Asilomar Fungal Genetics Meeting 2007
Teaching Fungal Biology and Genetics 3-6 pm, Wed. March 21, 2007
Amy J. Reese and Patricia Pukkila, session co-chairs

Schedule proposal

3:00 – 3:10 Amy J. Reese and Patricia Pukkila, ***Introduction to session***

3:10 – 3:30 Thomas Volk, University of Wisconsin- La Crosse, ***The internet and its ability to lure people into learning something about fungi they didn't know they wanted to know***

3:30 – 3:50 Maria Costanzo, Saccharomyces Genome Database, ***Fungal gene and protein information at the Saccharomyces and Candida Genome Databases***

3:50 – 4:35 Amy J. Reese, Cedar Crest College, ***Fungal genetics and biology round table discussion: best practices and trouble spots***

4:35 – 4:55 Coffee break

4:55 – 5:15 Steven James, Gettysburg College, ***Deleting Aspergillus nidulans checkpoint regulators in an undergraduate molecular genetics course***

5:15 – 5:35 Sarah Lea Mcguire, Millsaps College, ***Teaching with fungi: from college freshmen to seniors***

5:35 – 5:55 Patricia Pukkila, The University of North Carolina at Chapel Hill, ***Bringing student inquiry and research into your courses by collaborating with graduate research consultants or advanced undergraduates***

5:55 – 6:00 Patricia Pukkila, ***Wrap-up to session***

Concurrent Session: Teaching Fungal Biology & Genetics

- If you are interested in receiving notes from this session, please fill out the sign-in form.

Academic roles represented

- Do your roles include:
  - Mostly research
  - Research & teaching
  - Mostly teaching
  - Graduate student / post-doc
  - Patient care
  - Administration
  - Other

Institution types represented

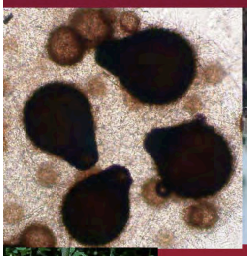
- Would you consider your school to be:
  - Mostly a research university / medical school?
  - A balance between research & teaching?
  - Mostly a teaching college or university?
  - A community or technical college?
  - Non-academic?
  - Other?

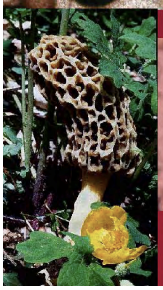
Level of fungal topics taught

- Fungal biology/genetics topics covered:
  - At the medical school level
  - At the graduate level
  - Upper undergraduate level
  - General microbiology course
  - Introductory biology course
  - Other

Luring people into learning about Mycology using the internet*

**Even though they didn't know they wanted to learn anything at all*





24th Fungal Genetics Conference
Asilomar, CA
March 21, 2007

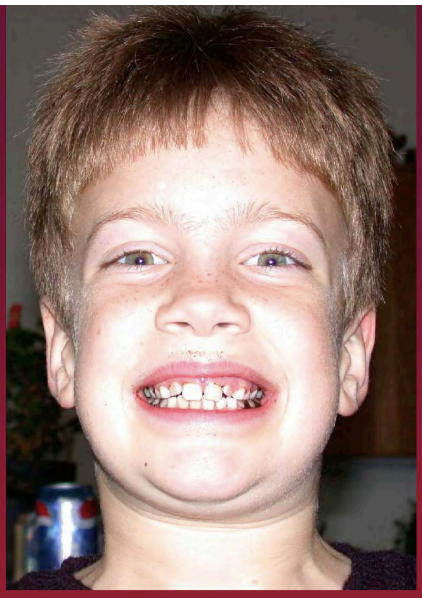
Tom Volk
Department of Biology
University of Wisconsin-La Crosse
TomVolkFungi.net

University of Wisconsin-La Crosse

- On the Mississippi River in western Wisconsin
- About 9000 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, Genetics Lab, and Latin & Greek for scientists

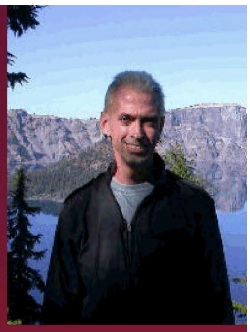
Don't be afraid of Mycology



- Jennifer, Keef and Fungal Genetics

"My mommy works in a Jungle Phonetics lab"

Why have web pages online?



- Most people do not know what Mycology is.
- Email: *I have to do a report on mycology for my science class. Could you please send me a picture of mycology? Thanks.*
- The internet provides an opportunity for educating a large number of people
- Almost 980,000 visitors to my main page at TomVolkFungi.net since I went online in November 1995.
- 10,000-20,000 visitors per month
- Millions more on the rest of my pages

From: Christopher Hutson [chutson99@gmail.com] Sent: Wed 9/13/2006 5:06 PM
To: Volk Thomas J
Cc:
Subject: calvatia gigantea

Mr. Volk -

I discovered your pages recently and had no choice but to spend several hours reading because i am weak and i cannot stop. I noticed that you asked for other ideas involving giant puffballs - i have a little page on what we like to do with them.

http://foragereport.chrishutsonart.com/calvatia.html

regards

_Chris Hutson

Something for everyone?

