCAAAGACAGGCGTGATAAGAGAAT
TCTGGATGTGCGGCCCTTCGTGAAATGTCCCTGAAAACCCCAGCTCGCTGTCCCTTGGAT
ACCCTCGTTGCCACCTGTCATTTTAGCTGGCTCGATCTGTGTCCAAACCGTTCCTGACAT
GTTCGGCTTGATACGTTGCACATGCCGAGCCGAGTTACACCCTAGCGCGTCAGCGACAGG
GAGAGCTCTTGAACGGAGCAGCGGTCGTCTTTTGCAGCCTCTCGTGGGGTCTCACAGTTT
GTTGTAGGACCATGTTTGTGCTACTTGACTCTATCTGCGGTAAATTGATCTTTAACAGAA
TTTCTAGCACACAGCCAGCTGTCTTTGACTGTTTTTTCACCTGTCGCTTAGTTATTACTA
TTTTTATTTTTAATTTTATTTTTTCCTTGGTTTTGTTGATAGGCACTTTGGTTTGCGCCA
AACCATACGGTGGCAGCACTCTCCATCTCGCCCTTCCTATCTAGCCAATTGTCGCTTCAG
AATCCAGGGCCAGCGTCTTGTTTCCTATATCATCCGGTTGCTTGCCCTCCTGAATGCTCG
CCTCCCAACCTTCATTCCCTCCTGCCCCCCCTCCGCGTCCTCCTCTTTCCTCTTCCAGCG
CTTCTCACGTGTCTTGAGCTTTCAGCACTGCAGTTGGCCTCCGAGGATTGCCACTAGATA
CCCCTTTCTTCCTCCTGTCTCGCTCACCTCGAACGGAGCGTTTGGTTCTTGCTCAACATC
ATGTCGTCCGCTCCTCAGTCCGCTGCTGTGGACACGTCTCATCAACAGCTCGCCAAGGAT
GCCTCTATCGAGGACCCTACCGCTGCCAGCACCGGCTCCCACCACGATGTCGCCGACGAT
AAGGTCGCCTACTCGTCATCTGACCGTGATATCGAGAGCAGCGGCCGCCCTCCCATTGAA
GCAATTGAGCCTCACCCTCAAGGTGAGCCTGGCCGCGTCAGCAAGCTTTGGCACTCGATC
CGCACTCACAAGGCTACCCGCATTCTCCTGGATGTCTTCCTCATCTGCTTGATTCTTGGA
TGGTGGTTGCCTGGTATTATCCGTGAGGAGACTCGCCACCGATGGGTCATCACCACAATT
TGGTCCTGGTTCTTCATTCTGCTTATTCTCTTCCATAACGATCGCTACCTTCCCAAGGCT
CCGTTTGCACAAGCTATCGAGACTGTTTGGACCACTTGCATTTCCAAGCCTTGGAGCATG
GTCCCCCACTACGGCCAGCTTGCTCTAGGATGGCTCGCTCTTCTCGCCCTCTACTTTGGT
AGTGCATTCGGGATCAAGGAGGTTCCCGAGTCGCGATATGGCGACCGCGCCCGTTCGCTC
TTTGGCCTTTTCCTCATCAACAGCTTCTTTTACGCCATCTCAACGCGCCGCGCTAGCATC
AAACTCCAGCCCGTTATGACCGGACTTGGTTTGCAAATGATCATTGGTCTCCTGGTATTC
AAGACGGGTGCTTTCTATAGCGTAGCCCAGTGGCTCGCTTTCGCTGCTGCCGACTTGCTC
GCTCAGGGTCAGATCGGCGGCGCCGCCTTCTTCTGGGGCAGCCTTGCTGGCCAACACTAC
TTTTTCATCGACACGCTCTCGTCGATCATCTTCTTCGTTGCCCTCGTTGTGCTCCTCTCG
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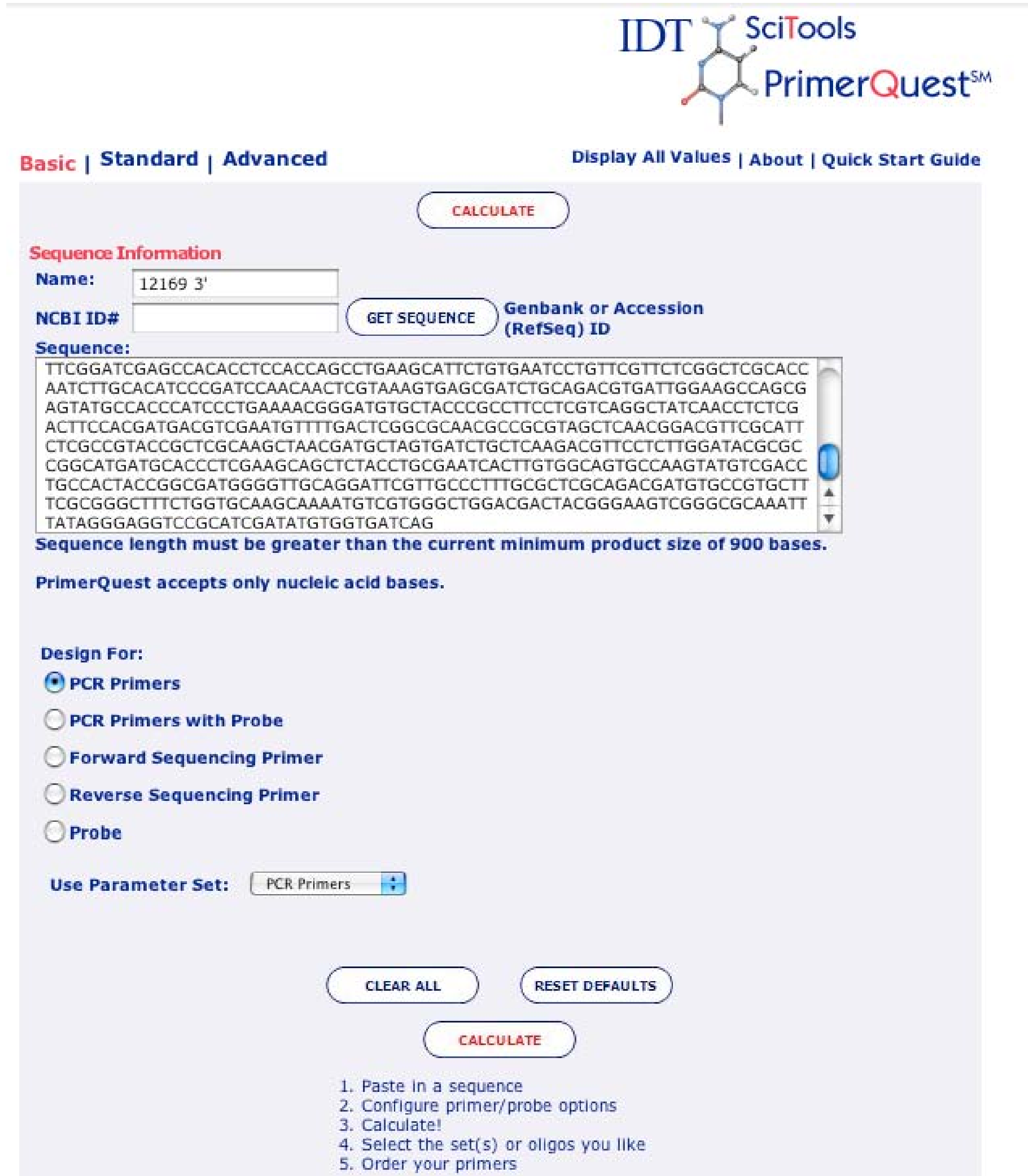
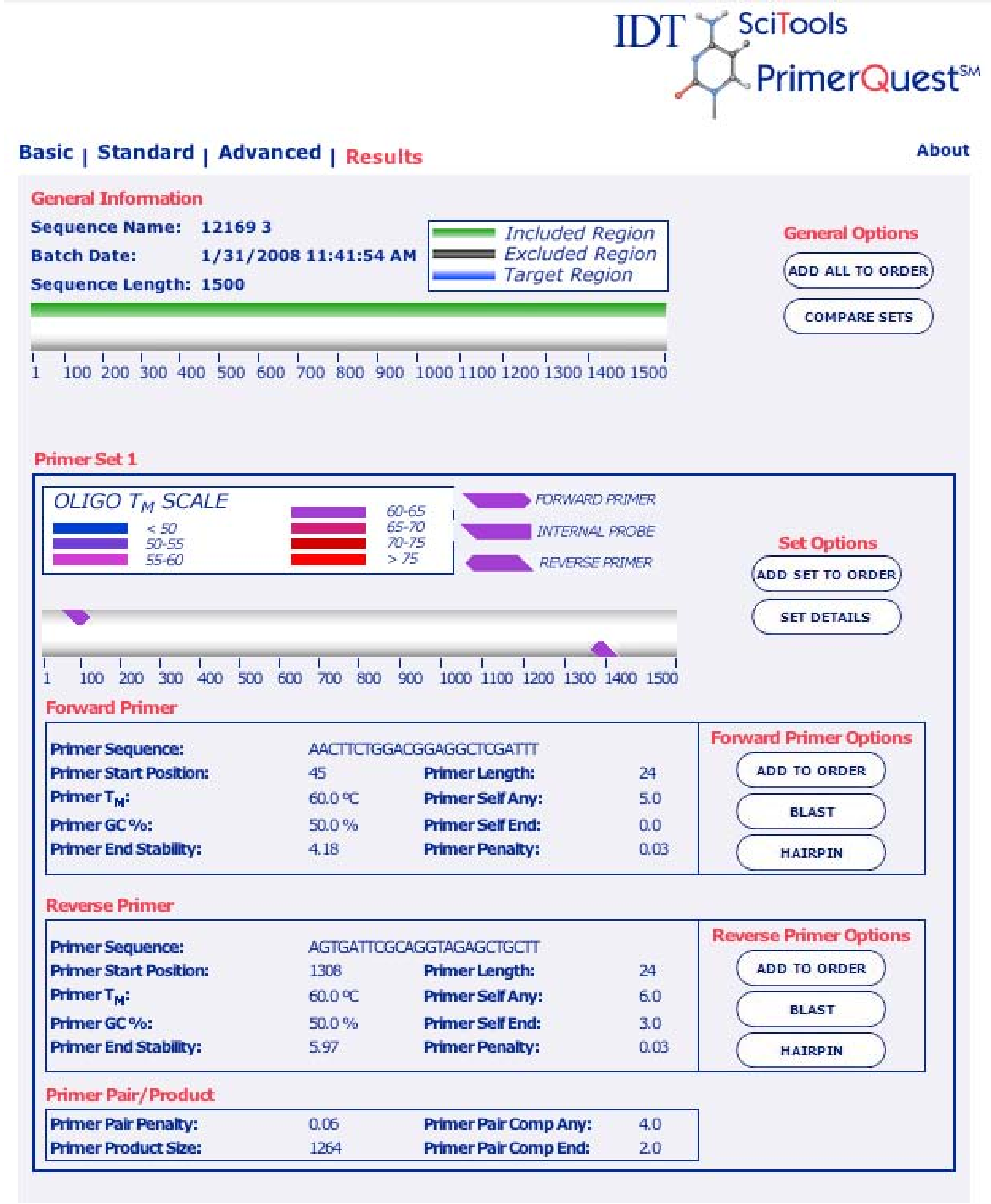
Primer design with IDT

Example Designing primers on 3' flank



- Primer design output

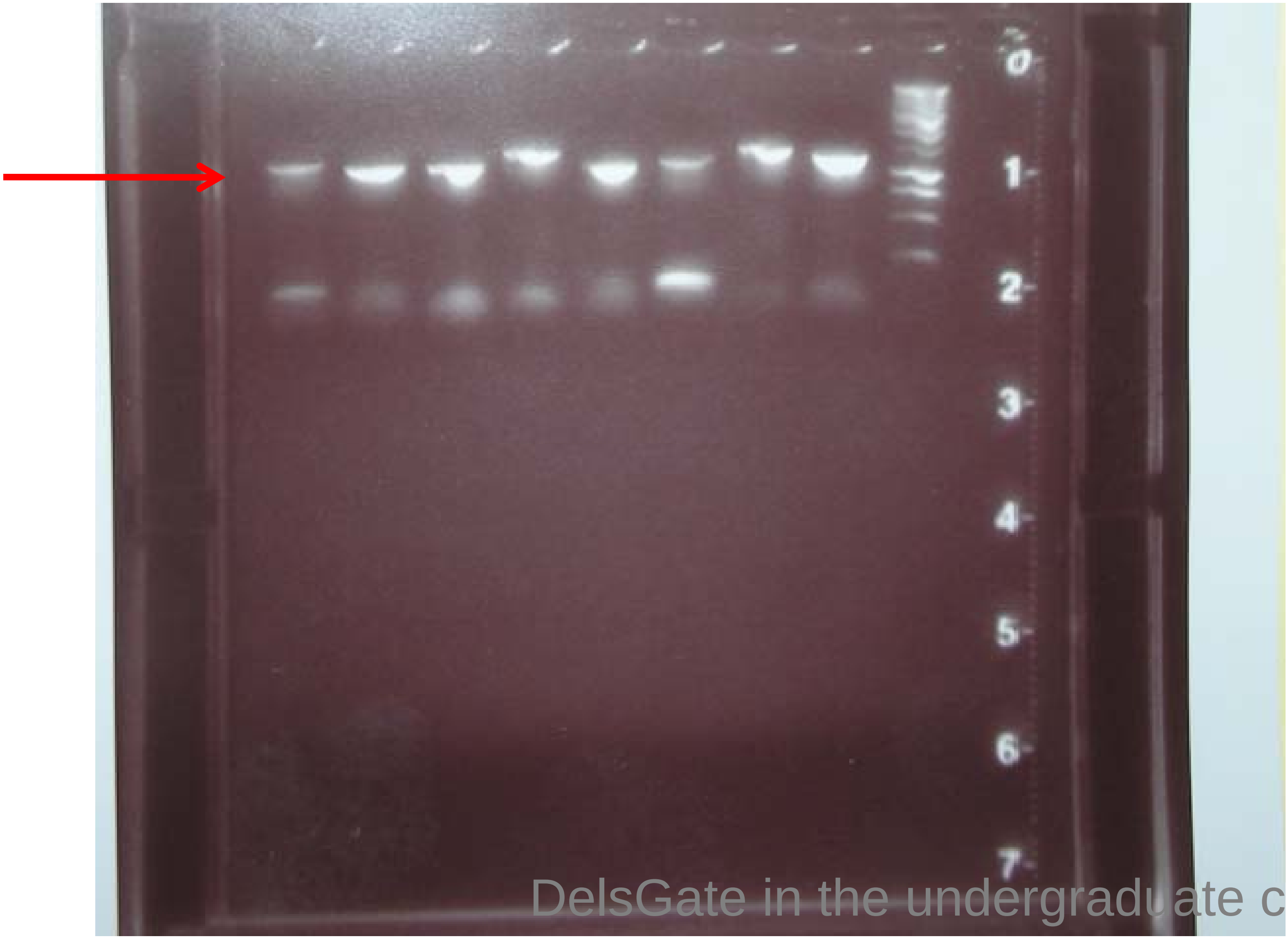


Oligo orders

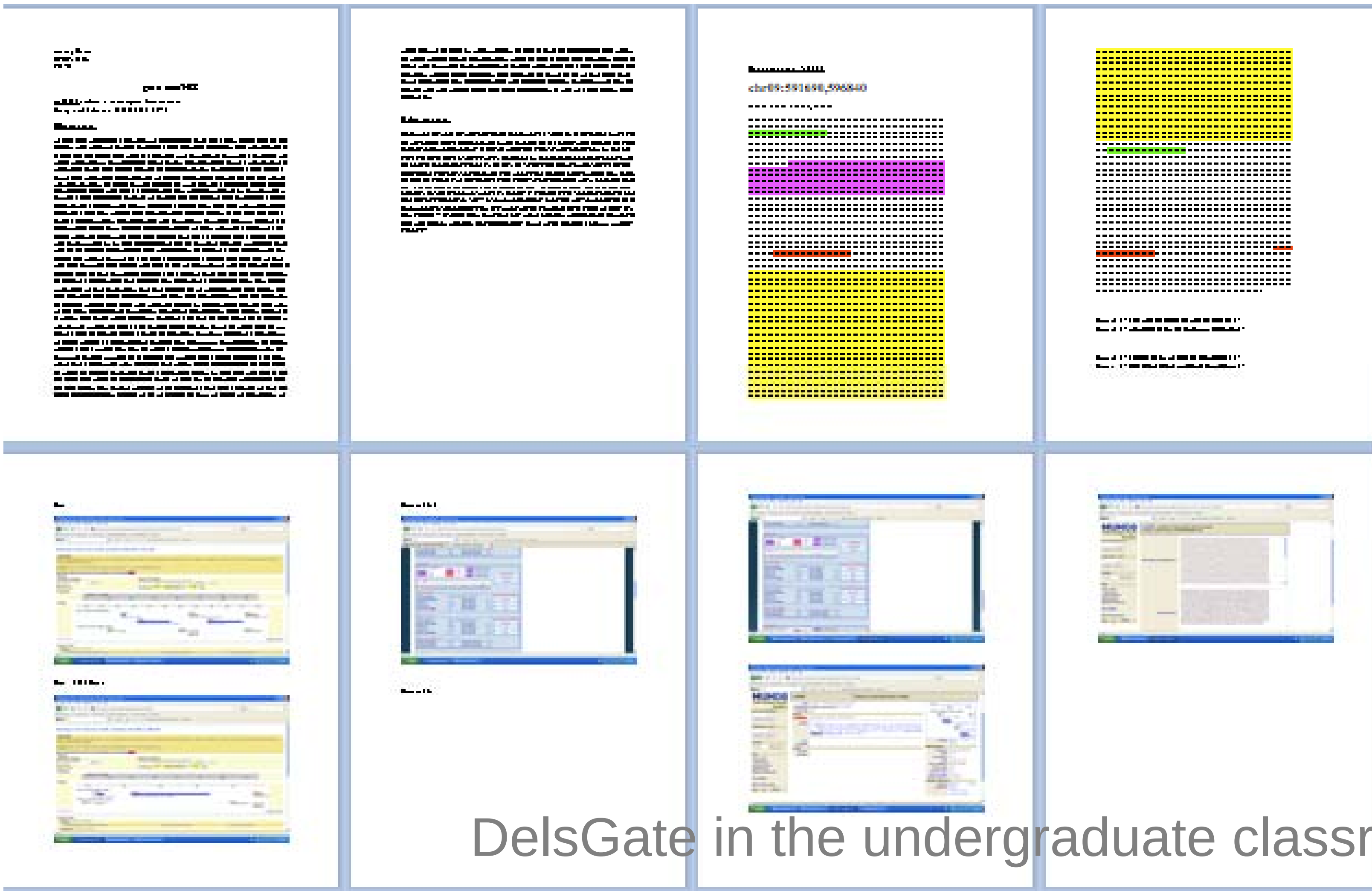
Sheets | Charts | SmartArt Graphics | WordArt