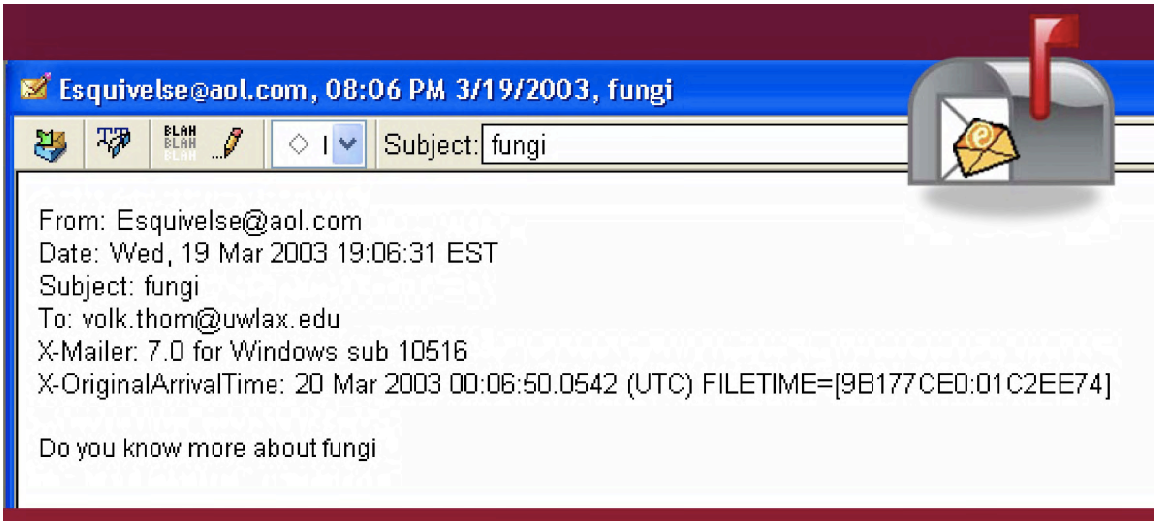
- TomVolkFungi.net
- Fungus of the month pages.
- Relate fungi to holidays
- Relate fungi to everyday life.
  - e.g. Dog stinkhorn, *Stachybotrys*
- Relate web pages to history
  - Irish potato famine, Caesar's mushroom
- Genetics: *Schizophyllum*, this month
- Gross-out: Dog vomit slime mold, athlete's foot
- Fun: *Pilobolus*

Web pages bring Email

- 75-100 unsolicited emails per week

From: Beth Spencer [ann25spen@yahoo.com] Sent: Tue 9/26/2006 4:11 PM
To: Volk Thomas J
Cc:
Subject:

i have a mushroom growing in my yard and wanted to know if i could eat it or what kind it was thanks beth



Naveed Davoodian, 11:24 AM 4/19/2005, Dear Mr. Volk

Subject: Dear Mr. Volk

Date: Tue, 19 Apr 2005
From: "Naveed Davoodian" <naveeddavoodian@yahoo.com>
Subject: Dear Mr. Volk
To: <volk.thom@uwlax.edu>

Dear Mr. Volk,

I am an 18 year old mycology enthusiast and I am in the midst of a serious fungal dilemma. I cannot identify the following 3 species of fungi! I was trekking through the woods near a swamp about 3 weeks ago (i live in central Florida) and I came across these specimens. I snapped photos and went home to identify them, but my field guide did not suffice. I then surfed the internet until my eyes began to hurt, but still no sign of these fungi.

can you help me?!

photographs of the 3 species are attached.

Judith L. Johnson, 12:07 PM 3/19/2003, fungi data

Subject: fungi data

Date: Wed, 19 Mar 2003 11:07:33 -0500
From: "Judith L. Johnson" <Judith.Johnson@ncmail.net>
Organization: N.C. Dept. of Juvenile Justice and Delinquency Prevention
X-Mailer: Mozilla 4.75 [en]C-CCK-MCD (Win98; U)
X-Accept-Language: en
To: volk.thom@uwlax.edu
Subject: fungi data
X-OriginalArrivalTime: 19 Mar 2003 16:09:55.0851 (UTC) FILETIME=[FB6825B0:01C2EE31]

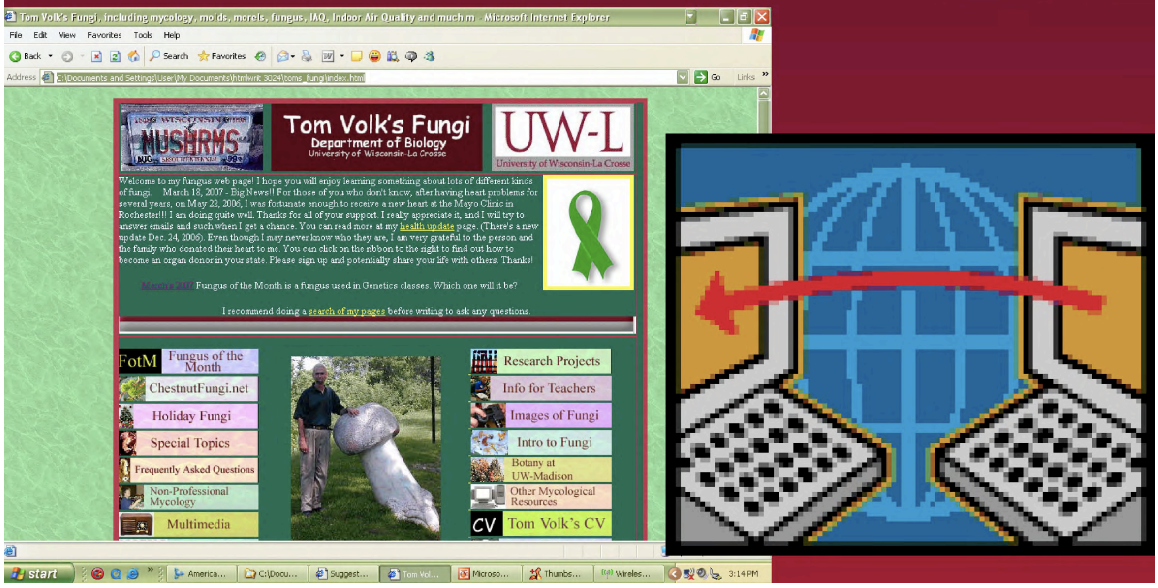
This information was useful in our discussion of the fungi kingdom, here at the Cumberland Detention Center In North Carolina