	A	B	C	D
1	Oligo Sequence	Oligo name	Student	Position
2	2009			
3	TA GGG ATA ACA GGG TAA T GCCTTGCTTCCTTACCTTGGGTTT	um02717-1	Alex Campolc	5' flank 5' end
4	GGGG ACA AGT TTG TAC AAA AAA GCA GGC TAA TCGAGTCAATCTGTGCTCAAGCCT	um02717-2	Alex Campolc	5' flank 3' end
5	GGGG ACC ACT TTG TAC AAG AAA GCT GGG TA AAAGTAGGTGGTAAGGTGCGGGAT	um02717-3	Alex Campolc	3' flank 5' end
6	ATT ACC CTG TTA TCC CTA TCCCGATCATCTGATGGATGCCAA	um02717-4	Alex Campolc	3' flank 3' end
7	TCTGCAGTACTCGAACGGCAATGA	um02717-5	Alex Campolc	inside ORF
8				
9	TA GGG ATA ACA GGG TAA T TAGTGAAGGCGATTGACTGGCTCA	um04796-1	Regan Frake	5' flank 5' end
10	GGGG ACA AGT TTG TAC AAA AAA GCA GGC TAA AGCTTGTGAAGAGATGGTCGCAGA	um04796-2	Regan Frake	5' flank 3' end
11	GGGG ACC ACT TTG TAC AAG AAA GCT GGG TA TGACACTTGAACAATCAACGCCGC	um04796-3	Regan Frake	3' flank 5' end
12	ATT ACC CTG TTA TCC CTA ATTACGGTTATGGCGAGGCCAGAT	um04796-4	Regan Frake	3' flank 3' end
13				Outside Flank F
14	TA GGG ATA ACA GGG TAA T TGTACTGTGGCTGTACTGTGCTGT	um03588-1	Audrey Greer	5' flank 5' end
15	GGGG ACA AGT TTG TAC AAA AAA GCA GGC TAA AGAGCGTTGAGTGAGAAAGCGAGA	um03588-2	Audrey Greer	5' flank 3' end
16	GGGG ACC ACT TTG TAC AAG AAA GCT GGG TA TCTCGTGTAATCGTGTCCAGCCTT	um03588-3	Audrey Greer	3' flank 5' end
17	ATT ACC CTG TTA TCC CTA GCTGCATCCATAACCAGCAACGAA	um03588-4	Audrey Greer	3' flank 3' end
18				Outside Flank F
19	TA GGG ATA ACA GGG TAA T TCCGATCGCATCGCTGTTTATTGC	um06140-1	TJ McGaha	5' flank 5' end
20	GGGG ACA AGT TTG TAC AAA AAA GCA GGC TAA TGTCGATTGGTGCTCGCTATCTGT	um06140-2	TJ McGaha	5' flank 3' end
21	GGGG ACC ACT TTG TAC AAG AAA GCT GGG TA GCCCGCGCTTGTTGTATTGTTGTA	um06140-3	TJ McGaha	3' flank 5' end
22	ATT ACC CTG TTA TCC CTA TGCGGATGTCGATGATTTGTCCGA	um06140-4	TJ McGaha	3' flank 3' end
23				Outside Flank F
24	TA GGG ATA ACA GGG TAA T TTGTCTTGCACACGACATTGCACC	Um00264-1	Alison Richbc	5' flank 5' end
25	GGGG ACA AGT TTG TAC AAA AAA GCA GGC TAA CGAATTATGGCGCTTCGCAAAGGT	Um00264-2	Alison Richbc	5' flank 3' end
26	GGGG ACC ACT TTG TAC AAG AAA GCT GGG TA ATCAGTGTCGGCTCACTCATTCGT	Um00264-3	Alison Richbc	3' flank 5' end
27	ATT ACC CTG TTA TCC CTA TCCTTCCTCGGACAGCATGTTGAA	Um00264-4	Alison Richbc	3' flank 3' end
28				Outside Flank F
29	TA GGG ATA ACA GGG TAA T CGCGTTGGTGGTGAAAGAACAACT	Um03016-1	Dori White	5' flank 5' end
30	GGGG ACA AGT TTG TAC AAA AAA GCA GGC TAA TCGCGAGCAATACACGATACACGA	Um03016-2	Dori White	5' flank 3' end
31	GGGG ACC ACT TTG TAC AAG AAA GCT GGG TA CTGGCGACATTTCTGGCTTTCGTT	Um03016-3	Dori White	3' flank 5' end
32	ATT ACC CTG TTA TCC CTA GTTCCAGGAGCATTGCGTGAACAA	Um03016-4	Dori White	3' flank 3' end
33				Outside Flank F
34	TA GGG ATA ACA GGG TAA T AGATGTAGCCGCCAGACTCTTTGT	um02301-1	Cara Smith	5' flank 5' end
35	GGGG ACA AGT TTG TAC AAA AAA GCA GGC TAA GCCATAAATCGGCACAAGGAAGCA	um02301-2	Cara Smith	5' flank 3' end
36	GGGG ACC ACT TTG TAC AAG AAA GCT GGG TA TGTACGCATAAGCACTCGTCCCTT	um02301-3	Cara Smith	3' flank 5' end
37	ATT ACC CTG TTA TCC CTA TGAGCCGATCGATTGACTGACGTT	um02301-4	Cara Smith	3' flank 3' end
38	[illegible]	um02301-5	Cara Smith	inside ORF

BTEC DelsGate PCR products gel 2 3/09



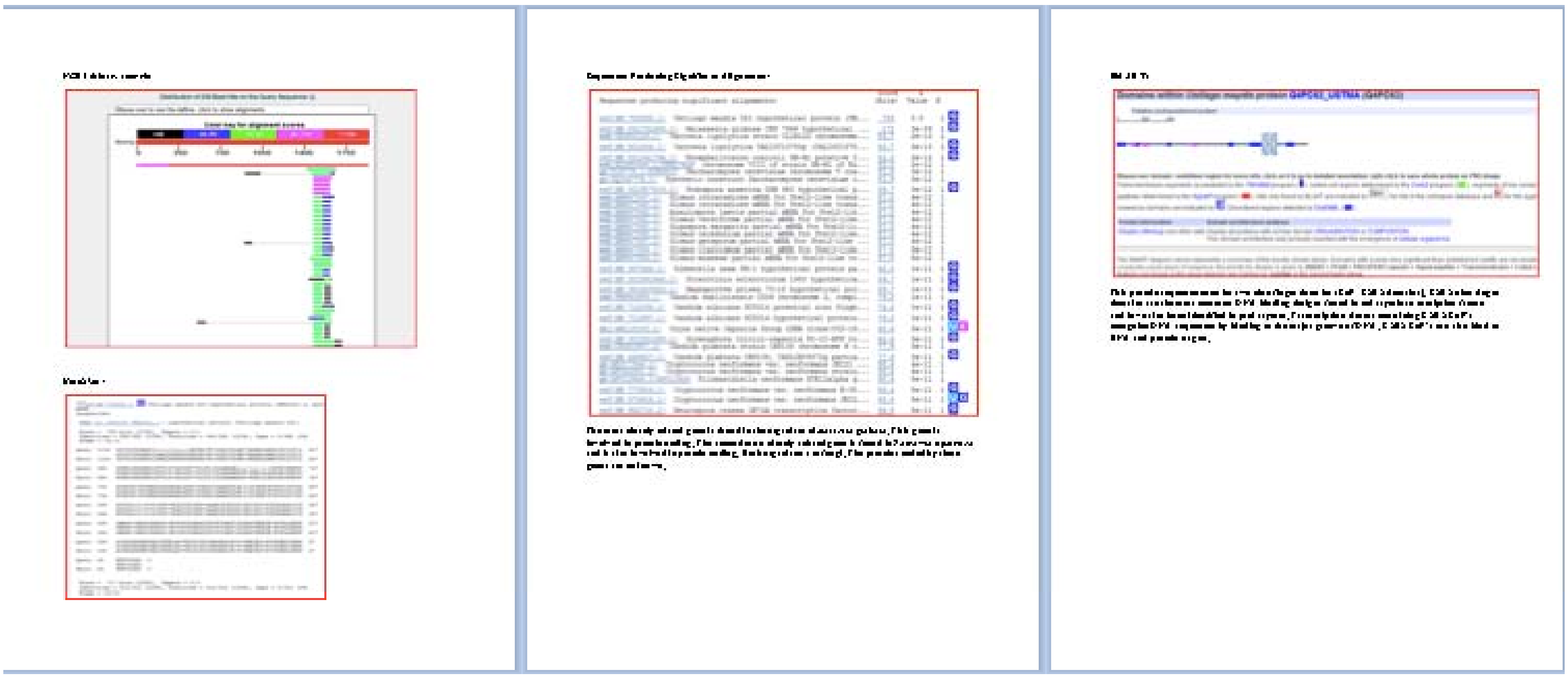
Audrey um03588
Report part 1 Word file



Audrey um03588
Report part 2 Lasergene file

Audrey um03588
Lasergene features added

Cara um02391
Report part 3 Use of BLAST and SMART
Zn finger transcription factor?



DelsGate in the undergraduate classroom

Summary

- Students learn how to use a genome database, and other software for Mol Biol.
- Students each generate a deletion construct for one differentially expressed gene.
- Students generate reports on their gene and generate hypotheses about potential function via BLAST and SMART.
- Students transform *U. maydis* to delete the gene from the genome.

Discussion topics, P. Spanu

- “Non-traditional” students-in some senses, all our students are not like us (more tech-savvy)
- Public understanding of science; tie with service learning, community-based research w/ public presentation of student work; faculty responsibilities, not what we do when we have time, value of scientific thinking
- Evolution, predictions of student models
- Roles of professional societies; esp GSA, ASM, plant biology society (gives grants-raffles-win a trip to Hawaii!!) collaboration among professional societies
- Use of internet, video capture instead of single microsopes; u-tube; google-docs; podcasts; design webpages; webCT; blogs; improve wikipedia pages; ways for students to provide content, not just consume content

Discussion topics, con’t.

- Information vs procedural understanding--technology alone isn’t enough- “learning how to learn” student in charge, empower to teach (powerpoint, clickers); effective writing; peer interaction; peer instruction peer review
- “Market system”-making mycology attractive; biodiversity
- Responsibilities for training both in research and education--influence of granting agencies
- Teaching vs research--value & resources

Lessons learned from building a program for women in science

March 20, 2009

Joan W. Bennett

Fungal Genetics Conference

Asilomar, California

Outline

- Introduction
- **Research on women in science**
- Rutgers University
  - Office for the Promotion of Women in Science, Engineering and Mathematics
- NSF-ADVANCE

Where Women Stand in U.S. in (2008):

(After 30 years of legislation outlawing sex discrimination):

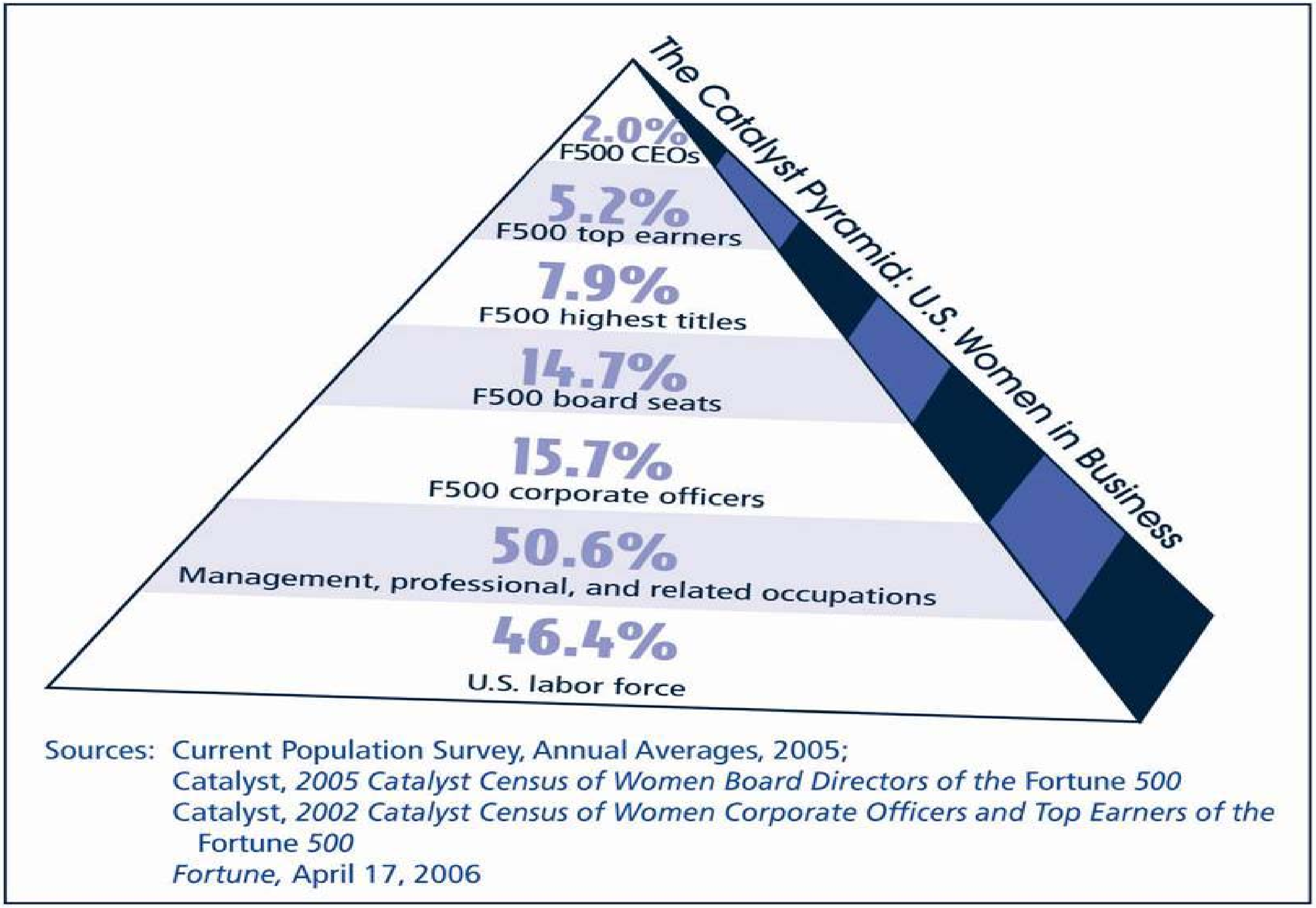
- --Men occupy 95 percent of the top corporate positions
- --Men occupy 85 percent of elected offices
- --Full-time female employees earn less than 75 cents for every dollar earned by men
- --Women constitute two-thirds of those living in poverty in the U.S.
- Lisa Hetfield and Mary Hartman, Institute for Leadership for Women, Rutgers Univ.

Glass ceiling

- The “glass ceiling” is an invisible barrier; inequality of gender or racial differences not explained by job-relevant criteria

- e.g. Asian American scientists both male and female are under represented at all stages of their careers.

The Glass Ceiling



Equal Opportunities for Women and Minorities in Science and Technology Act of 1981

Mandated that NSF report statistics on underrepresented groups and initiate a suite of programs to influence diversity in the science and engineering workforce.

(NSF is the only R&D agency so mandated.)

Sources of data

Science and Engineering Indicators is published biannually by NSF

Professional Women and Minorities is published biennially by the Commission on Professionals in Science and Engineering (CPST)

Trends in Educational Equity of Girls & Women (2004, U. S. Dept. Education)

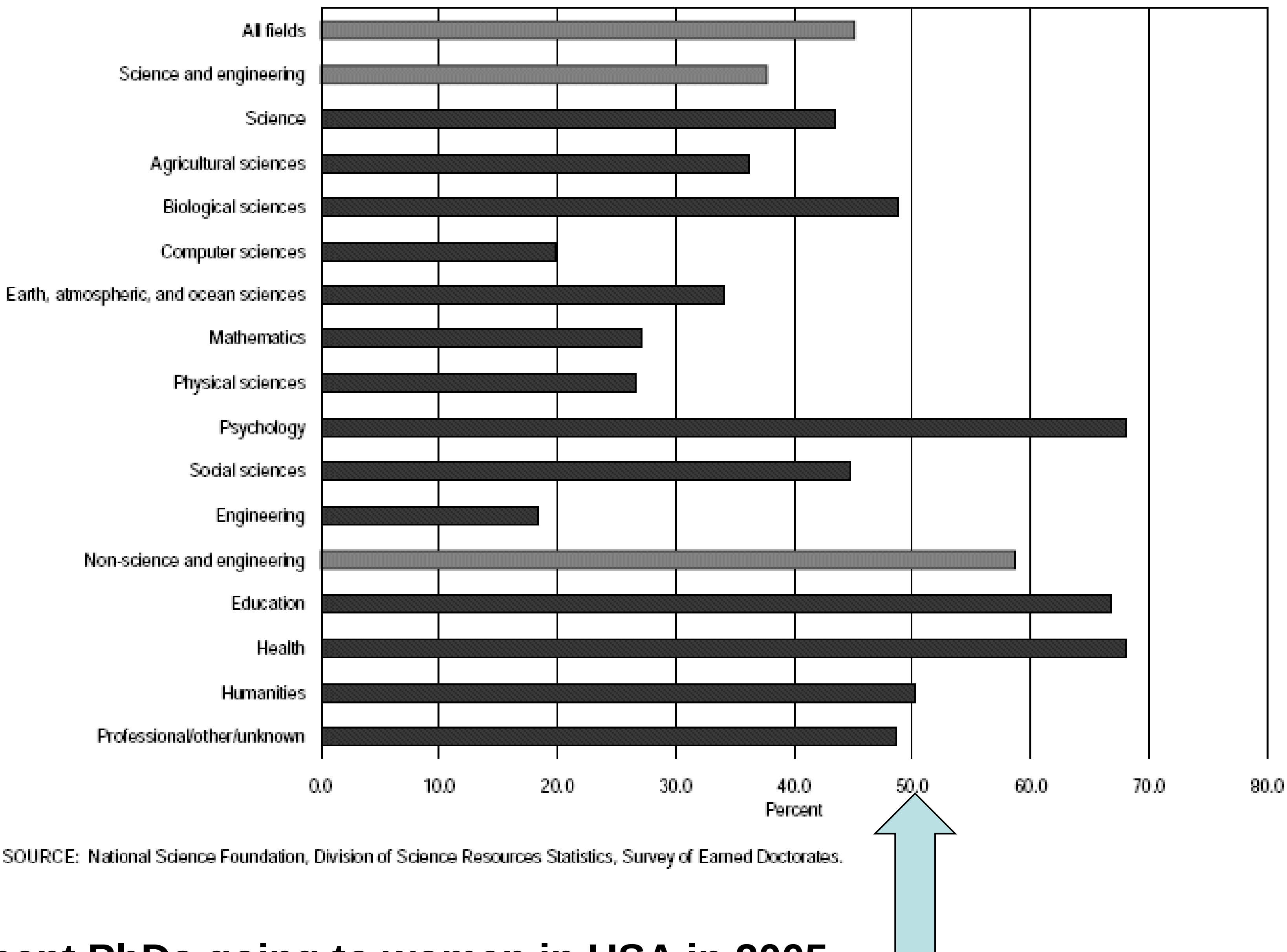
Broadening Participation in Science and Engineering Faculty (2004, the National Science Board)

A National Analysis of Diversity in Science and Engineering Faculties at Research Universities (Nelson, D. J. and Rogers, D. C. 2005)

Women, Minorities and Persons with Disabilities (2007, NSF)

We have excellent data to track the lack of progress of women in science, engineering and mathematics careers.

FIGURE 2. Female doctorate recipients, by field of study: 2005



SOURCE: National Science Foundation, Division of Science Resources Statistics, Survey of Earned Doctorates.

Percent PhDs going to women in USA in 2005

http://www.nsf.gov/statistics/infbrief/nsf07301/

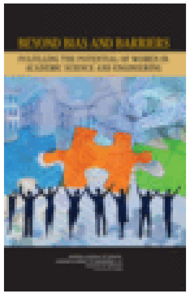
After the PhD

Women and non whites comprise fewer than 15% of full professors in top research departments.

About 15% in biology, psychology, and social science; lower in mathematics, physical science and engineering.

Minority faculty comprise about 4% of full professors; minority women are less than 1%.

Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering
National Academy of Sciences 2006



Mommy track

- Family and home are considered “women’s work.”

- Family responsibilities are a second full time job

- Lack of family-friendly workplaces.

- Bottom line: women opt out and/or are pushed out by the overwhelming responsibilities.

Bias/discrimination

- **Bias** is to favor a perspective or group over others and to be unfair or partial to them. The motive may be unconscious and rooted in tradition or prejudice; children can be socialized to be biased.
- **Discrimination** is to analyze differences among things or people; to make distinctions. It is negative when a statistical profile (stereotype) is used to the detriment of the individual.

Social scientists have created a taxonomy of biases

- Overt vs. covert
- Personal vs. institutional
- Conscious vs. unconscious

“Don’t take this wrong, but you are really good for a woman.”

Review of research on bias

"Subtle biases underlie ordinary discrimination: comfort with one's own in-group, plus exclusion and avoidance of out-groups."

- Fiske, S. T. (2002). What we know now about bias and intergroup conflict, the problem of the century. *Current direction in Psychological Science* 11: 123-128.

Self presentation

Women use more "**tentative speech**." Women who were more authoritative were less influential with men, and less liked by men, than women who used tentative speech. The language style of males did not affect the evaluations they received.

- Carli, L. L. 1990. Gender, language and influence. *J. Personality and Social Psychology* 59: 941-951.