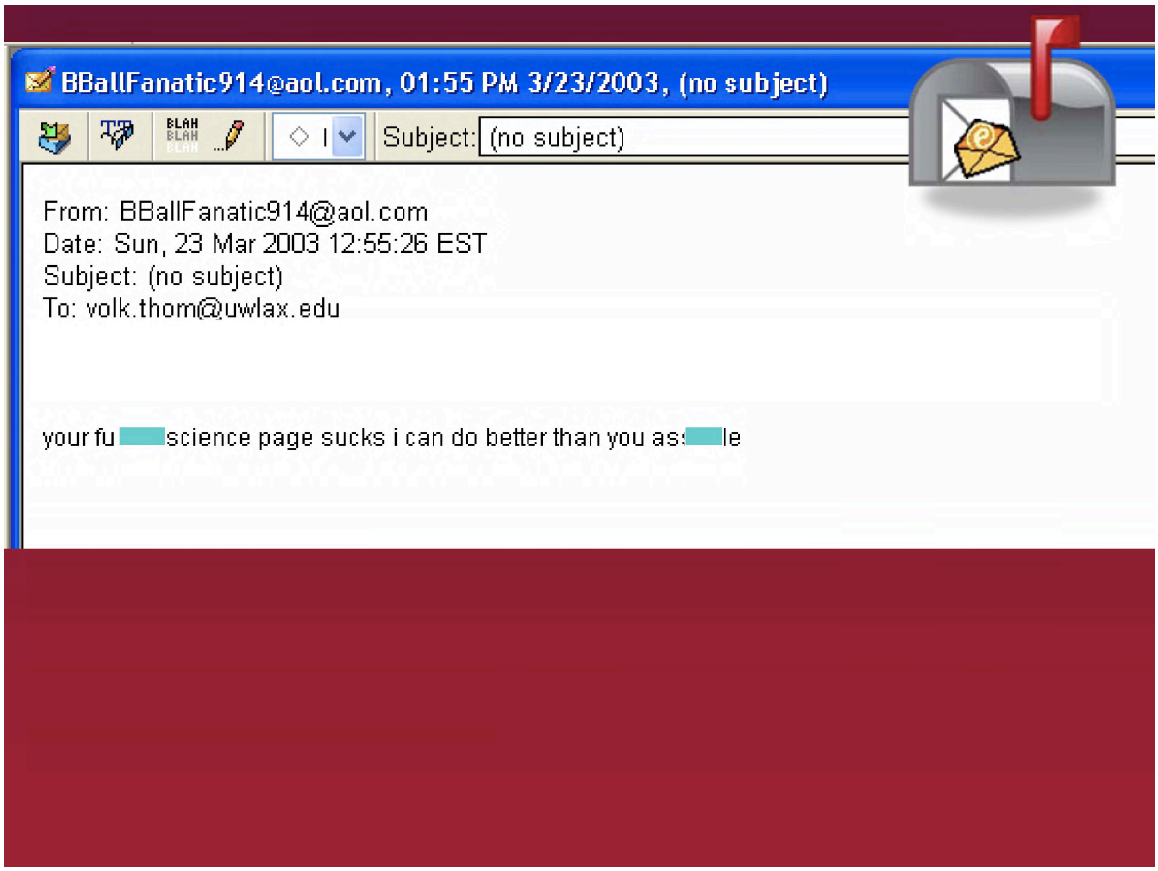
Educational activity - Birthday Internet Assignment

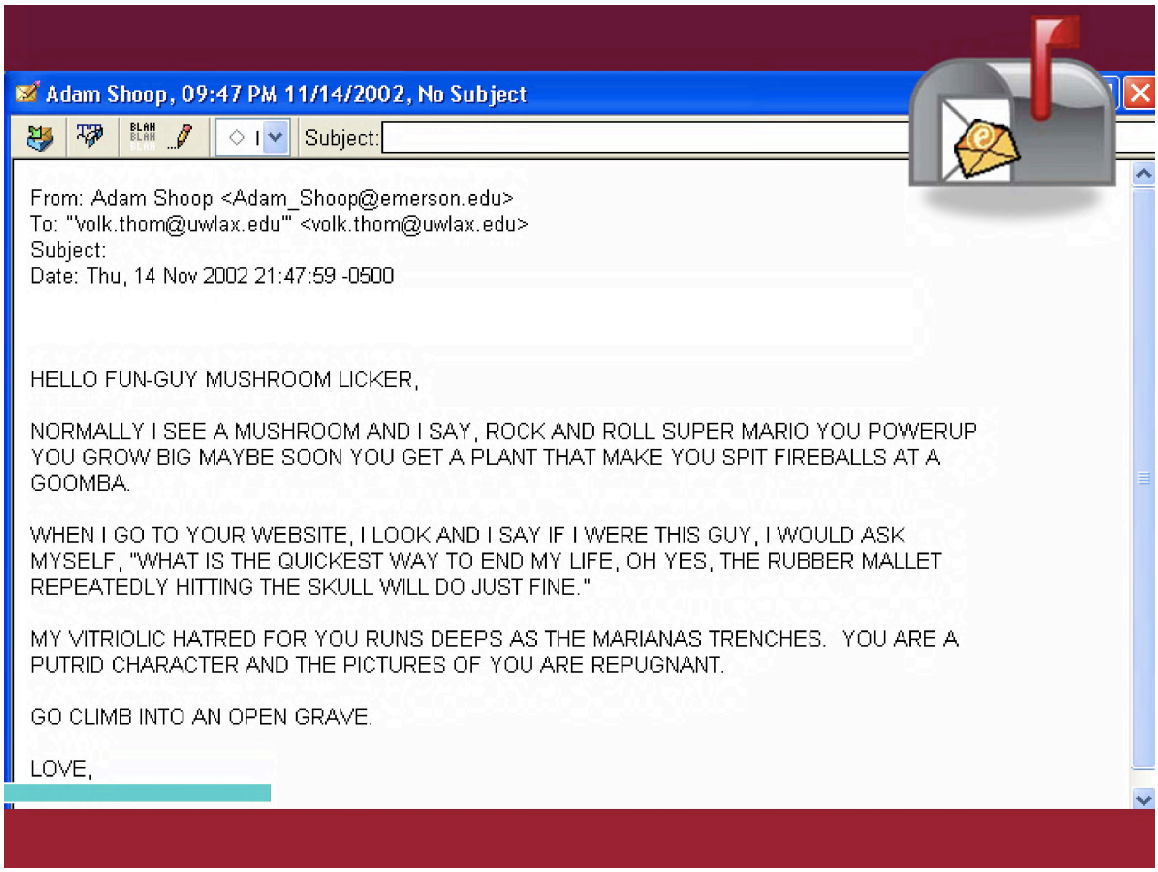
- To be sure students have read my web pages and know what's available on them, I give my students this assignment. Judging by the responses I get, students seem to really like doing it:
- Please visit TomVolkFungi.net Look around and see what you can find! There are many pictures and descriptions of the fungi we'll be talking about in lecture.
- For your assignment, determine the "Fungus of the Month" for YOUR birthday month. In all cases you will have several choices for that month, since I started the Fungus of the Month in January of 1997.
- Then after reading about the fungus of the month for your birthday month send me an email with the following things in it:
- Body of email
  1. Your name 2. Month of your birthday
  3. Fungus of the month for your birthday month
  4. What is the food source for that species? Is the fungus a saprophyte, parasite or mutualist?
  5. To which phylum does that fungus belong ?
  6. Write a few sentences about why that fungus is interesting.

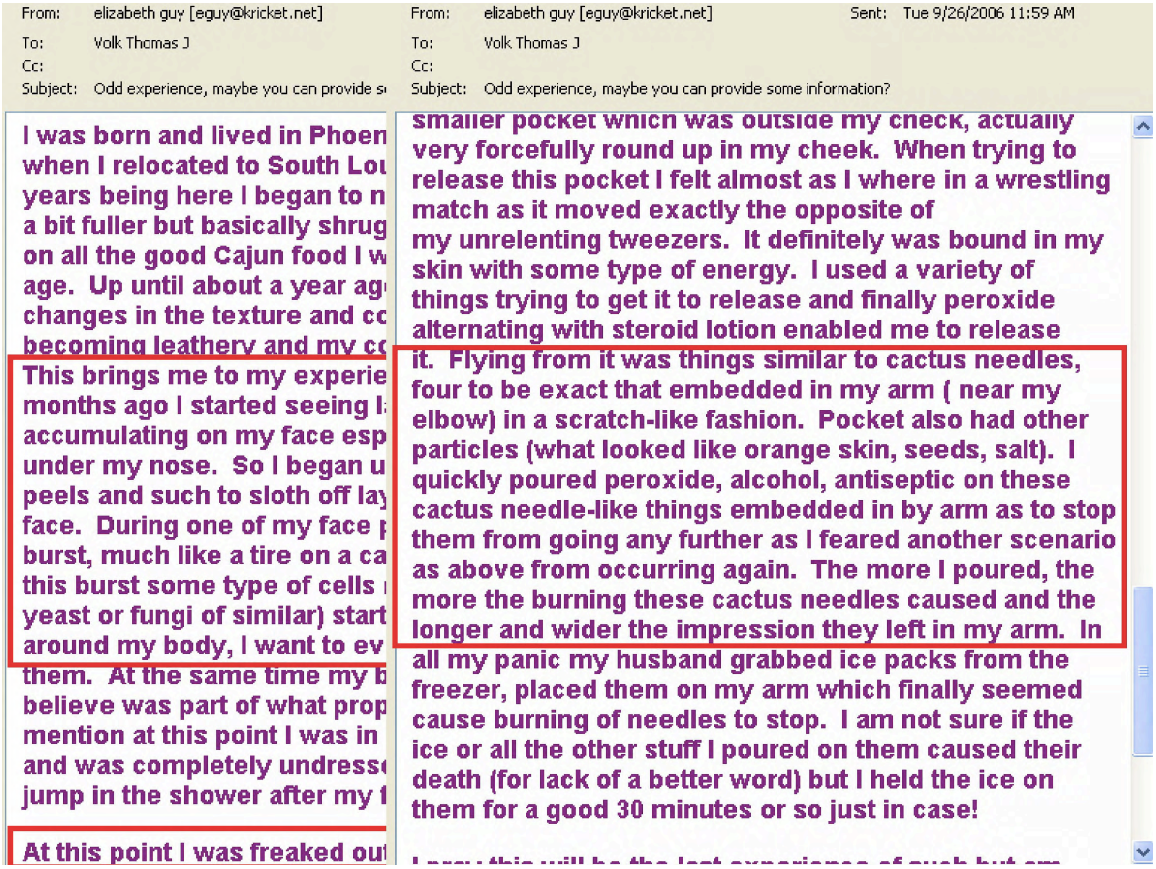
Why have web pages online?