Leadership

Meta-analysis indicates that **women are devalued for adopting stereotypically masculine leadership styles** ("autocratic")

Note: men are not devalued for adopting stereotypically feminine leadership styles ("democratic").

Eagley, A. H., Makhijani, M. G. and Konsky, B. G. (1992) Gender and the effectiveness of leaders: a meta-analysis. Psychological Bulletin 111: 3-22.

Range of behavior

- Both men and women who engaged in **gender incongruent tasks** had lower expectations, performance and self evaluations than those in gender-congruent. Women significantly underestimated their success at masculine tasks. [Science is considered a masculine profession].

- Beyer, S. and Bowden, E. M. (1997) Gender differences in self perceptions: convergent evidence from three measures of accuracy and bias. Personality and Social Psychology Bulletin 23: 157-172.

Stereotype threat

- When individuals are made aware of their identities (e.g. girls purportedly not being good at math), their performance will be impaired on tests. The effect is triggered by raising awareness of negatives just before the test.

- Steele & Aronson, 1995
- Steele, Reisz, Williams & Kawakami, 2007

Gender schema (Valian)

- Unconscious beliefs, **shared by men and women**, that skew our perceptions of their respective abilities.

Valian, V. (1998) *Why So Slow? The Advancement of Women*. MIT Press.

Examples from Valian book

– Same c.v. sent for faculty positions

Those with male names chosen more OFTEN

– Letters of recommendation for medical faculty position.

– **More superlatives for males with similar or poorer records**

– Swedish Medical Council post doctoral fellowships

– **Women needed stronger credentials to be awarded**

Institutional (structural) bias

"Impersonal" rules and policies:

- Qualification tests that make it hard for one group to pass (e.g., admissions **quotas** for women, certain ethnic groups)
- **Nepotism** rules
- Rigid **time-to-tenure tenure regulations** (conflicting "clocks")

Accumulative advantage

- Small disadvantages accumulate.

- A computer simulation of promotions, where men and women started equally, but men were given a 1% advantage over women, showed that after 8 moves the top level was 65% male. (Martell, Lane & Emrich, 1996)

My favorite study of unconscious bias comes from the world of classical music

Orchestras and blind screening

During the 1970s some orchestras began to audition with a screen in place to conceal the identity of the job candidate.

Blind screening increased women's chances of being hired by 30 percent. Women now make up over 25 % of orchestra musicians. This is a large increase considering how few positions become available in a symphony each year.

- Goldin, Claudia and Rouse, Cecilia E. , Orchestrating Impartiality: The Impact of "Blind" Auditions on Female Musicians (January 1997). NBER Working Paper No. W5903. Available at SSRN: http://ssrn.com/abstract=225685

Challenge to audience

- If anyone can think of a similar clear and objective metric that we could measure in science, I would love to collaborate on a study.

Outline

- Introduction
- Research on women in science
- **Rutgers University**
  - **Office for the Promotion of Women in Science, Engineering and Mathematics**
- NSF-ADVANCE

Website:
http://sciencewomen.rutgers.edu

Designed to increase the prominence of Rutgers female faculty by providing "one stop shopping" for informational summaries of faculty profiles. It also contains a "role model site" to increase the visibility of women on the science faculty. This feature is called "**Girl geek**."

http://sciencewomen.rutgers.edu/

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Women in Science, Engineering, and Mathematics

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- News and Announcements
- Faculty Profiles
  - Our Stories
- Resources
- Staff Information
- Advisory Board
- How You Can Help
- Suggestions and Comments

RETURN TO RUTGERS HOME PAGE

Office for the Promotion of

Women in Science, Engineering, and Mathematics

Welcome! This website seeks to serve as a resource for women in science fields and later to describe the status of women in science, technology, engineering, and mathematics (STEM) at Rutgers University. We will keep you up to date about programs and initiatives for women in STEM fields at all levels, from the undergraduate to the senior scientist. We hope you will find information that will make your career paths easier, facilitate collaborations between women and men about our common issues, and open dialogue across the natural sciences, social sciences, and the humanities.

We hope to provide a forum for discussion in future, and we look forward to hearing your comments and feedback about our website. If you would like to recieve our newsletter and be on our mailinglist please notify us via email or via our comments link above.

Joanna Burger

Catherine Duckett (right) and friend

Lisa Klein

“GIRL GEEKS”

Experimental You Tube interviews

Nina Fefferman (DIMACS), Noemie Koller (Physics) Marge Munson (Douglass College) and Diana Sanchez (Psychology)

See:

http://www.youtube.com/user/RUsciwomen.

LEADERSHIP TRAINING

- Send representative to attend programs at the American Council on Higher Education

- Sponsor participants for the Bryn Mawr Summer Institute

Social events/networking

- Sponsored lectures, picnics, luncheons, potlucks and so forth. Examples:

Summit for Women in the Science and Technology Workforce, co-sponsored by the New Jersey Gender Parity Council in collaboration with the Center for Women in Work

A “Coming of Age” luncheon party was held for the Douglass Project at Bunting Cobb dormitory

Co-sponsored with the Women’s Studies Department at Rutgers-Camden a lecture on gender and physics by Dr. Amy Bug of Swarthmore College

Grants proposals

- **"A leadership program at Rutgers University for women in the science, technology, engineering and mathematics (STEM) professions,"** (Joan W. Bennett, PI; Eileen Appelbaum, David Finegold, Teresa K. Boyer, Mary S. Hartman, Nancy DiTomaso, and Mary Trigg, coPIs). Rutgers University Academic Excellence Fund, **$50,000.** (2008)
- (continued support from BIO-1 Wired U.S.Dept Labor **$124,000,** 2009-2010)

- **"Project SUPER* (Superstar) Scholars at Rutgers University,"** (National Science Foundation. S-STEM 0726650 Project SUPER*) (Joan W. Bennett, PI, J. White and R. Riccioni, coPIs), **$599,706.** (2008-2011)

Objective Analysis of Self and Institution Seminar (OASIS)

- A series of four Friday afternoon workshops was funded by our Academic Excellence Fund grant (Spring 2008) and continued by a second grant from U.S. Dept Labor (Spring 2009). Mary Ellen Clark, Executive Director of BIO-1 (School of Management and Labor Relations) named and organized the seminar. Beth Tracy organizes the sessions.

Grants proposals

“RU-Stepped up for Success” (Kathy Scott PI; Joan W. Bennett, Catherine Duckett and Marie Logue CoPI’s). NSF -STEM TALENT EXPANSN PGM (STEP)

Targeted interventions support “at risk” undergraduates pursuing science careers on the New Brunswick campus. The Office for the Promotion of Women in Science, Engineering and Mathematics is involved in a peer mentoring program and will establish a science dormitory for women on the Busch Campus, tentatively called Rosalind Franklin House. **$1.9 million,** (2008-2011)

Outline

- Introduction
- Research on women in science
- Rutgers University
  - Office for the Promotion of Women in Science, Engineering and Mathematics
- NSF-ADVANCE

- The National Science Foundation has a program called ADVANCE for supporting faculty women in science, engineering and mathematics. The goal is “institutional transformation.”

http://ruweb.rutgers.edu/about-the-university.shtml

Special challenges for Rutgers University

1. Geography

2. Size

3. History and traditions

- Before submitting the proposal, we gathered data about the sex ratio of the Rutgers University science, engineering and mathematics faculty.

- Because of the decentralization of the university’s data systems, it was not a trivial task.

Women SEM Faculty Rutgers-New Brunswick (2006)

	(1)	(2)	(3)	(4)	(5)
			NRC Cumulative	Utilization	Top 100 depart-ments, FY
	Rutgers Departments		Doctorates, 1981-98[b]	Index[c]	2002[d]
School of Arts & Sciences (AY 2003-04)[a]	Total	% Female	% Female	%	% Female
Social & Behavioral Sciences	**181**	**32.0**	**50.1**	**.64**	
Anthropology	20	45.0	54.2	.83	na
Economics	30	16.7	24.2	.69	16.3
Geography	7	14.3	28.6	.50	na
Political Science [Pol Sc. & Gov't]	30	30.0	30.5	.98	26.1
Psychology	50	28.0	57.4	.49	37.3
Sociology	31	48.4	51.7	.94	39.8
Life Sciences	**60**	**23.3**	**41.0**	**.57**	24.4
Cell Biology & Neuroscience	26	26.9	42.5	.63	na
Genetics [Microbiology, Human & Animal Genetics, Genetics]	17	23.5	43.5	.54	na
Molecular Biology & Biochemistry	17	17.6	38.6	.46	na
Mathematical & Physical Sciences	**248**	**10.5**	**20.4**	**.52**	
Chemistry	41	24.4	24.8	.98	13.7
Computer Science	38	2.6	19.0	.14	13.2
Geological Sciences [Geology]	16	12.5	22.5	.56	16.5
Mathematics	70	8.6	22.5	.38	12.9
Physics & Astronomy	62	9.7	11.3	.86	9.1
Statistics [Mathematical Statistics]	19	5.3	25.7	.21	na

Summary Rutgers New Brunswick index

- The following departments are at 90% or better in terms of the pipeline:
  Chemistry, Physics and Astronomy,
  Political Science and Sociology
- The following departments are at less than 50% in terms of the pipeline: **Molecular Biology and Biochemistry, Computer Science, Mathematics, Statistics, Economics and Geography**

Women SEM Faculty Rutgers-
New Brunswick Engineering (2006)

	Total	% female	NRC '81-98	Index	Top 100
School of Engineering (Fall 2006)	**130**	**12.3**	**12.1**	**1.02**	
Biomedical Engineering [Bioengineering & Biomedical]	17	14.7	23.4	.63	na
[Chemical]	13	7.6	16.3	.47	12.6
Civil & Environmental Engineering [Civil]	12	25.0	11.2	2.23	13.0
Electrical & Computer Engineering [Computer & Electrical & Electronics]	26	15.4	8.6	1.79	9.5
Industrial & Systems Engineering [Industrial & Manufacturing & Systems]	11	18.2	19.2	.95	na
Materials Science & Engineering	26	3.8	19.5	.20	na
Mechanical & Aerospace Engineering	25	4.0	7.2	.56	8.8

The School of Engineering with only 12% women faculty is at parity when compared to pipeline (but departments vary)

NSF ADVANCE

"Rutgers University for Faculty Advancement and Institutional Re-imagination" ADVANCE – National Science Foundation (Joan W. Bennett PI; Catherine Duckett, Patricia Roos and Nancy Rosoff, Co-PI's).

Duration: Sept. 1, 2008-Aug. 30, 2013

Funding level: **$3.67 million**

RU-FAIR

1. Recruitment and retention initiatives

- Develop a targeted strategy for increasing the number of women in general, and minority women in particular of the Rutgers faculty including training for search committees to enhance the recruitment of women and minority SEM faculty, leadership training for established faculty, and a coordinated mentorship program.

2. Communication Initiatives

- Enhance communication among faculty within a geographically and structurally complex multi-campus university. e.g. web site, social events, leadership training

3. Networking and Liaisons with Women's Programs Initiatives

- Develop mini-grants to encourage interdisciplinary research across schools and campuses and to work closely with the nationally acclaimed Rutgers Institute for Women's Leadership (IWL)

4. Visibility Initiatives

- Achieve greater visibility for our women faculty by creating a bigger web presence, instituting a lecture series, nominating our faculty members and postdoctoral associates for prestigious awards, and generating greater press coverage for their research accomplishments.

5. Family Initiatives

- Bolster the resources available for dual career families and for families with children. Further, we will study what changes in current tenure regulations and other policies would best accommodate the needs of families.

Mechanisms for implementation

RU FAIR Professors

One for each campus $50,000/year for two years, renewable.

Funds can be used for own research, to support a graduate student or etc

(Judy Weis, Biology Newark; Helen Buettner, Engineering, New Brunswick; George Arbuckle, Chemistry, Camden)

Mini-grants

- First round of proposals due on April 1, 2009
- $1,000-15,000 for interdisciplinary research
- (e.g bring lecturers to campus, seed money for research projects, course development, child care studies, etc)

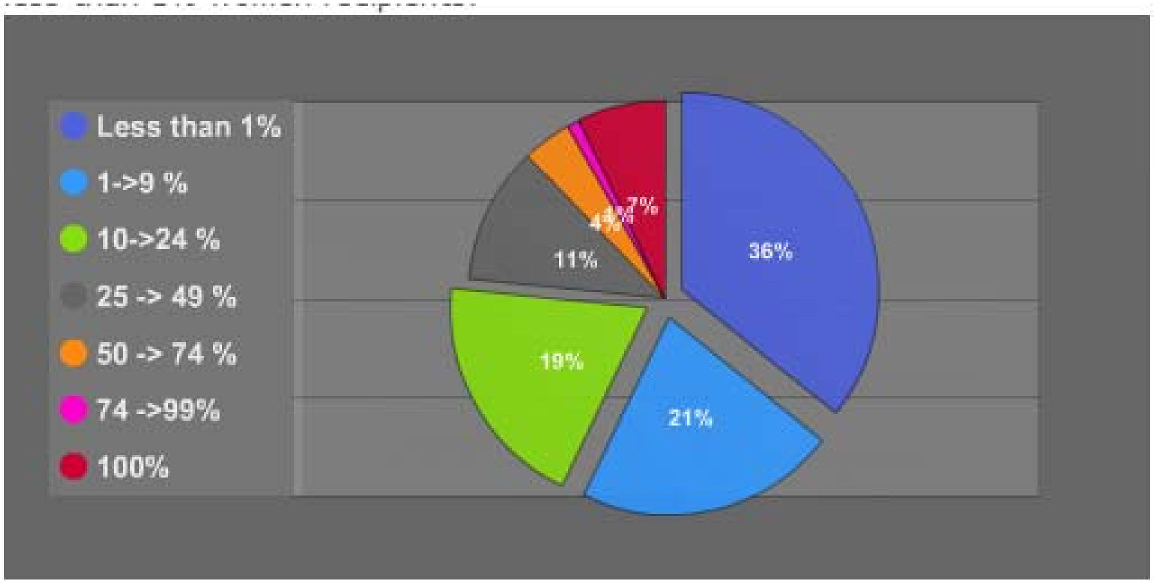
Life cycle grants

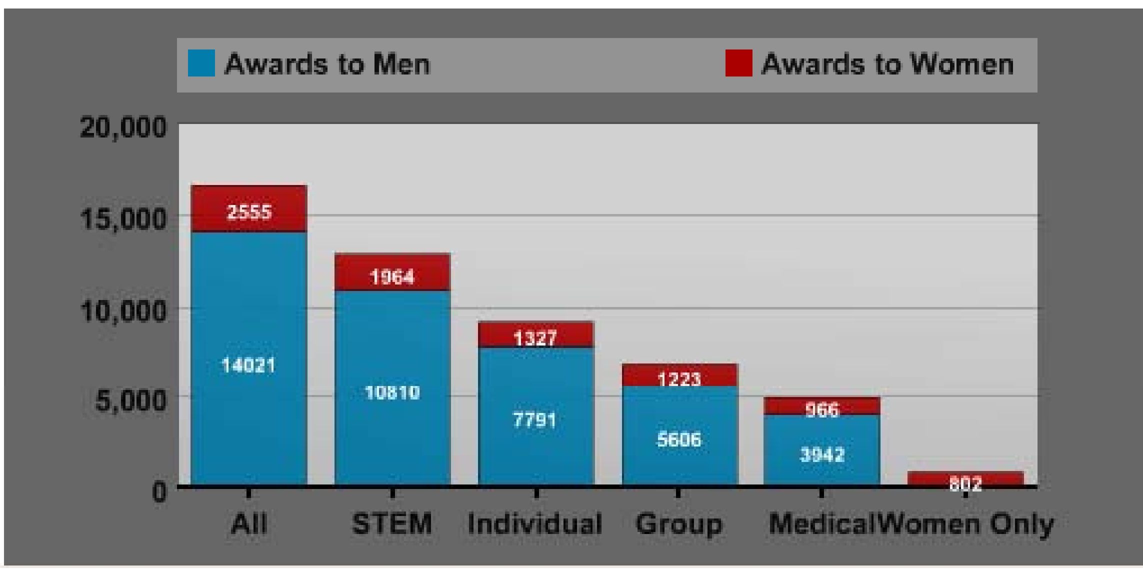
- Based on a program developed at the Univ. of Wisconsin under the leadership of Jo Handelsman, these grants are available to people with unexpected family emergencies (bridge funding for emergency child care, elder care, or etc)

In STRIDE committees

- Work with President’s council on Diversity to develop a manual of best practices and to “raise consciousness” of chairs and search committees about how to run fair and open searches.

RAISE Project = Recognition of the Achievements of Women In Science, Medicine, and Engineering





•(Stephanie Pincus
•and Florence Haseltine)

http://www.raiseproject.org/faq.php

All our initiatives are open to men and to women

THE BIG CHALLENGE

- Scientists, we are told, are entirely rational and cerebral creatures who continually process available data/information and behave accordingly. That's the theory.

- **The reality: Scientists are human beings and have human frailties. There is considerable evidence that faculty committees, both male and female, are susceptible to emotions and unconscious biases.**

Acknowledgments

Associate Director:
Natalie Batmanian

Assistant Director:
Thess Hinnant-Bernard

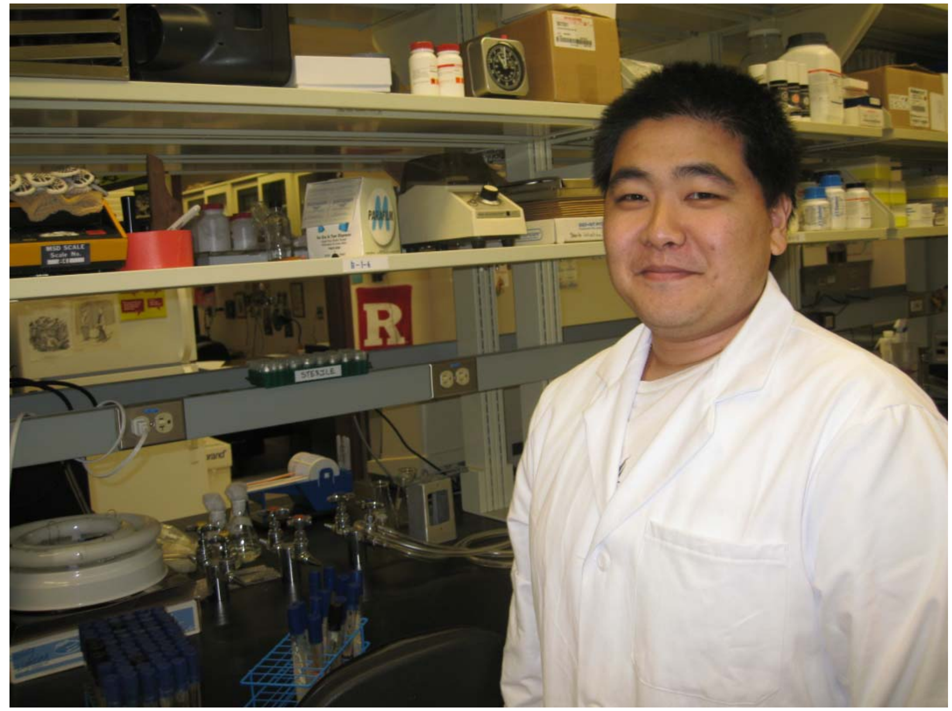
Program Coordinators: Carey Murray, Christina Leshko

Students: Erin Sutherland, Tiffany Slotowski

Budget Manager: Robert O'Such

Prakash Masurekar

Richard Hung



Arati Inamdar

Students: Samantha Lee, Christen Libertiny, James Mauro, Poras Patel and Craig Pritch

And thanks to Marshall Bergen for help with the taxonomic Identifications.

Thanks to Rutgers University for its incredible support for my Office for Women

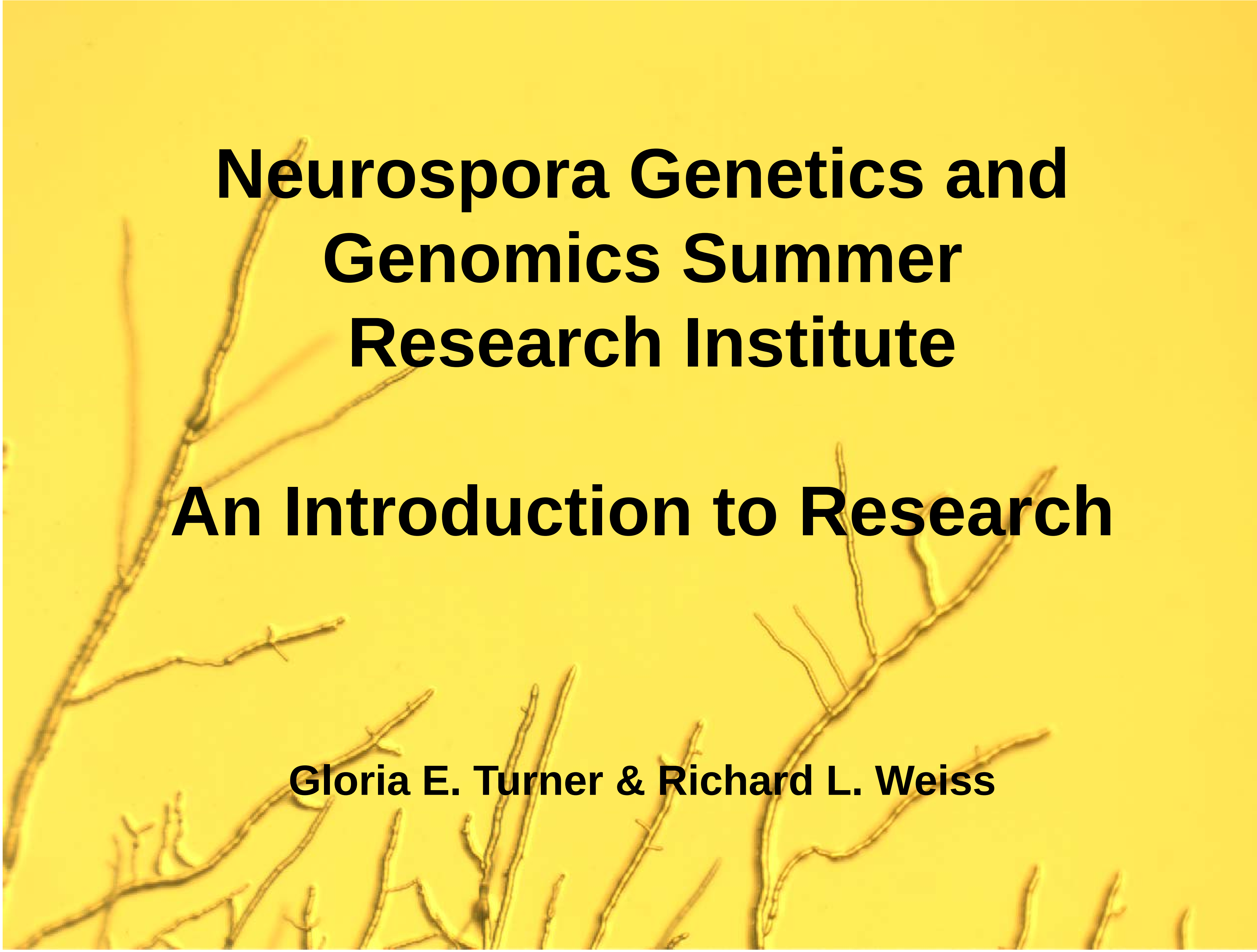
“Old Queens” building

images.businessweek.com/.../source/2.htm

(Rutgers was chartered as Queens College in 1766, is the eighth-oldest college in the USA and is now The State University of New Jersey)

http://www.clubbaseball.org/files/Team%20Logo%202.gif

Thank you for listening.


Neurospora Genetics and Genomics Summer Research Institute
An Introduction to Research
Gloria E. Turner & Richard L. Weiss

NGGSRI OBJECTIVES

- Perform phenotypic analysis on *Neurospora crassa* gene deletion strains.
- Establish a phenotype data base at the Broad Institute.
- Introduce laboratory research to beginning sophomore science students.

Structural Organization

- Nine week all day program.
- Twenty students phenotyped 40 KO mutants in quadruplicate. Half were from UCLA and half from local Community Colleges.
- Instruction was divided between computer labs and microbiology labs.

Research Organization

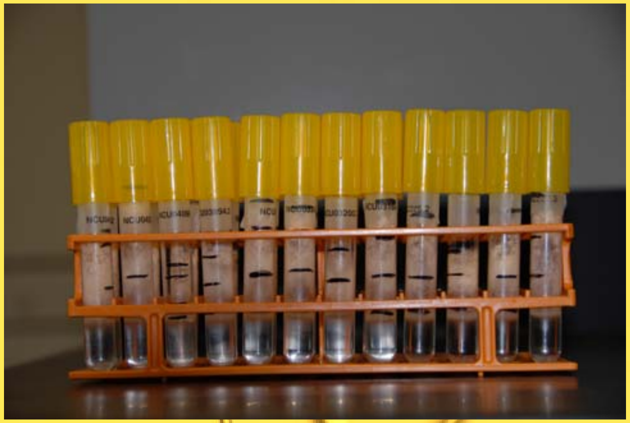
- Strain management Groups of 40
- Data Entry Forms & NCU Labels
- Daily Inoculation Schedule
- Independent Research Project
- Power Point Presentations

Support Activities

- Scientific Writing Class
- Excel and Bioinformatics Class
- Seminars
- Specific Weekly meeting for Bridge students

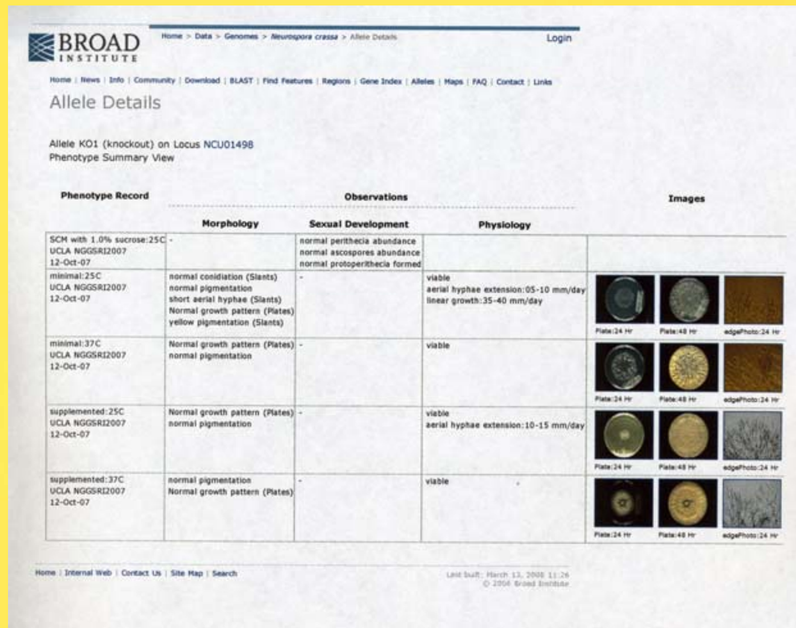
Five Phenotype Assays

- Plate growth & morphology on minimal and complete media
- Asexual Development.
- Sexual Development
- Aerial Hyphal Extension
- Growth rates



Assays translate to KO Allele Details

- **Results recorded on data entry forms that mirror Broad site.**
- **Students upload their data to the Broad Institute.**
- **Summary site with the quadruplicate values is accessed by NGGSRI Director.**



BROAD INSTITUTE

Home > Data > Genomes > *Neurospora crassa* > Allele Details

Login

Home | News | Info | Community | Download | BLAST | Find Features | Regions | Gene Index | Alleles | Maps | FAQ | Contact | Links

Allele Details

Allele KO1 (knockout) on Locus NCU01498
Phenotype Summary View

Phenotype Record	Observations: Morphology	Observations: Sexual Development	Observations: Physiology	Images
SCM with 1.0% sucrose:25C UCLA NGGSRI2007 12-Oct-07	-	normal perithecia abundance normal ascospores abundance normal protoperithecia formed		
minimal:25C UCLA NGGSRI2007 12-Oct-07	normal conidiation (Slants) normal pigmentation short aerial hyphae (Slants) Normal growth pattern (Plates) yellow pigmentation (Slants)	-	viable aerial hyphae extension:05-10 mm/day linear growth:35-40 mm/day	Plate:24 Hr · Plate:48 Hr · edgePhoto:24 Hr
minimal:37C UCLA NGGSRI2007 12-Oct-07	Normal growth pattern (Plates) normal pigmentation	-	viable	Plate:24 Hr · Plate:48 Hr · edgePhoto:24 Hr
supplemented:25C UCLA NGGSRI2007 12-Oct-07	Normal growth pattern (Plates) normal pigmentation	-	viable aerial hyphae extension:10-15 mm/day	Plate:24 Hr · Plate:48 Hr · edgePhoto:24 Hr
supplemented:37C UCLA NGGSRI2007 12-Oct-07	normal pigmentation Normal growth pattern (Plates)	-	viable	Plate:24 Hr · Plate:48 Hr · edgePhoto:24 Hr

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Last built: March 13, 2008 11:26
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BROAD INSTITUTE

Allele Details

Allele KO1 (knockout) on Locus NCU01498

Phenotype Summary View

Phenotype Record	Observations: Morphology	Observations: Sexual Development	Observations: Physiology	Images
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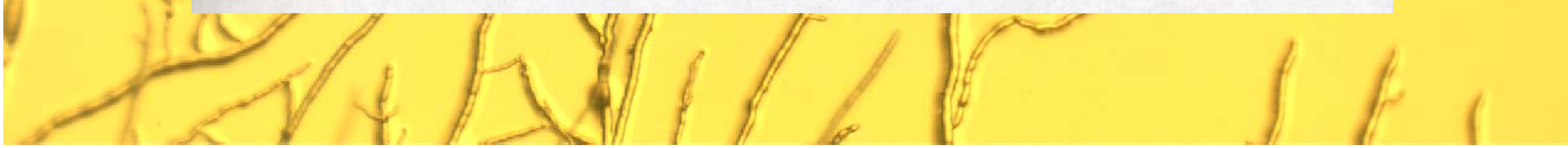
Last built: March 13, 2008 11:26



Inoculate Inoculate

- **Sterile technique**
  Students generate their own set of KO mutants.
- ***Neurospora crassa***
  Perform all assays on the wildtype parent.

Experts

- Sterile Technique
- Microscopy
- Model organism
- Computer Skills
- Data Management
- Presentations

Independent Research

- Ask a Biological Question/Specific Aim
- Background Information/Relevance
- How do I answer the research question/ Materials & Methods
- Perform experiment/Results
- Presentation

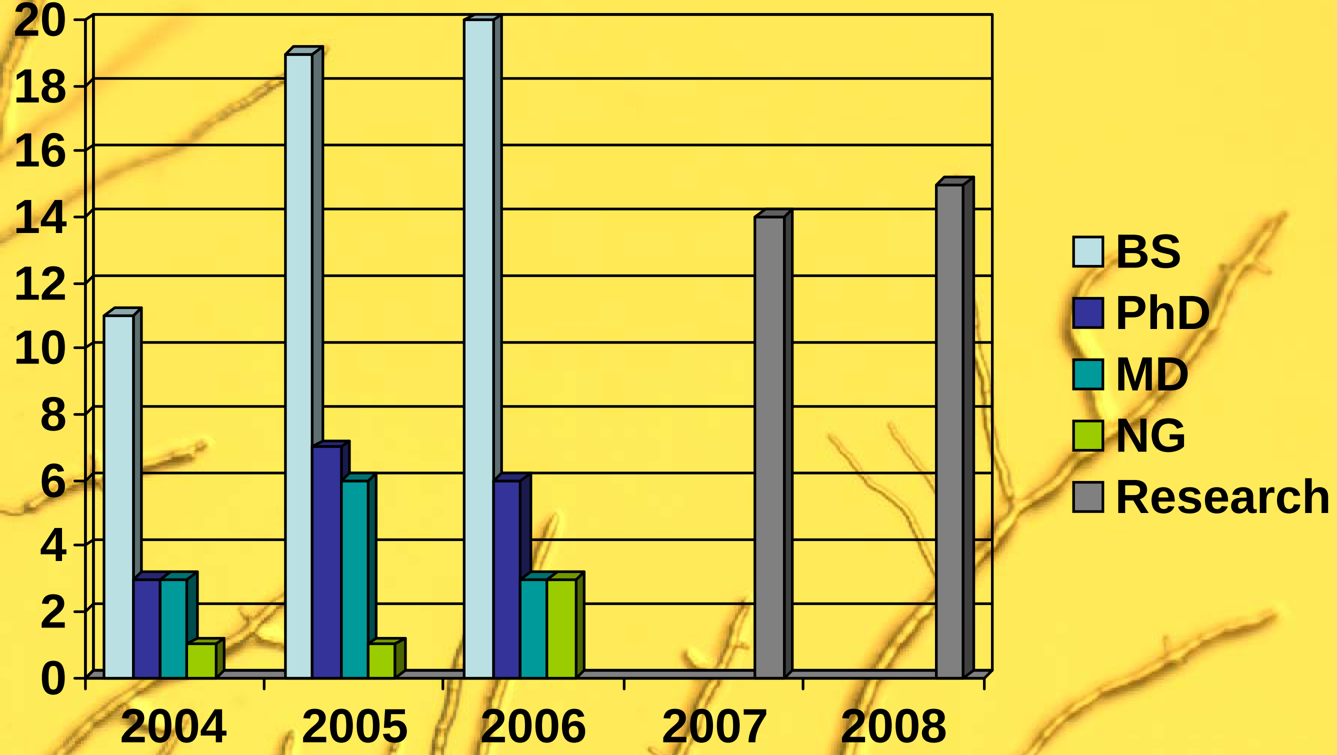
Resources

- **Blast searches with protein sequences**
- **Rowland Davis's NEUROSPORA** Contributions of a Model Organism
- **Research Observations**

Examples of Questions

- **How is the rate of *Neurospora crassa's* linear growth affected by the absence of sucrose or Vogel's salts?**
- **Is alternative respiration induced and standard cytochrome chain inhibited through the knockout of the cytochrome c oxidase subunit Va gene in *N. crassa* mutant NCU06695.**

Student Progress Summary



Acknowledgements

- **Support Staff**

  Pat Bernard, Paul Bernard Tuan Tran, Blanca Moreno-Hernandez, Mike De Guia, & Richard Johnston.

- **Visiting Lecturers**

  Katherine Borkovich,

  Rowland Davis, Oded Yarden, Deb Bell-Pedersen, Barry Bowman, Matthew Sachs, Andrew Diener & Maryann Vogelsang

- **Broad Institute**

  Bruce Birren, Matthew Crawford, Matt Henn, Lisa Larson & Tom Walk

- **Funding Sources**

  Structure, Function, and Regulation of the Genome of a Filamentous Fungus (PO1):

  NIGMS

  STUDENT SUPPORT

  Bridge Program for Community Colleges: NIGMS

  IMDSD NIGMS

NGGSRI STUDENTS

Undergraduate research in the state capital:

Helping your state legislators understand and appreciate higher education

25^{th} Fungal Genetics conference

March, 2009

Patricia J. Pukkila, Ph.D.

Professor of Biology, and

Director, Office for Undergraduate Research

U. North Carolina-Chapel Hill

Outline

- History
- Benefits of system approach
- Tips
- Ideas to increase influence
- A PROBLEM
- Other initiatives at UNC-Chapel Hill

Research in the Capital

- Multi-campus undergraduate research symposium for the NC general assembly
- Held in 2001, 2003, 2005, 2007


FRI., MAR 20, 2009
Wisconsin State Journal
Temp: 25°
46 / 32
FULL FORECAST
SUBSCRIBE NOW
TEMPORAR
DELIVERY
STOP
FRONT PAGE
LOCAL
SPORTS
OPINION
COLUMNS
ENTERTAINMENT
BUSINESS
MULTIMEDIA
BLOGS
TOP STORIES
Nobel laureate moves to MIT
Har Gobind Khorana
Har Gobind Khorana
LATEST STATE NEWS
• All but 1 Wis. House member vote for AIG tax
• Wisconsin parmesan named big cheese
• 28-year-old bald eagle returns to the wild
• Federal judge in Madison announces retirement
• Wis. wins $7 million drug settlement
SPORTS
Photo gallery: Madison Memorial vs. Germantown (WIAA Division 1 state quarterfinals)
FRI., MAR 20, 2009 - 12:12AM
Junior guard Vander Blue poured in a career-high 35 points on Thurs., March 19, as Madison Memorial beat Germantown 86-73 in a WIAA
CHECK THIS OUT
2009 NCAA TOURNAMENT
NCAA TOURNEY
Interactive guide to the men's NCAA tournament

THEN

Research *in the* Capital

An undergraduate research symposium

for the NC General Assembly

April 12, 2005


Committees

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THE UNIVERSITY OF NORTH CAROLINA

A multi-campus university

Quick Links

1789

Undergraduate Research Consortium

- Activities
- Campus Web Sites
- Resources
- Representatives
- Background
- URC Home

Academic Affairs Homepage
UNC Homepage

Quick Search

Committees

Agenda Committee (through June 2009)
Daniel Okunbur, FSU
Margaret Kanipes, NCA&T
Pat Pukkila, UNC-CH
Kate Bruce, UNCW
Dave Butcher, WCU

The Agenda Committee determines the frequency and format of Consortium meetings, and compiles the agenda for each URC meeting. Each campus serves one term, on a 3-year rotation as follows:
2008 - 2009: FSU, NCA&T, UNC-CH, UNCW, WCU
2009 - 2010: ASU, ECU, NCCU, NCSA, UNCC, WSSU
2010 - 2011: ECSU, NCSU, UNCA, UNCG, UNCP

16/16 have campus liaisons; 13/16 have centralized programs, website links

Explorations

Page Tools

Explorations

The Journal of Undergraduate Research and Creative Activity for the State of North Carolina

- Current Issue
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- Explorations Staff
- Recommended Sites

Greetings!

"Tell me and I forget, show me and I remember, involve me and I understand." - Chinese Proverb

Welcome to Explorations, the Journal of Undergraduate Research and Creative Activities for the State of North Carolina. Here we celebrate the ingenuity, creativity and engaged learning being undertaken by undergraduates throughout the state.

Originating as a companion to the State of North Carolina Undergraduate Research and Creative Activities Symposium, Explorations offers the opportunity for undergraduates at any 2- or 4-year college or university across the state to be published in a peer-reviewed journal and showcase their exciting work.

We encourage you to explore our site and see how involved undergraduates are moving from knowledge to understanding.

Deadline for Submissions: May 1, 2009 (intent) June 1, 2009 (final) SUBMIT TO BRUCE@UNCW.EDU

Request for Proposals
Issued April 21, 2006

www.northcarolina.edu/RDI.htm

Undergraduate Research Opportunity Expansion Initiative

Expanding access to undergraduate research opportunities at all UNC campuses, particularly for under-represented students

Funded by President Erskine Bowles, under the UNC Research Development Initiative

2008: part of Research Competitiveness request/ GA funding

Proposal Deadlines:

Undergraduate Stipends (for Summer 2006)		**May 8**
Graduate Student Funding –	**Letter of Intent**	**May 8**
	Full Proposal	**June 15**

UNC General Administration
Research and Sponsored Programs
910 Raleigh Road
Chapel Hill, NC 27514

Point of Contact:
Jennifer Klimas
Research Director
(919) 962-2676
jklimas@northcarolina.edu

Tips

- Purpose (*importance of research in education; benefits to NC*)
- Preparation (*see Blockus & Renoe; "One-minute WOW"; enthusiasm + gratitude; clarity + relevance; what was known →what has changed; peer instruction*)
- Publicity (*letters and Email, introduction in chambers by legislative hosts, office visits*)
- Publication (*abstract books; Websites; CURQ*)
- Persistence (*2001, 2003, 2005, 2007, 2011?...*)

Increasing legislative participation

- Involve state relations in planning several months in advance
- Campus visits to introduce students and legislators in a less formal setting

Undergraduate research symposia in state legislatures (*is your state on this list* ?)