- Some days I wonder…




BBallFanatic914@aol.com, 01:55 PM 3/23/2003, (no subject)
Subject: (no subject)
From: BBallFanatic914@aol.com
Date: Sun, 23 Mar 2003 12:55:26 EST
Subject: (no subject)
To: volk.thom@uwlax.edu
your fu science page sucks i can do better than you as: le


Adam Shoop, 09:47 PM 11/14/2002, No Subject
Subject:
From: Adam Shoop <Adam_Shoop@emerson.edu>
To: "volk.thom@uwlax.edu'" <volk.thom@uwlax.edu>
Subject:
Date: Thu, 14 Nov 2002 21:47:59 -0500
HELLO FUN-GUY MUSHROOM LICKER,
NORMALLY I SEE A MUSHROOM AND I SAY, ROCK AND ROLL SUPER MARIO YOU POWERUP YOU GROW BIG MAYBE SOON YOU GET A PLANT THAT MAKE YOU SPIT FIREBALLS AT A GOOMBA.
WHEN I GO TO YOUR WEBSITE, I LOOK AND I SAY IF I WERE THIS GUY, I WOULD ASK MYSELF, "WHAT IS THE QUICKEST WAY TO END MY LIFE, OH YES, THE RUBBER MALLET REPEATEDLY HITTING THE SKULL WILL DO JUST FINE."
MY VITRIOLIC HATRED FOR YOU RUNS DEEPS AS THE MARIANAS TRENCHES. YOU ARE A PUTRID CHARACTER AND THE PICTURES OF YOU ARE REPUGNANT.
GO CLIMB INTO AN OPEN GRAVE.
LOVE,



From: elizabeth guy [eguy@kricket.net]
To: Volk Thomas J
Cc:
Subject: Odd experience, maybe you can provide s

I was born and lived in Phoen
when I relocated to South Lou
years being here I began to n
a bit fuller but basically shrug
on all the good Cajun food I w
age. Up until about a year ag
changes in the texture and co
becoming leathery and my co
This brings me to my experie
months ago I started seeing l
accumulating on my face esp
under my nose. So I began u
peels and such to sloth off lay
face. During one of my face p
burst, much like a tire on a ca
this burst some type of cells
yeast or fungi of similar) start
around my body, I want to ev
them. At the same time my b
believe was part of what prop
mention at this point I was in
and was completely undresse
jump in the shower after my f

At this point I was freaked out

From: elizabeth guy [eguy@kricket.net] Sent: Tue 9/26/2006 11:59 AM
To: Volk Thomas J
Cc:
Subject: Odd experience, maybe you can provide some information?

smaller pocket which was outside my cheek, actually very forcefully round up in my cheek. When trying to release this pocket I felt almost as I where in a wrestling match as it moved exactly the opposite of my unrelenting tweezers. It definitely was bound in my skin with some type of energy. I used a variety of things trying to get it to release and finally peroxide alternating with steroid lotion enabled me to release it. Flying from it was things similar to cactus needles, four to be exact that embedded in my arm (near my elbow) in a scratch-like fashion. Pocket also had other particles (what looked like orange skin, seeds, salt). I quickly poured peroxide, alcohol, antiseptic on these cactus needle-like things embedded in by arm as to stop them from going any further as I feared another scenario as above from occurring again. The more I poured, the more the burning these cactus needles caused and the longer and wider the impression they left in my arm. In all my panic my husband grabbed ice packs from the freezer, placed them on my arm which finally seemed cause burning of needles to stop. I am not sure if the ice or all the other stuff I poured on them caused their death (for lack of a better word) but I held the ice on them for a good 30 minutes or so just in case!

I pray this will be the last experience of such but am

But then there are other days…

From: Melanie Tillman [melanie.tillman@carrollcountyschools.com] Sent: Thu 3/15/2007 9:06 AM
To: Volk Thomas J
Cc:
Subject: Great Page!

Your slide show is really nice. It is very informative but not too verbose. I'll bet you are an awesome instructor!