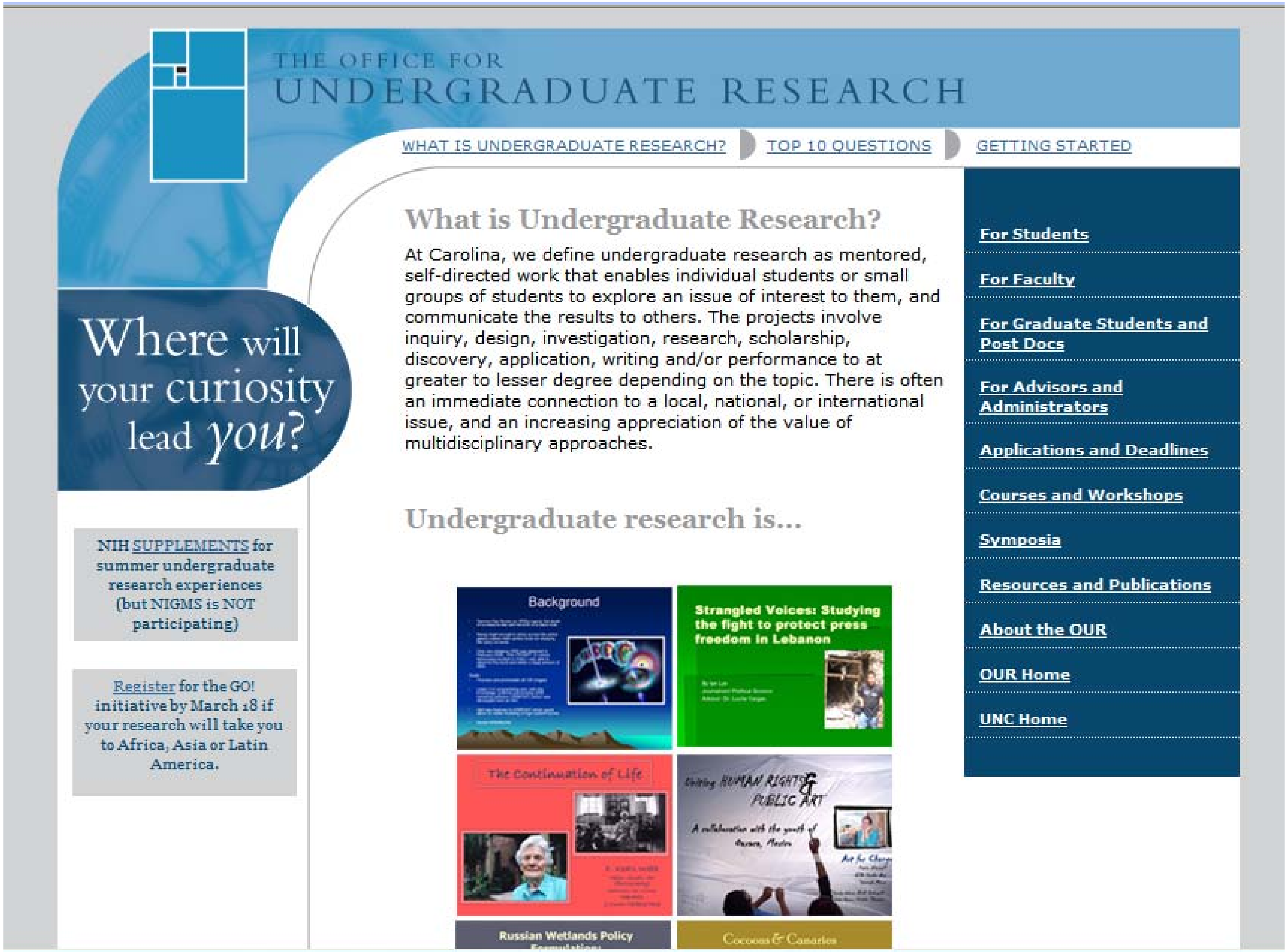
- California
- Georgia
- Kentucky
- Michigan
- Minnesota
- Missouri
- North Carolina
- Oklahoma
- South Carolina*
- South Dakota
- Utah
- Washington
- Wisconsin

**Planning stages*

THE PROBLEM:

Due to the uniquely challenging economic climate of this spring, the 2009 Research in the Capital Symposium was canceled. The UNC Undergraduate Research Consortium plans to continue this event in the future, when appropriate.

http://www.northcarolina.edu/research/campus/undergrad/Activities/Research_in_the_Capital.htm



www.unc.edu/depts/our

Carolina Research Scholar program

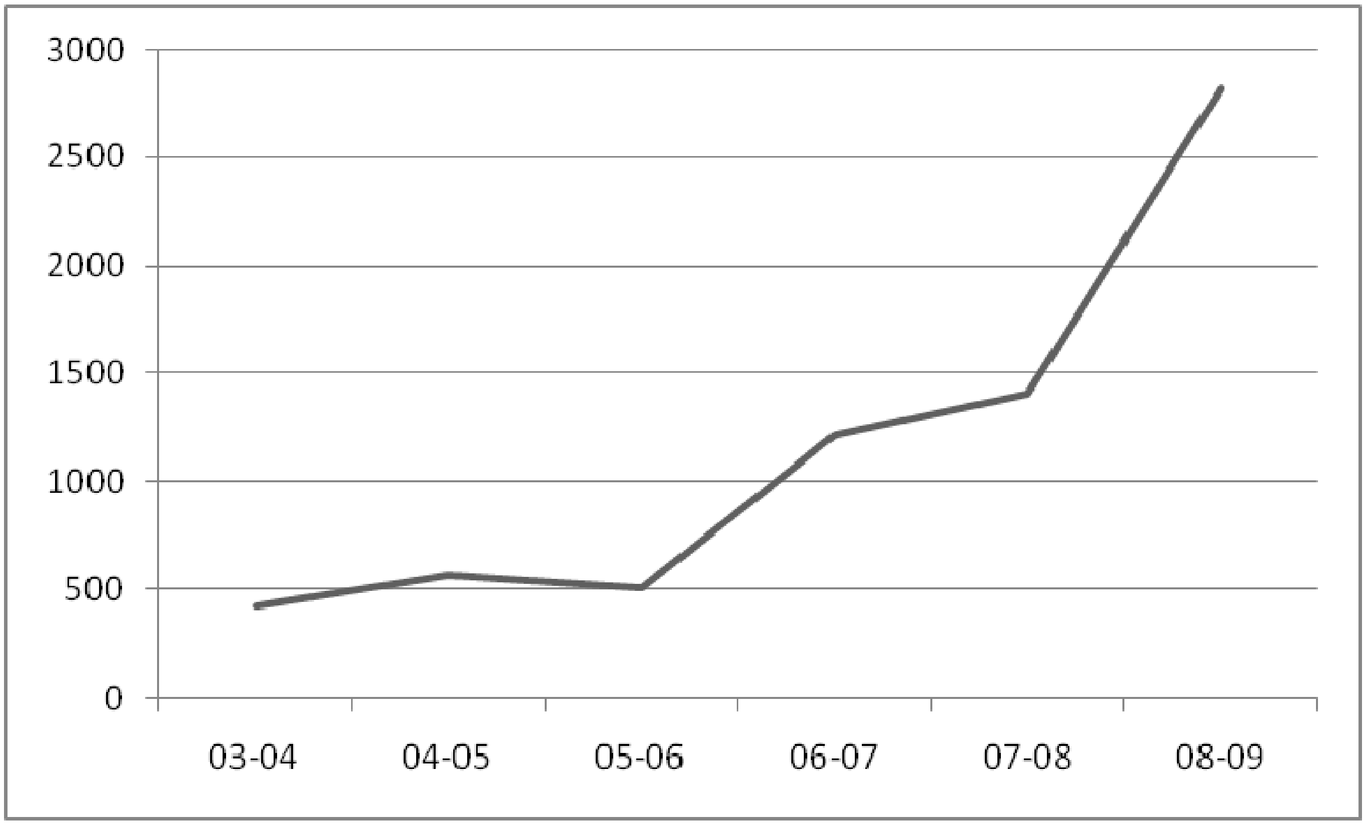
- Introductory “Modes of Inquiry” seminar
- Research-intensive courses (6 credits)
- Presentation of research conclusions at campus symposium or professional meeting

Transcript designation appears when distinction is earned

Graduate Research Consultant program

- Faculty apply for funds to support a Graduate Research Consultant (GRC) to transform a “course project” into a research project
- Undergrads work with “GRCs” who are paid for 30 hours/semester
- Research design, methods, communication
- Class time must be devoted to the products of student inquiry
- GRCs coach and do not grade

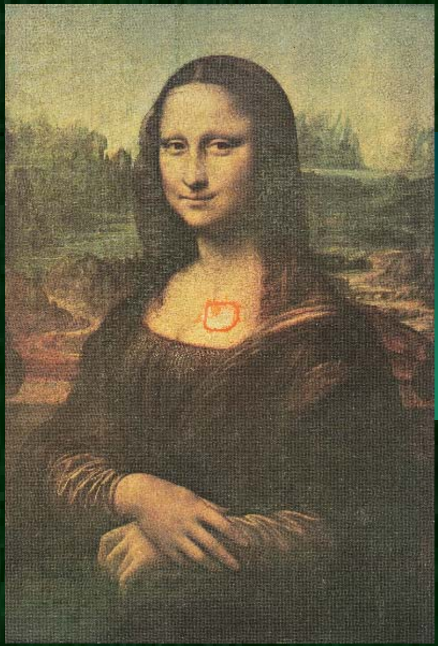
Student enrollment in GRC courses 2003-2009



217 courses - 108 faculty - 31 departments - 238 grads - 6,924 undergrads

Plant Pathology vs. Medical Mycology

Battle of the Fungi



25th Jungle Phonetics Conference
Asilomar, California
March 20, 2009

Tom Volk
Dept. of Biology
University of Wisconsin-La Crosse
TomVolkFungi.net

University of Wisconsin-La Crosse

- On the Mississippi River in western Wisconsin
- About 8500 students
- About 1200 Biology and Microbiology majors

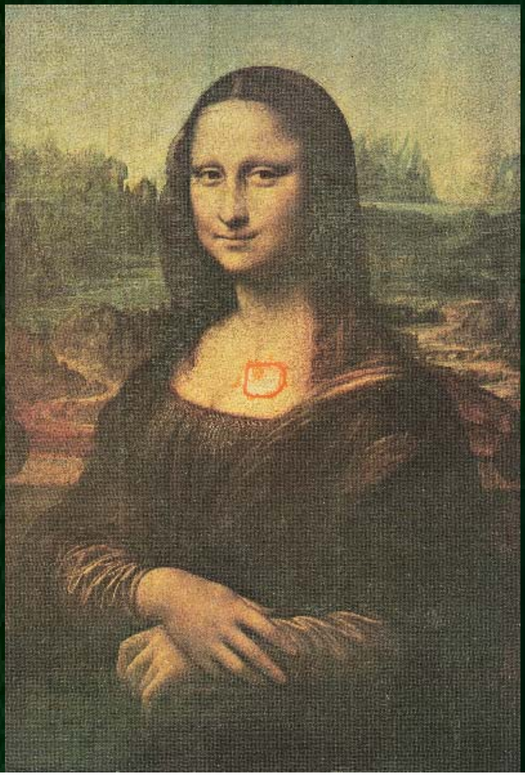
I teach courses in Mycology, Medical Mycology, Plant-Microbe Interactions, Advanced Mycology, Food & Industrial Mycology, Plant Biology, Organismal Biology, and Latin & Greek for Scientists

Are plant pathology and medical mycology really so different from one another?

Fungi cause many more plant diseases than animal diseases

- ~70% of plant diseases caused by fungi.

- Perhaps 5% of diagnosed human disease caused by fungi.



Economic impact

- Fungi cause several trillion US$ damage each year throughout the world in destruction and lost yield, and cost of fungicides.
- Economic impact of fungi on animal hosts is probably “only” in the billions US$.
- link

Bad fungal effects on humans

- an tissue
- eating the
  ngus itself (e.g.
- ating the fungus,
  oom poisoning)
- immune system

Obvious host differences

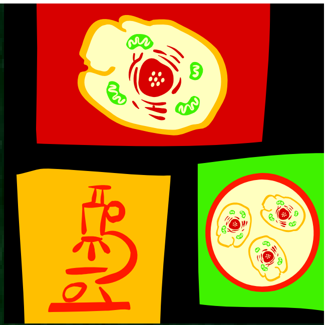
PLANTS

- Cell walls
- Autotrophic
- Non- motile
- Vascular system– xylem and phloem

ANIMALS

- No cell walls
- Heterotrophic
- Motile
- Vascular system– arteries, veins, heart, etc.

Cell wall and membrane vs. just cell membrane



- Intuitively, it would seem that fungi would have an easier time getting into a cell without a cell wall and waxy cuticle.

- Many holes in plants– stomata . All over.
- Few major holes
  - Secondary growth
  - Lateral roots

Mike Clayton

- Human skin is fairly intact
- Only large orifices for fungi to enter
  - Mouth and nose
  - Genital areas

Host subcellular defenses

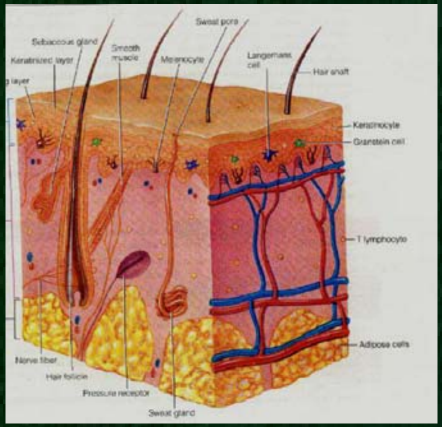
PLANTS

- Apoptosis
- Hormonal response
  - Ethylene
  - Abscissic acid

- Plants can afford to lose leaves, branches or other large organs--indeterminate growth

ANIMALS

- Skin
- Mucous
- Tears
- Hairs



- Mammals cannot afford to lose most body parts--determinate growth

Environment inside the body

- Plants are essentially at environmental temperature
- Low redox potential

- Mammals have constant elevated temperature
- Most fungi cannot survive at 37°C
- Redox potential is high– most fungi cannot survive

Disease triangle

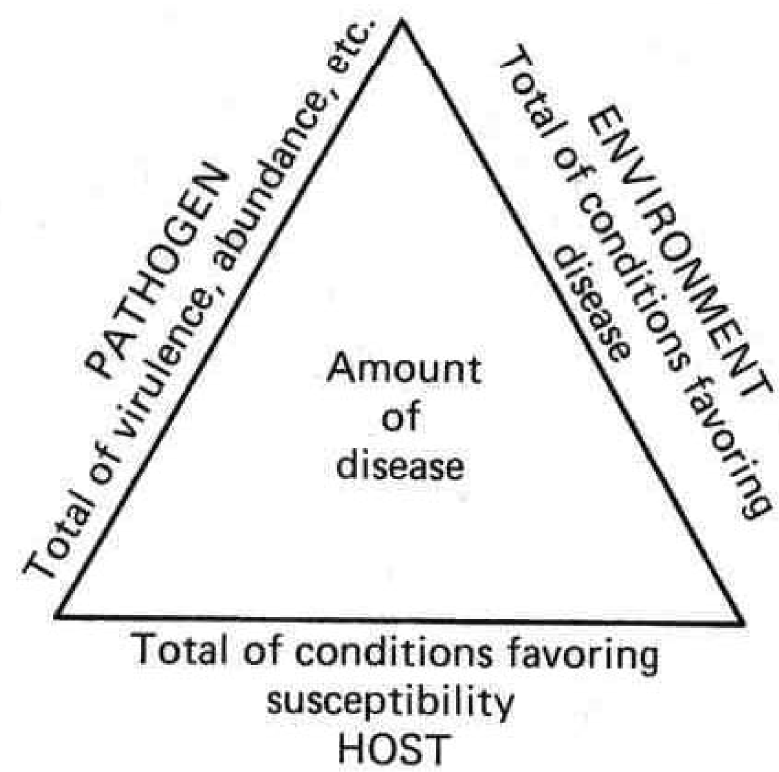
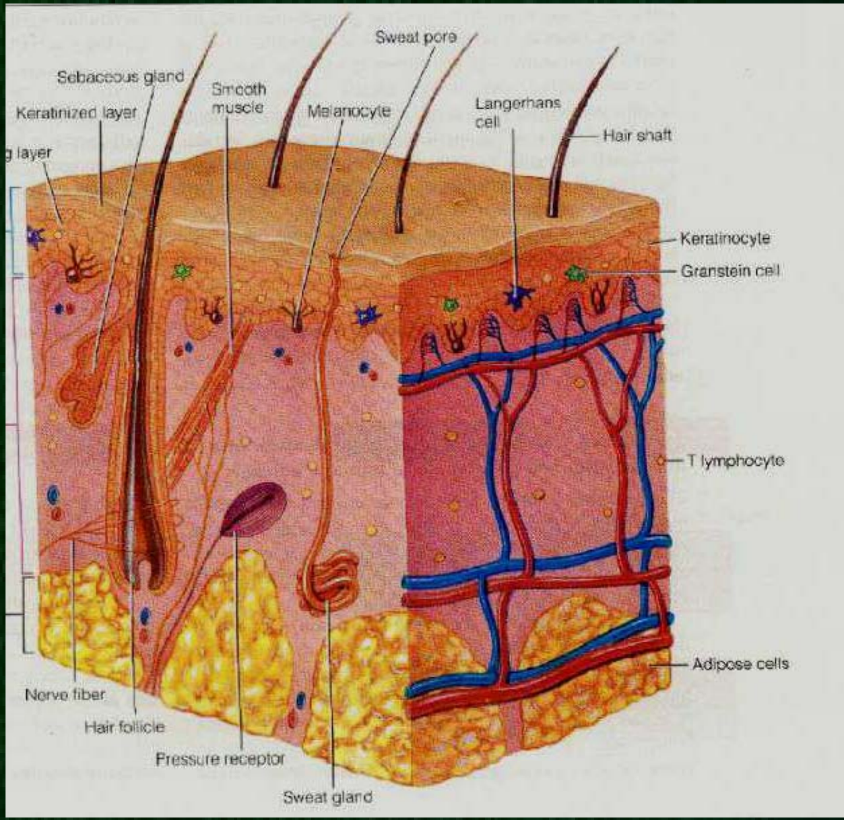


FIGURE 2-1 The disease triangle.

Agrios, 2003

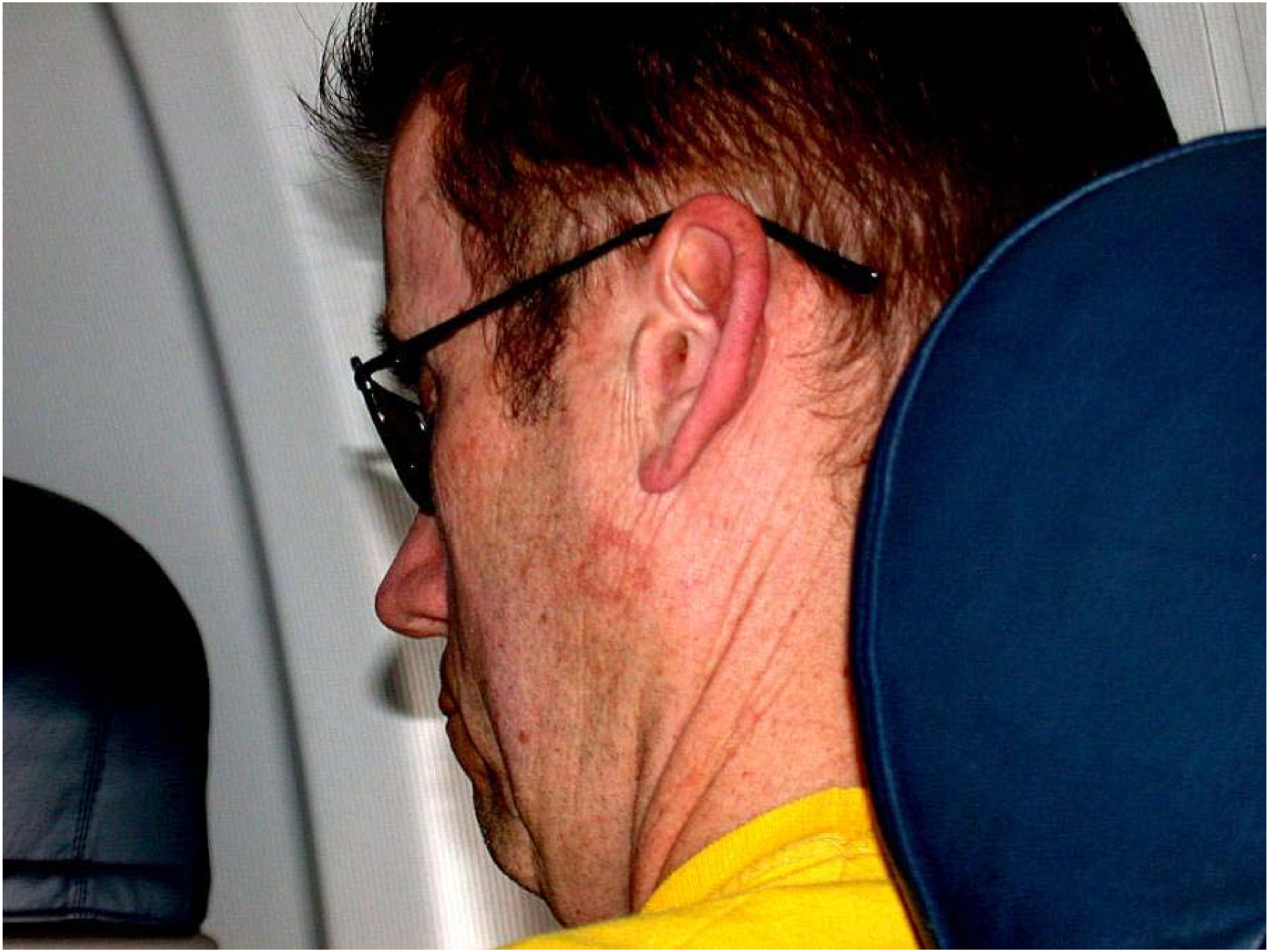
- Rarely discussed in medical mycology directly, especially environment

- About 175 human pathogens are recognized among the ~ 73,000 described species of fungi.
- **Superficial infections--** About 10 species
- **Cutaneous infections--** About 20 species (dermatophytes / yeasts)
- **Subcutaneous localized disease--**. A dozen species are associated
- **Systemic (deep)--** About 20 species may cause infections starting in the lungs
    - **Opportunistic pathogens--** In addition there are many that cause disease in debilitated or immunosuppressed patients.
    - Stressed host



Plant pathogens have mostly the same categories of infections

- Foliar and fruit– cuticle/ epidermis diseases
- Foliar– powdery mildews, tar spots
- Subepidermal diseases– some require traumatic implantation
- Systemic diseases– travel through vascular system

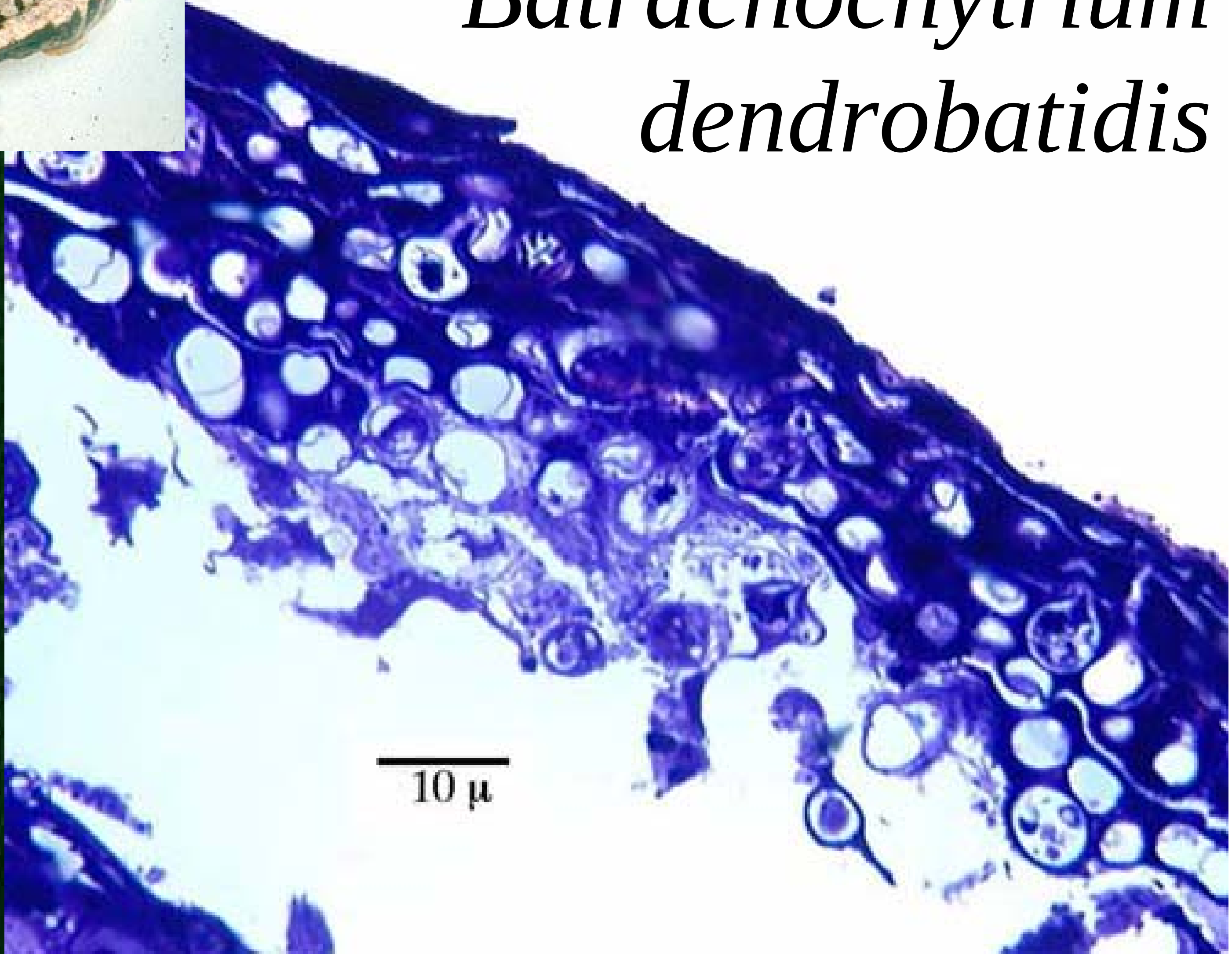


Cuticular, epidermal

Pathology may be similar

Synchytrium endobioticum, black wart of potato http://www.vet.uga.edu/ivcvm/2000/Daszak/Daszak.htm

Frog chytrid- *Batrachochytrium dendrobatidis*



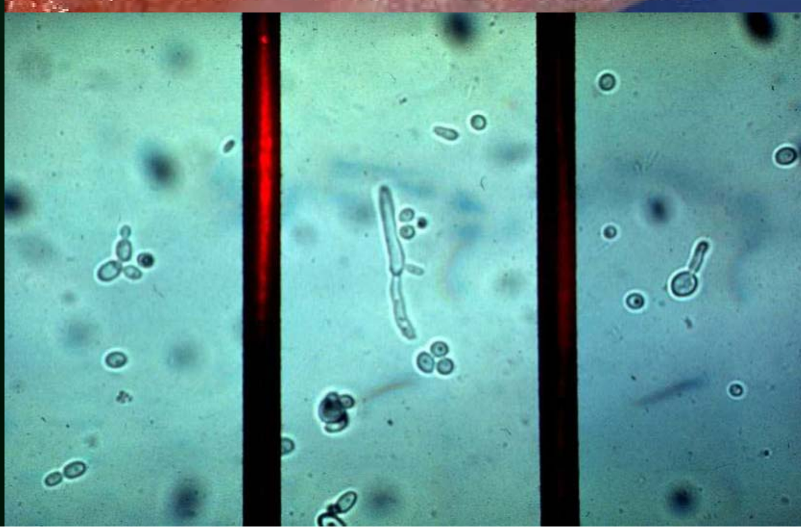
- **Subcutaneous mycoses**—chronic localized infections of the skin and subcutaneous tissues following traumatic implantation of the fungus

Traumatically implanted fungi

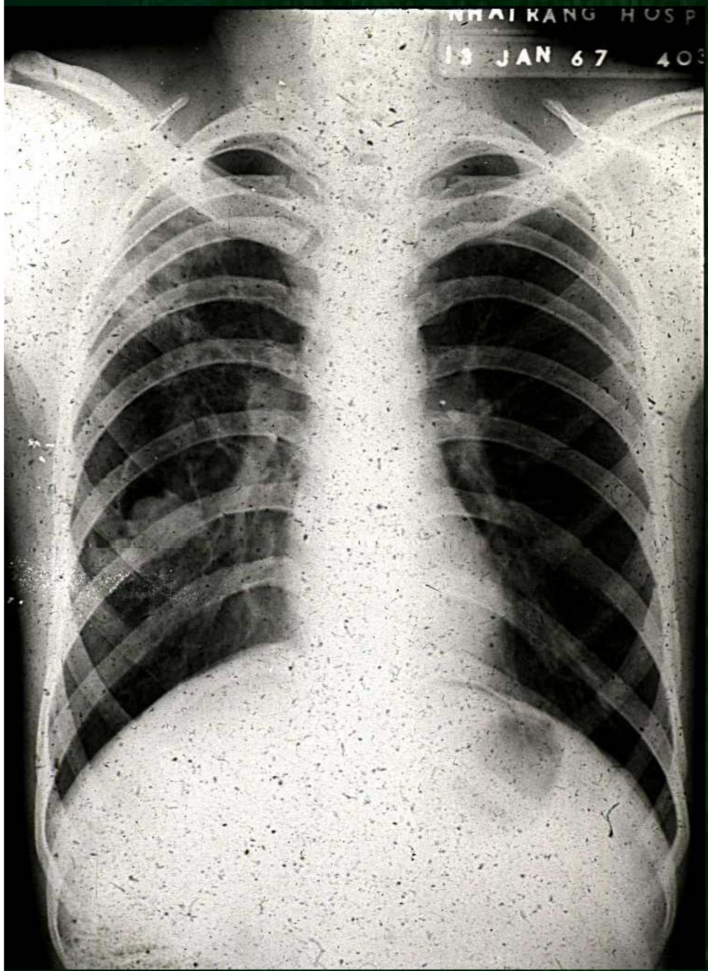
Deep Mycoses-- opportunists

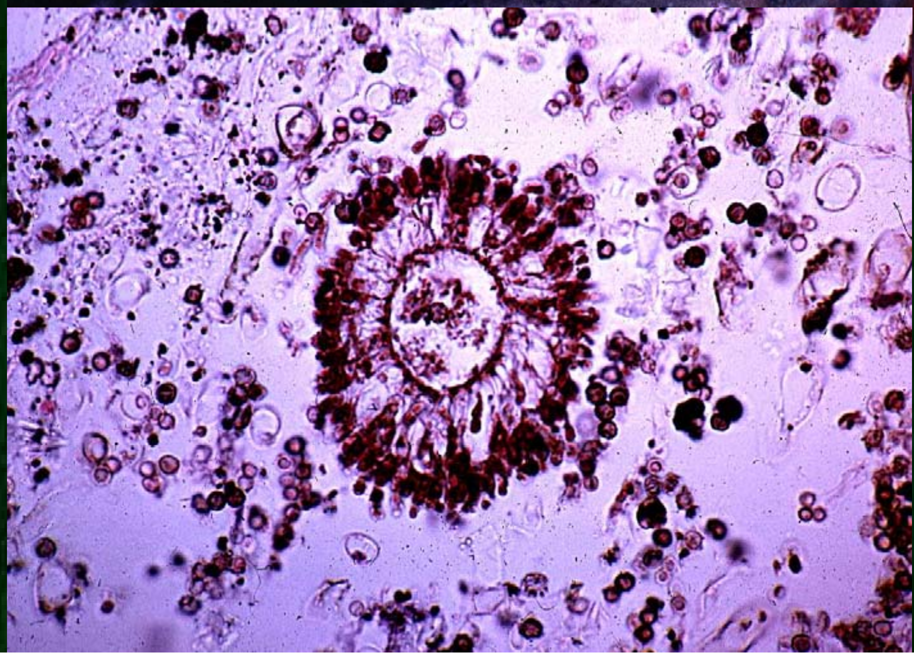
- Require some sort of break in the host defenses to cause disease
- Does not have to enter through the lungs
- Most fungal diseases are a result of the cytotoxin, corticosteroid, immunosuppressed age

Candidiasis-- *Candida*, usually *C. albicans*



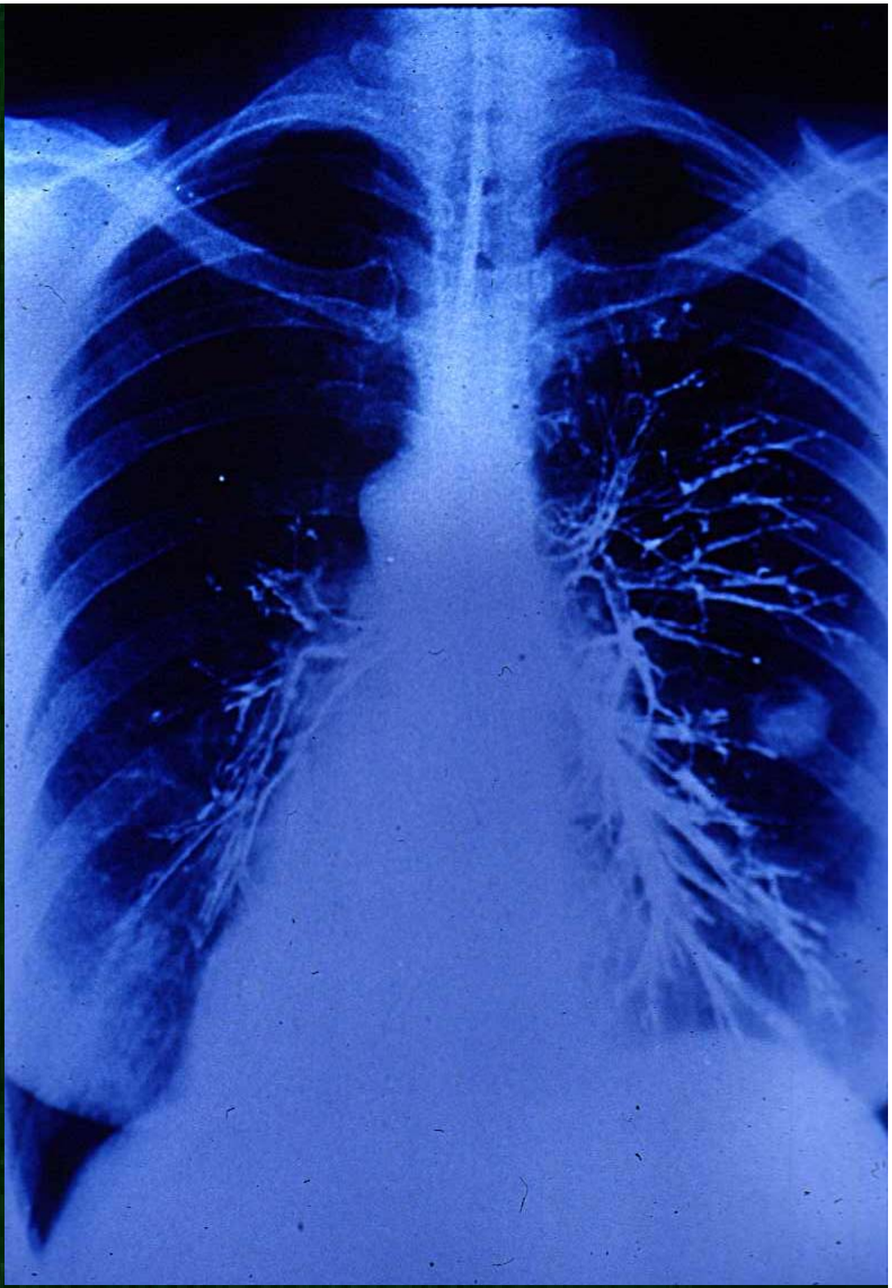
Aspergillosis-- *Aspergillus*, esp. *A. fumigatus*





Deep mycoses true pathogens

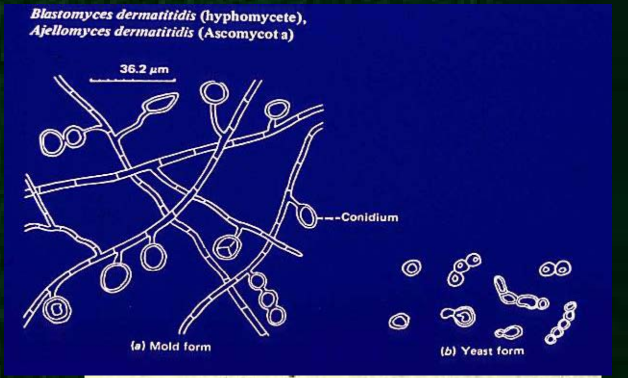
- Almost always start as lung infections
- True pathogens can overcome the physiological and cellular defenses of the normal human host by changing their morphological form.



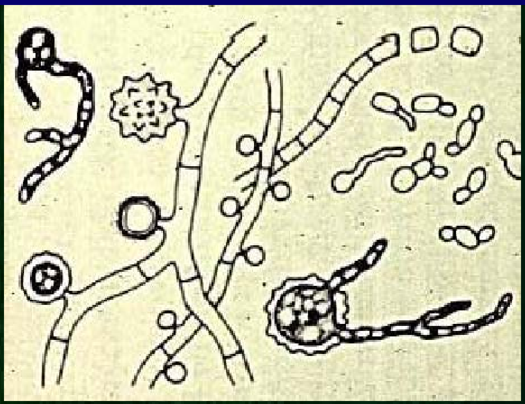
Four truly pathogenic fungi

- All are dimorphic, changing form in the body to evade the immune system

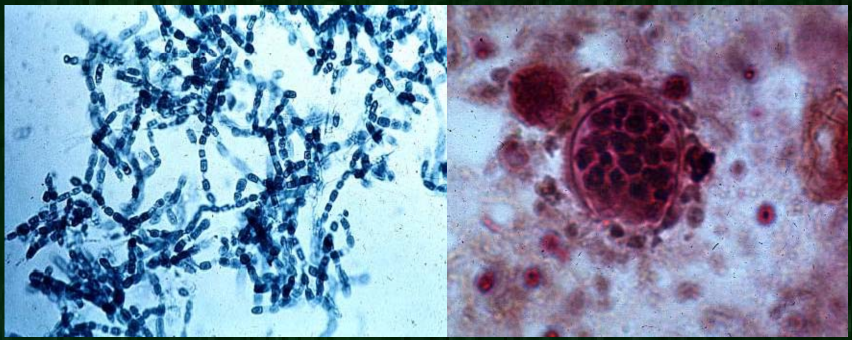
Blastomyces dermatitidis

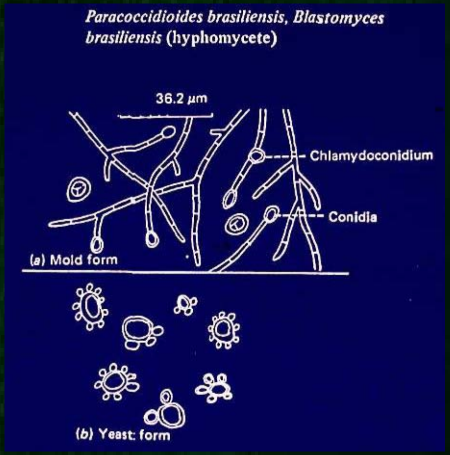


Histoplasma capsulatum



Coccidioides immitis, C. posadasii



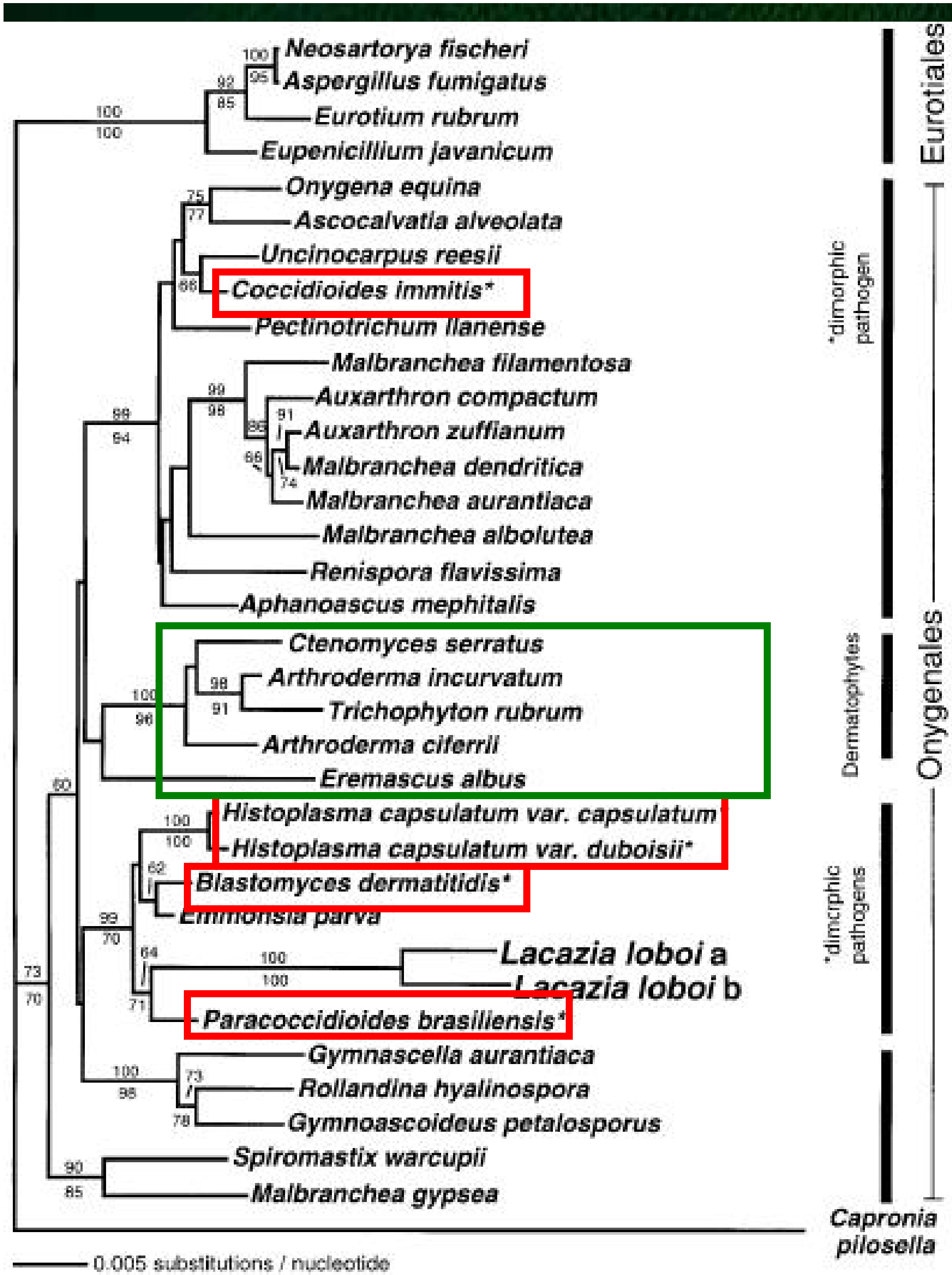


Paracoccidioides brasiliensis

Classification of pathogens

- Most plant pathogens are Ascomycota, found in almost every order, plus rusts and smuts
- Many Basidiomycota are forest pathogens