Melanie Buchanan-Tillman, M.Ed.
Science Educator,
Villa Rica Middle School

SeashellPM@aol.com, 08:49 PM 11/5/2002, help! (please)

Subject: help! (please)

SeashellPM@aol.com, 05:52 PM 11/14/2002, Re: help! (please)

Subject: Re: help! (please)

Date: Thu, 14 Nov 2002 17:52:15 -0500
From: SeashellPM@aol.com
To: volk.thom@uwlax.edu
Subject: Re: help! (please)

Dr. Volk: thank you so much!! Wow! there's no one I'd like to talk to more (except maybe Paul McCartney ☺)!

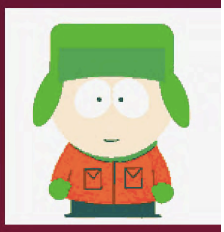
Sorry for keeping you waiting so long, I've been having some trouble with the internet…

I live in Phoenix, AZ and, sadly, do not see many mushrooms here. Occasionally several will crop up in the park after it rains, but my resident city is not noted for its humidity. Thus, I do most of my mushroom sighting in textbooks and field guides. However, I keep a very optimistic view of mushrooms, hoping that someday I will be able to see live specimens with more regularity.

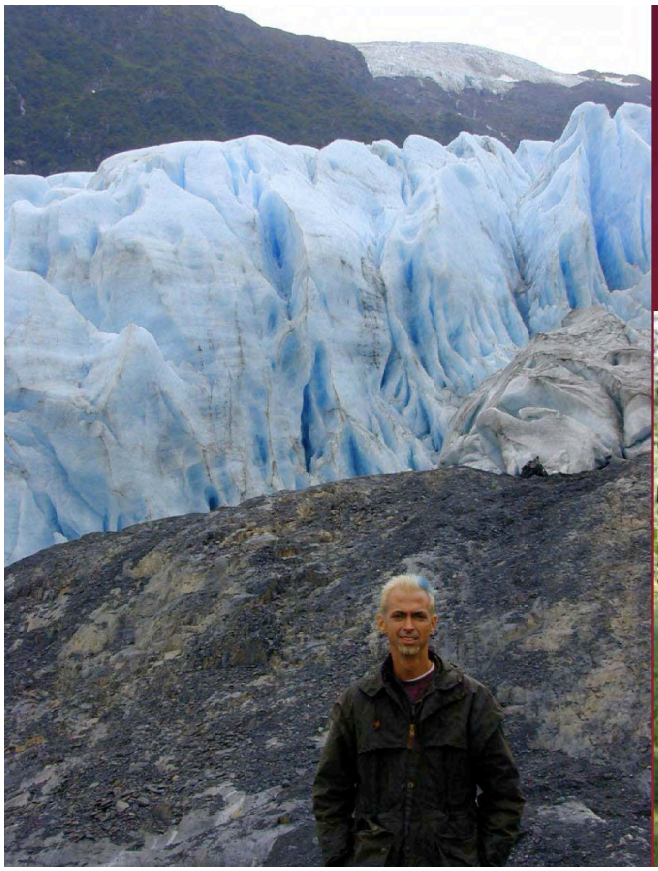
Again, thank you very much! It may be a little while before I can send you my questions, because I have to find out what things I don't know…

~Jennifer

We've learned something today



- Don't be afraid for jungle phonetics.
- The internet can be a powerful tool for education
- Making pages fun and relevant can lead people to visit over and over again.
- If you want to be the co-author of a Fungus of the Month, contact me!

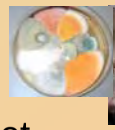


Be sure to visit
TomVolkFungi.net

Teaching Medical Mycology : Luring students into learning about fungi

Thomas J. Volk

Department of Biology, University of Wisconsin-La Crosse, La Crosse WI 54601 volk.thom@uwlax.edu TomVolkFungi.net




Abstract

This presentation is the story of a successful Medical Mycology course at the University of Wisconsin-La Crosse (about 8500 students), where enrollment one semester has peaked at 38 students. I started with an enrollment of 13 students in Spring 1997; there have been 250 students in the past 11 years. Through word of mouth and course "advertising," enrollments have steadily increased, especially among microbiology majors and among pre-med students, when they realize they will likely receive little training in mycology in medical school. Calling the course "Medical Mycology" is also a marketing tool to lure students into learning about mycology.



Medical Mycology at the University of Wisconsin-La Crosse

Although fungi are increasing in importance as more patients become immunocompromised and acquire fungal infections, Medical Mycology is not yet a common course in undergraduate or graduate programs, with fewer than 40 full-fledged Medical Mycology courses currently taught in North America, according to Tex Beneke, Al Rogers, and Star Publishing. However, Medical Mycology can be a successful and popular course if taught and "marketed" to students in interesting ways.

The University of Wisconsin-La Crosse is a medium-sized university of about 8500 students, located on the Mississippi River in western Wisconsin. We have about 1200 majors in Biology and Microbiology, with concentrations in Biomedical Sciences, Cell & Molecular Biology, Environmental Sciences, and Aquatic sciences. We also have a Master of Science program with about 60 students. I have eight graduate students in my lab. I teach courses in Medical Mycology, Mycology, Plant-Microbe Interactions, Food & Industrial Mycology, Plant Biology, Organismal Biology, and Latin & Greek for Scientists.