- Most human pathogens are classified in the Onygenales, a sister group to the Eurotiales (e.g. *Penicillium*, *Aspergillus*)



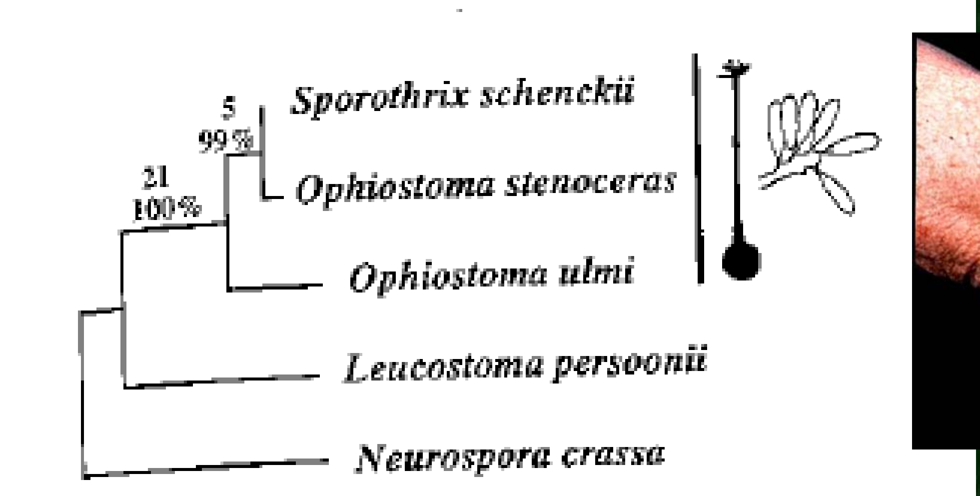
- Phylogenetic analysis of *Lacazia loboi* places this previously uncharacterized pathogen within the dimorphic Onygenales
- Roger A. Herr, Eric J. Tarcha, Paulo R. Taborda, John W. Taylor, Libero Ajello and Leonel Mendoza
- *Journal of Clinical Microbiology*
  January 2001
  39(1): 309-314
- Some exceptions

See FotM

Sporotrichosis

Commonly known as **rose-picker's disease**

- Caused by *Sporothrix schenckii*, a thermal dimorphic pathogen

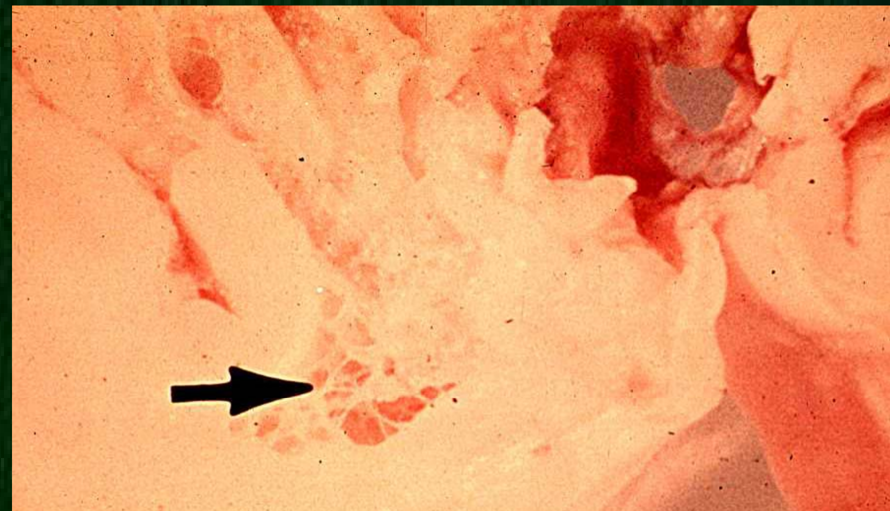


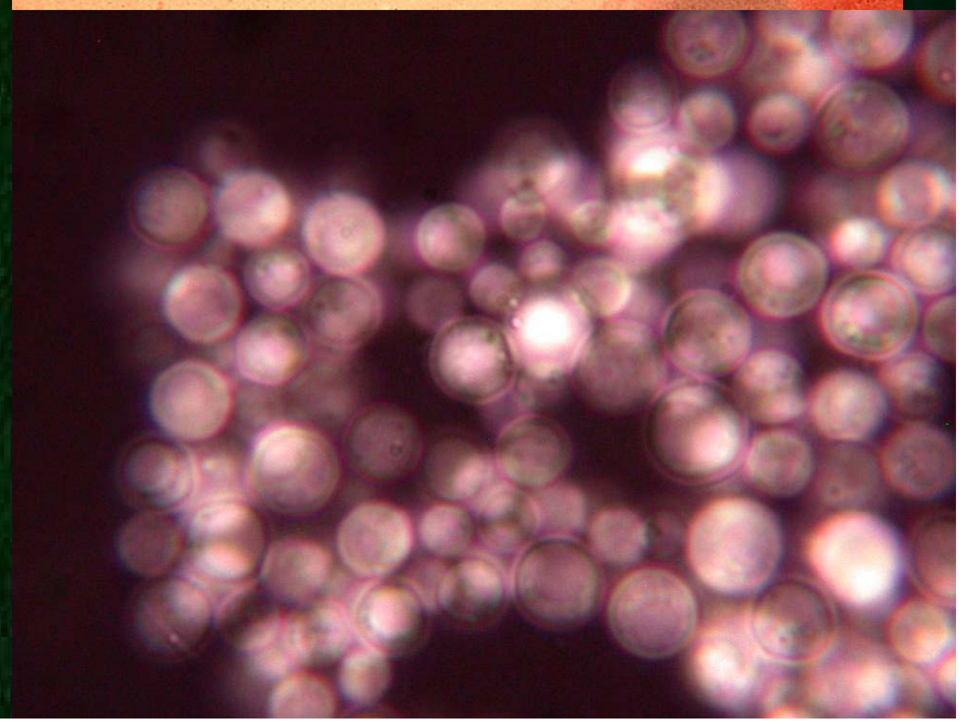
Berbee, M.L. and J.W. Taylor. 1992


WELL, YOU'RE OVER YOUR ORIGINAL VIRUS, BUT IT LOOKS AS IF YOU CAUGHT DUTCH ELM DISEASE FROM THE TONGUE DEPRESSOR!
8-31
Tom Wilson

Cryptococcosis--- *Cryptococcus neoformans*

MRI scan showing multiple cryptococcomas [white masses] in the brain (Geraldine Kaminsky)





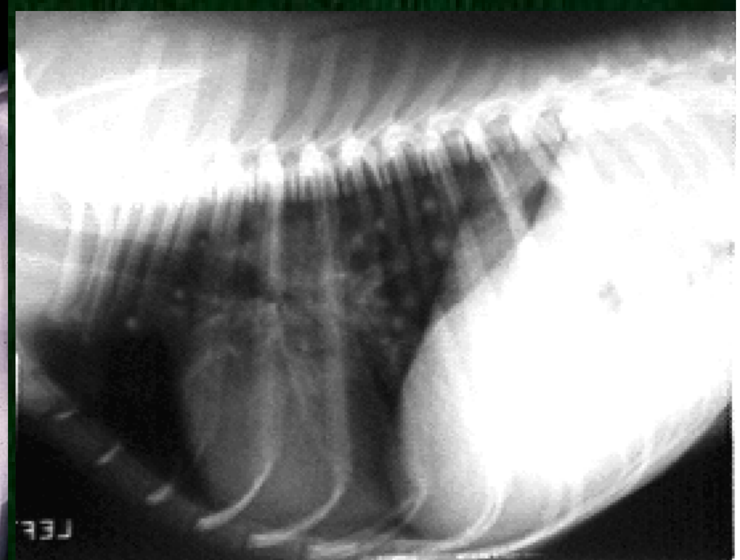
Basidiospores of *Cryptococcus neoformans* var. *neoformans* following mating of two compatible strains (June Kwon-Chung)

Systemic plant pathogens

Specificity

- Most fungal plant diseases are specific for certain host species
- Almost all fungal human diseases also affect other mammals

Dutch elm disease



Blastomycosis in humans and dogs

Contagion

- Plant diseases mostly contagious, i.e. one infected plant can infect more plants of the same species

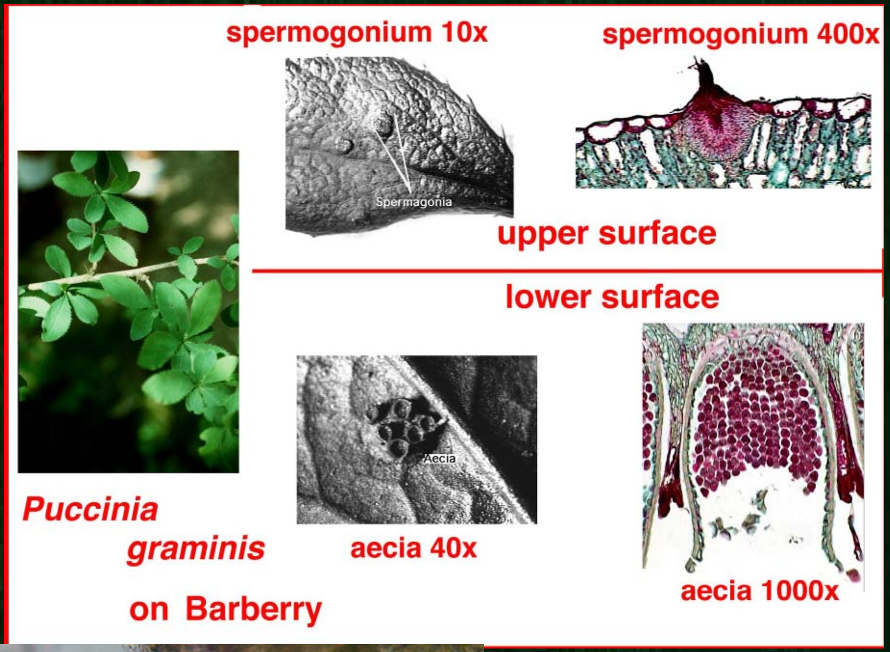
- Human diseases mostly not contagious
- Some cutaneous diseases like athlete's foot and ringworm are anthropophilic

Obligate vs. facultative parasites

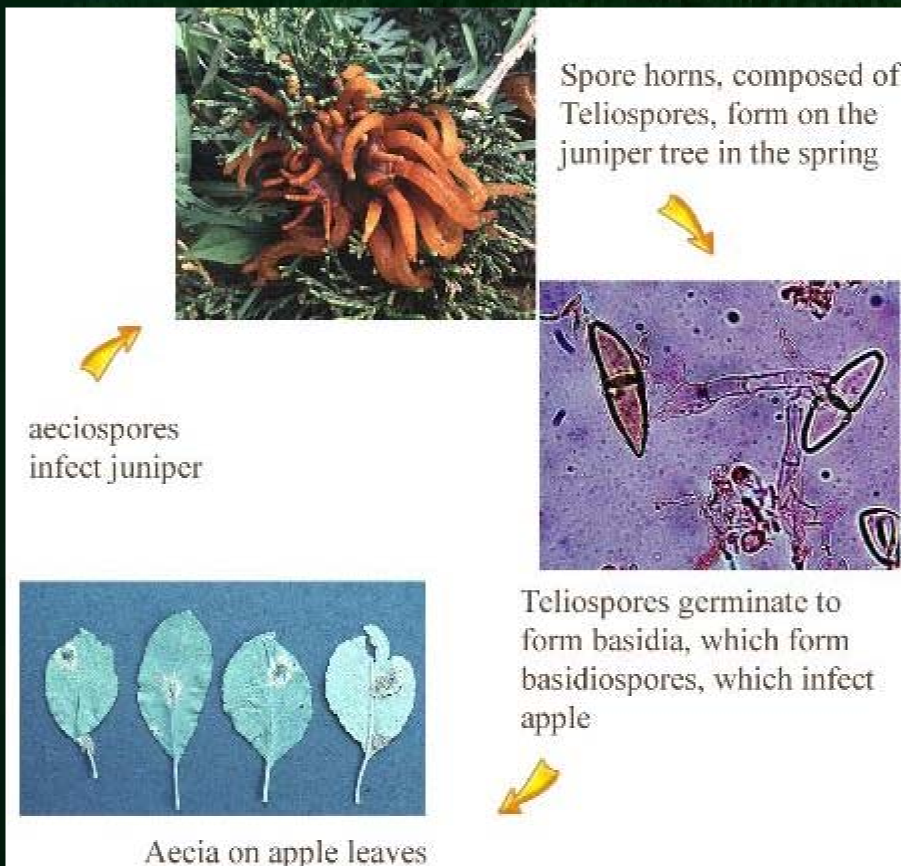
- Many plant pathogens are obligate parasites

- No obligate human pathogens– although some are anthropophilic

Many plant pathogens are obligate parasites



Moreover, many fungi need plants to complete their life cycles



- Humans are a dead end for almost all fungal infections

Pathogens vs. mutualists

- Most plants have mutualistic associations with many fungi
- No fungi are known to be human mutualists

Antifungals

PLANTS

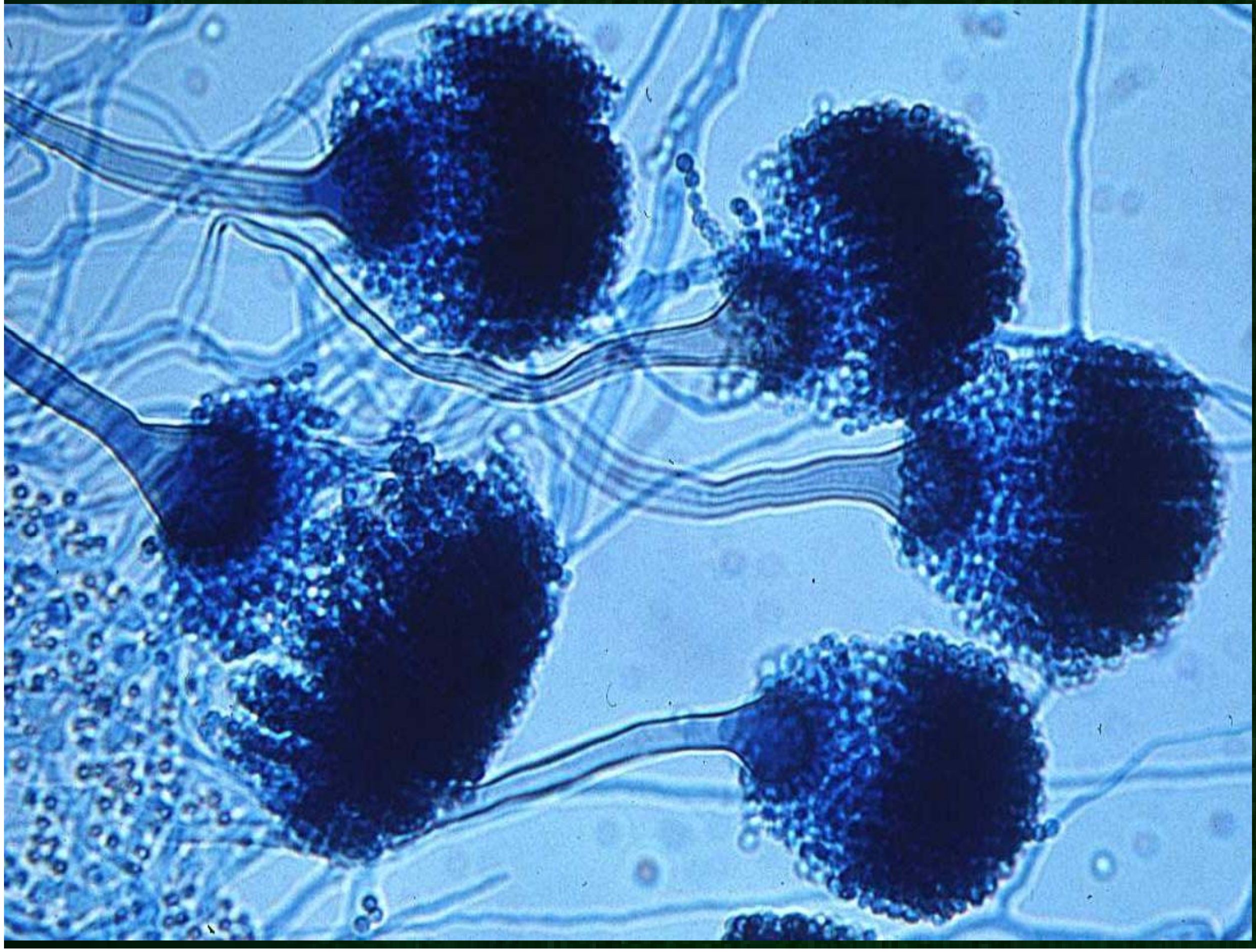
- Most fungicides used to treat plants are toxic to humans
- Topical
  - Useful for mild or superficial infections
- Systemic
  - Allows fungicide to be delivered to all portions of plant

ANIMALS

- Need to control host toxicity. Problem if patient dies.
- Topical
  - Useful for mild or superficial infections
- Systemic
  - Effectiveness is variable due to delivery problems

Direct relationship between plant pathology and medical mycology

- Mycotoxins– plant pathogens
- Plants are harmed

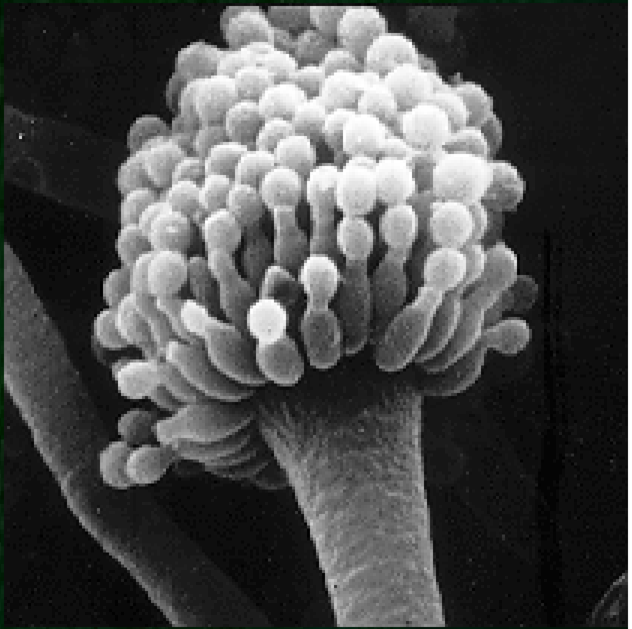


- Animals can become ill, get cancer, or die from eating food contaminated with mycotoxins

Aspergillus Toxins

- Turkey X disease
  - England in 1961, 100,000 turkeys died from an unknown cause
  - All had liver necrosis, bile duct hyperplasia, loss of appetite, wing weakness, and lethargy
  - Other poultry were also affected

www.ansci.cornell.edu/plants/ toxicagents/aflatoxin/11.jpg



www.niaid.nih.gov/dir/labs/ LCI/aspergillus.gif

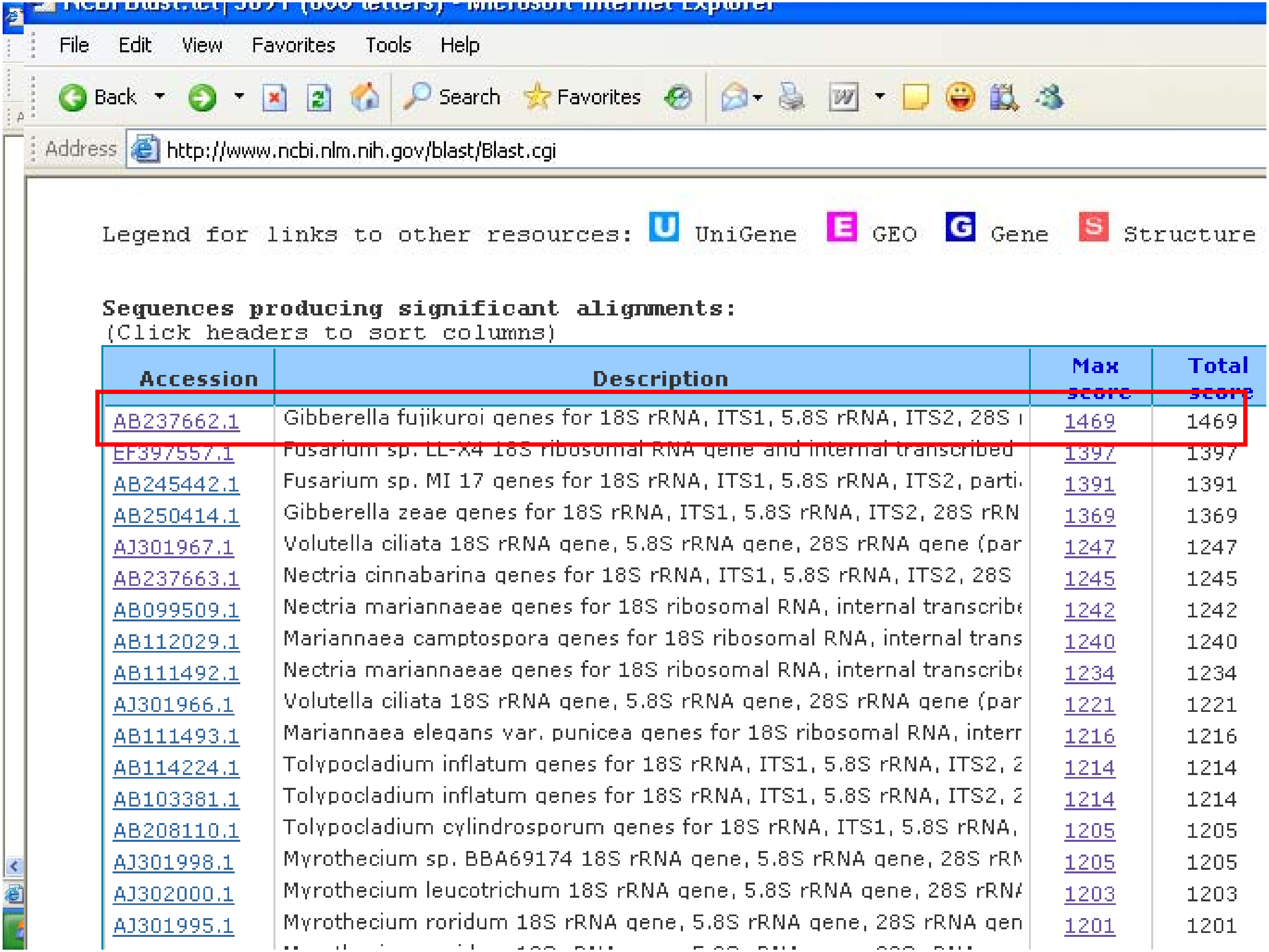
Ergotism

Claviceps
on rye

Trichothecenes from *Fusarium* / *Gibberella*

www.ent.iastate.edu

My foot

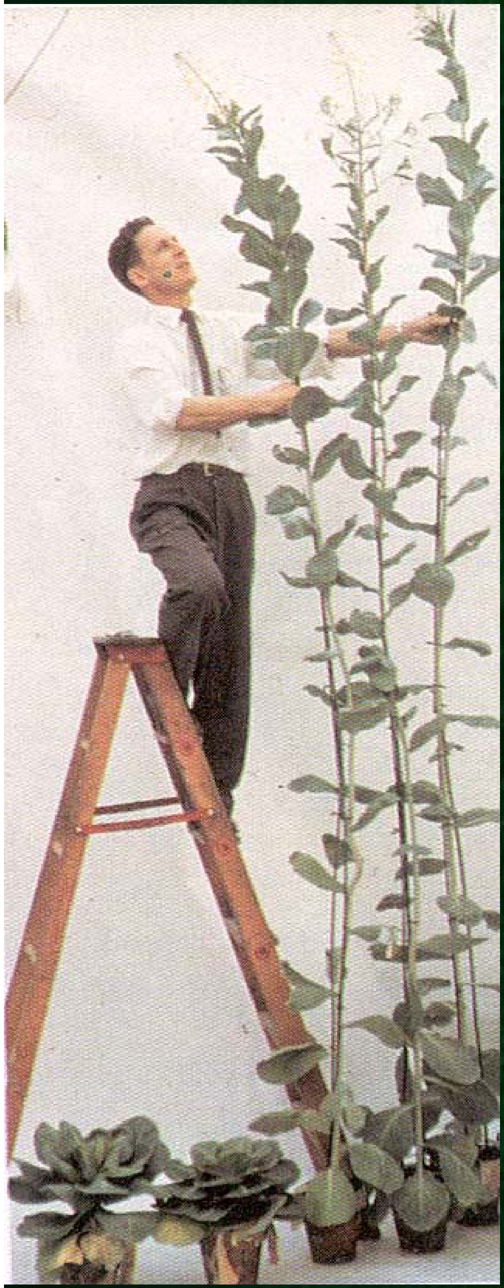


Legend for links to other resources: U UniGene E GEO G Gene S Structure

Sequences producing significant alignments:
(Click headers to sort columns)

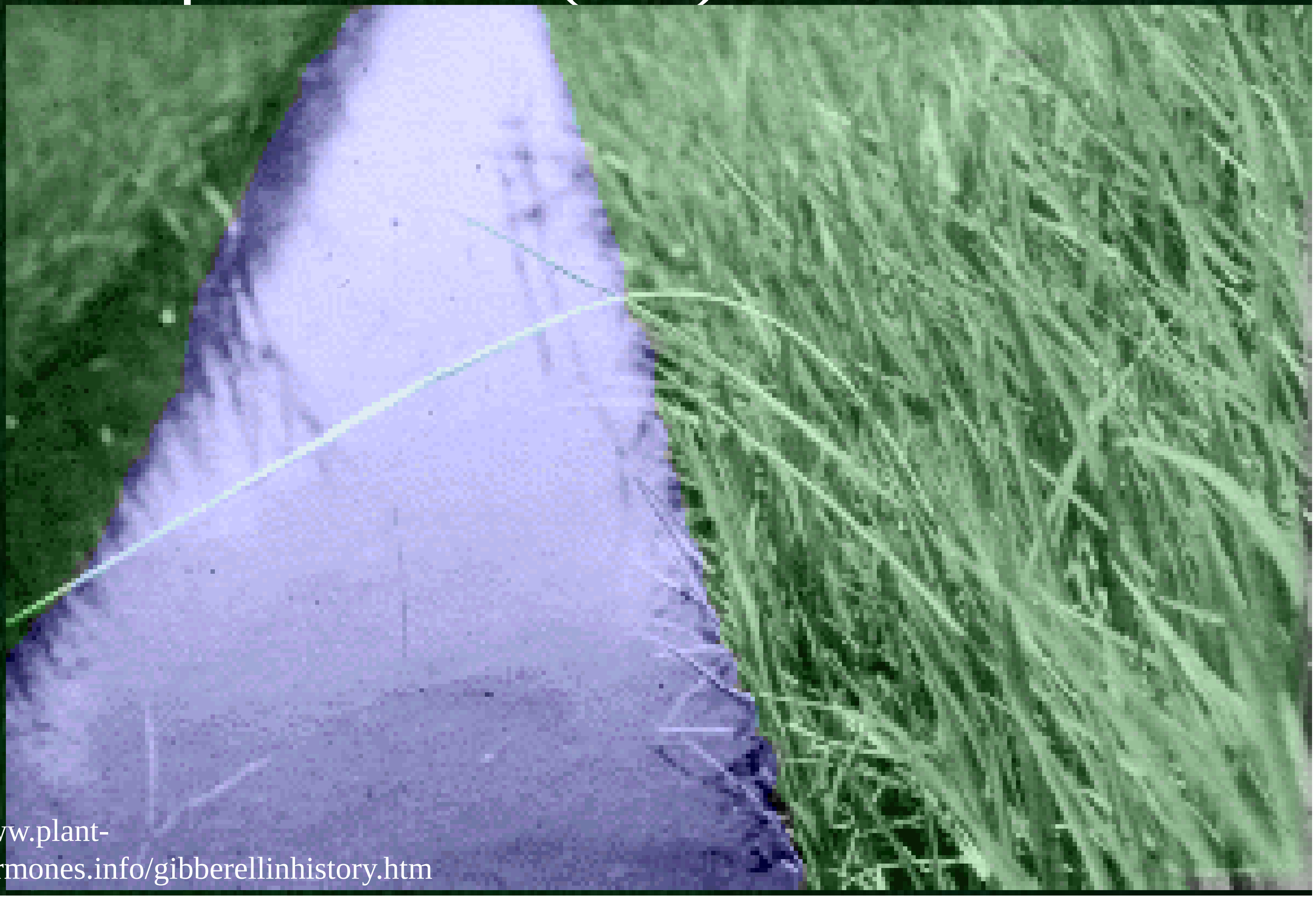
Accession	Description	Max score	Total score
AB237662.1	Gibberella fujikuroi genes for 18S rRNA, ITS1, 5.8S rRNA, ITS2, 28S r	1469	1469
EF397557.1	Fusarium sp. LL-X4 18S ribosomal RNA gene and internal transcribed	1397	1397
AB245442.1	Fusarium sp. MI 17 genes for 18S rRNA, ITS1, 5.8S rRNA, ITS2, parti	1391	1391
AB250414.1	Gibberella zeae genes for 18S rRNA, ITS1, 5.8S rRNA, ITS2, 28S rRN	1369	1369
AJ301967.1	Volutella ciliata 18S rRNA gene, 5.8S rRNA gene, 28S rRNA gene (par	1247	1247
AB237663.1	Nectria cinnabarina genes for 18S rRNA, ITS1, 5.8S rRNA, ITS2, 28S	1245	1245
AB099509.1	Nectria mariannaeae genes for 18S ribosomal RNA, internal transcribe	1242	1242
AB112029.1	Mariannaea camptospora genes for 18S ribosomal RNA, internal trans	1240	1240
AB111492.1	Nectria mariannaeae genes for 18S ribosomal RNA, internal transcribe	1234	1234
AJ301966.1	Volutella ciliata 18S rRNA gene, 5.8S rRNA gene, 28S rRNA gene (par	1221	1221
AB111493.1	Mariannaea elegans var. punicea genes for 18S ribosomal RNA, interr	1216	1216
AB114224.1	Tolypocladium inflatum genes for 18S rRNA, ITS1, 5.8S rRNA, ITS2, 2	1214	1214
AB103381.1	Tolypocladium inflatum genes for 18S rRNA, ITS1, 5.8S rRNA, ITS2, 2	1214	1214
AB208110.1	Tolypocladium cylindrosporum genes for 18S rRNA, ITS1, 5.8S rRNA,	1205	1205
AJ301998.1	Myrothecium sp. BBA69174 18S rRNA gene, 5.8S rRNA gene, 28S rRN	1205	1205
AJ302000.1	Myrothecium leucotrichum 18S rRNA gene, 5.8S rRNA gene, 28S rRN	1203	1203
AJ301995.1	Myrothecium roridum 18S rRNA gene, 5.8S rRNA gene, 28S rRNA gen	1201	1201

Gibberella fujikuroi



www.school.net.th/

- Score = 1469 bits (795), Expect = 0.0 Identities = 797/798 (99%), Gaps = 0/798 (0%)



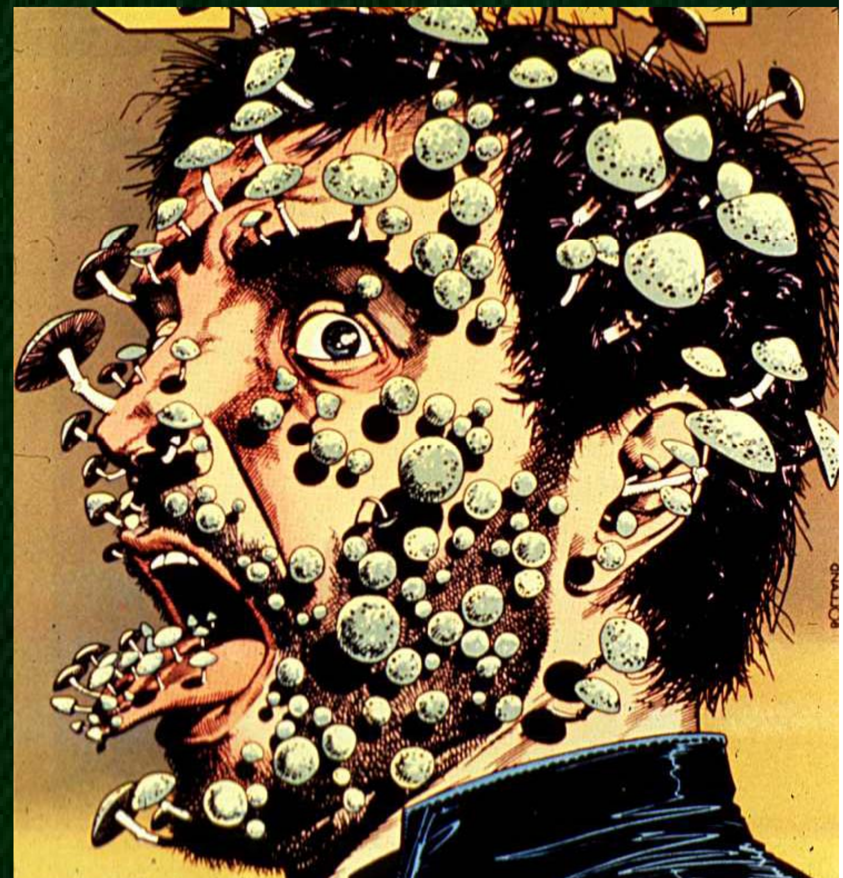
www.plant-hormones.info/gibberellinhistory.htm

Human diseases are "more gross"

Corn smut

Chromoblastomycosis

Who wins?



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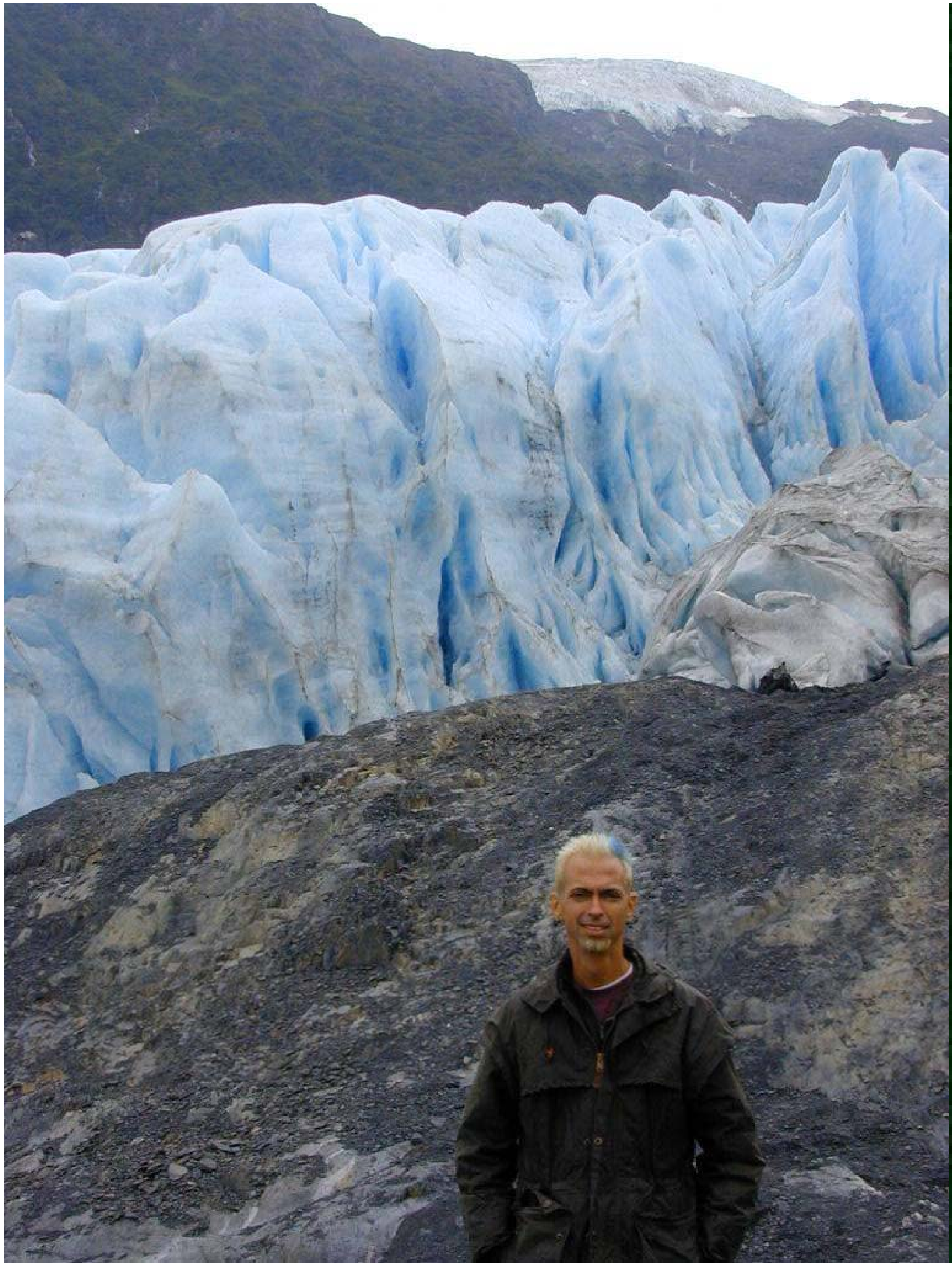
- Thanks to Pietro Spanu and Pat Pukkila for inviting me to speak.
- John Rippon for uncredited medical mycology pictures
- Becky Curland

  and Beth Jarvis



Be sure to visit
TomVolkFungi.net