The Lecture: "A study of the yeasts, molds, and actinomycetes that are pathogenic to humans and other animals." Although the prerequisites are Mycology or Intro Microbiology, I assume students have no previous knowledge of fungal biology. My course is somewhat different than most medical mycology courses, since I teach it mostly from the fungus' point of view. Of course, we also discuss the symptoms and treatments for each fungal disease, as well as mycetismus and mycotoxicosis. See the syllabus on the right of this poster.

My background and training is primarily in wood decay fungi, morels, and more general mycology. When I started teaching this course at UW- La Crosse in 1997, I had not previously had a medical mycology course or taught one. I was lucky that my friend, John Rippon, gave me most of his collection of teaching slides (about 2500), which I have scanned for computer use. He also gave me his class notes and handouts, for which I am very grateful. All of my class presentations are now done in PowerPoint, with modifications and (sometimes major) updates every year. See syllabus on the right. The three lecture exams consist of mostly essay questions, requiring students to integrate their knowledge, rather than just memorization.

The Laboratory is the crux of the course. The lab emphasis is on laboratory techniques for isolation and identification of pathogenic fungi. Besides studying many pre-prepared slides, each student makes a permanent reference slide collection of approximately 45 species of pathogenic and "contaminant" fungi, mostly deuteromycetes, using PVLG (polyvinyl-lactic acid-glycerine) to make permanent mounts of slide cultures or tape mounts. Students learn the techniques and skills necessary to identify nearly any deuteromycete or yeast, a very important and sought-after job skill. Students also isolate fungi into pure culture from their environment and are required to identify three of these "unknown" species over the course of the semester. The two lab exams consist of 15-18 set-ups (typically one or more slides, drawings, photographs, books, biochemical tests, and/or posters) with 3-6 questions at each station. These questions tend to be more objective than the lecture exams.

Top ten reasons to take Medical Mycology BIO 413/513 this Spring Semester

10. In this age of immunocompromised people (AIDS, steroid therapy, chemotherapy and environmental pollutants) fungi are becoming ever more important as pathogens of humans and other animals.

9. If you're planning to go into the medical field you won't get many (if any) lectures on mycology in professional schools. Medical schools have in the past been impressed that applicants have take medical mycology here. This course will give you a leg up on your medical school colleagues. It is strongly recommended for the Biology and Microbiology majors, especially in the biomedical concentration.

8. According to Star Publishing (via Tex Beneke and Al Rogers), there are only 39 (thirty-nine) schools in North America where a course in medical Mycology is offered. This is a great opportunity to take this interesting course.

7. You'll see interesting pictures of interesting people who happen to be infected with fungi.

6. You'll learn about poisonous mushrooms, as well as deadly mycotoxins in food.

5. Each student will make a reference slide collection of all the fungal pathogens we study. You can take this collection with you and treasure it forever (maybe even longer). It's actually something that your co-workers will covet.

4. Dealing with medical fungi in a clinical setting is a practical skill that will increase your job possibilities. Companies and medical professionals want workers with training in mycology.

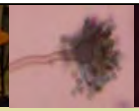
3. We hold a poster session where you and your friends can make and look at posters and eat interesting foods.

2. You'll get to see lots of Skin Flicks (and learn how to cure them)

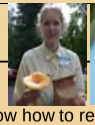
1. Everyone's doing it. C'mon you know you want to…

Lecture meets 8:50-9:45 MW. There is a choice of two labs: 8:50-10:50 F or 11-1 F.
For more info see Tom Volk in 3024 Cowley Hall or TomVolkFungi.net


Taking pictures with Nikon CoolPix 995 through the lens of the microscope


Aspergillus, taken with digital camera through the microscope lens


Cryptococcus, taken with digital camera through the microscope lens

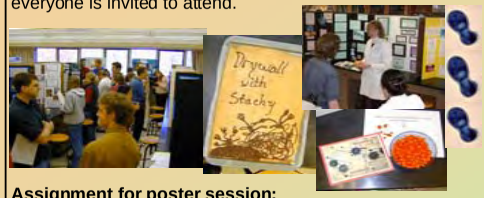



Poster sessions

It is important for students to know how to research a topic outside the sphere of what they learn in class. In many courses the professor assigns a term paper covering a particular topic. A student researches the material and writes a more or less coherent essay on the topic. However, the other students in the class learn nothing about any topic except their own. In addition, term papers can be tedious and time-consuming for the professor to grade, especially since these generally are due at the end of the year when everything else is becoming busy.

One alternative is to hold a poster session, an idea I got from Mike Tansey of Indiana University, who has had his students make posters for their mycology lab for years. I have taken his idea one step further and hold an actual poster session

We have a formal poster session, much like the one you're attending right now, but with better food, since students can bring treats, often related to their topics. Each student presents a poster on a self-chosen topic, similar to my fungal web pages at http://TomVolkFungi.net, where many medically important fungi have been featured. The poster session is a great learning tool for mycology courses. Students can learn more in depth about a particular topic that interests them, and in addition they can learn something about other students' chosen topics. The poster sessions are advertised to students and faculty in the department and everyone is invited to attend.



Assignment for poster session:

Your poster should include information on a medical mycology topic of your choice. It can be a disease, a treatment, an organ that's affected in different ways. Use your imagination. You should clear the topic with me in advance; try to pick something not covered in class. It's a good idea to pick something that might help in your future career

Some advantages of the Poster session:

- Students experience researching a topic in depth
- Students get to show their creativity in ways other than writing
- Students gain experience making a poster
- Students gain experience presenting a poster to an audience
- Students get the experience of participating in a poster session in a relatively low pressure situation, i.e. not at their first scientific meeting
- Students learn about other topics not assigned to or chosen by them
- Posters are easier to grade than term papers
- Posters are available for use in the course and in other courses in following semesters (and at scientific meetings and forays)
- Visiting students and staff not in the class can learn something about mycology and might be influenced to take mycology someday
- Mycology is promoted in the department and the university

Volk, Thomas J. 2001. Poster Sessions as teaching and learning tools in Mycology courses. MICOLOGIA APLICADA INTERNATIONAL 13(1): 45-49

Syllabus: Medical Mycology BIO 413/513

Dr. Tom Volk, 3024 Cowley Hall 785-6972
Lecture meets MW 8:50-9:45, Labs 8:50-10:50 F or 11-1 F.

1	Introduction	
	Classification systems	
	LAB 1	General Mycology
2	Fungal Life Cycles, deuteromycetes	
	Lab procedures, contamination	
	LAB 2	General Mycology
3	Fungal physiology and pathogenesis	
	Lab Diagnosis /Antifungal therapy	
	LAB 3	Common Fungal Contaminants
4	***EXAM I General Mycology***	
	Superficial Mycoses	
	LAB 4	Common Fungal Contaminants
5	Dermatophytes	
	Dermatophytes	
	LAB 5	Superficial Mycoses and Dermatophytes
6	Chromoblastomycosis & Mycetoma	
	Phaeohyphomycosis,Sporotrichosis	
	LAB 6	Dermatophytes
7	Pseudallescheriasis	
	Mushroom Poisoning	
	LAB 7	***LAB EXAM I***
	SPRING BREAK	
8	Mycotoxicosis, mycoallergies	
	Lab identification of yeasts	
	LAB 8	Subcutaneous fungal infections
9	***EXAM II***	
	Candidiasis	
	LAB 9	Pathogenic yeasts
10	Candidiasis	
	Cryptococcosis & other yeast inf	
	LAB 10	Pathogenic yeasts
11	More Yeast infections	
	Intro to systemic mycoses	
	LAB 11	Poster session
12	Histoplasmosis	
	Blastomycosis	
	LAB 12	Fungi of deep mycoses
13	Coccidioidomycosis & Paracoccidioidomycosis	
	Opportunistic infections	
	LAB 13	Fungi of deep mycoses
14	Opportunistic inf., + Actinomycetes	
	Review	
	LAB 14 LAB EXAM	***LAB EXAM II***
	Final Exam (Exam III)	**Partially comprehensive**

All topics, exams, and schedules subject to change.

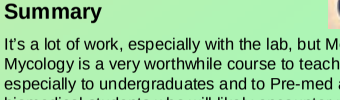
Text: Kwon-Chung, K.J. & John E. Bennett, 1992. Medical Mycology. Philadelphia & London: Lea & Febiger

Lab: Beneke, Everett S & Alvin L. Rogers. 1996. Medical Mycology and Human Mycoses. Belmont CA: Star Publishing -- also Dr. Allen Nelson's lab manual (modified by T.Volk) handed out in class.

Grading:

Lecture Exams	Exam I	70 pts.
	Exam II	130 pts.
	Exam III	130 pts.
Lab Exams	2 @ 120	240 pts.
Slide Collection		30 pts.
Quizzes, internet assignments, etc.		~130 pts.
Unknowns 15 pts each—three filamentous and 1 yeast		60 pts
Poster on an interesting medical mycology topic		50 pts.
Total		~800 pts.

If you miss a lecture exam, the only way to make it up will be as an oral exam. There will be no make-up exams for missed lab exams—it is impossible to reconstruct a lab exam or leave it up for more than the time allotted. All exams are partially comprehensive. Grades are assigned on a standard scale: 91-100=A, 81-90=B, 71-80=C, 61-70=D, <61=F.




Summary

It's a lot of work, especially with the lab, but Medical Mycology is a very worthwhile course to teach, especially to undergraduates and to Pre-med and other biomedical students who will likely encounter mycology very little in their post-baccalaureate training.

Fungal Gene and Protein Information at the *Saccharomyces* Genome Database (SGD) and *Candida* Genome Database (CGD)

Maria C. Costanzo
Department of Genetics • Stanford University School of Medicine
24th Fungal Genetics Conference
March 21, 2007

Overview

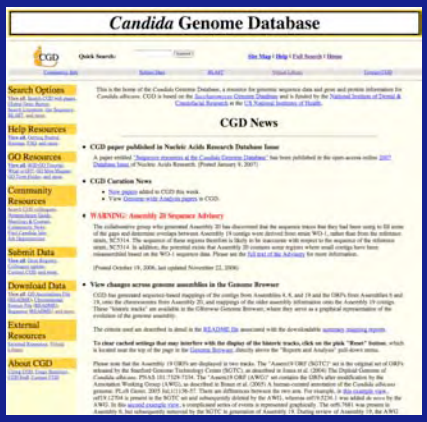
- What types of information are available at SGD and CGD?
- How do I find and download information?
- How do I submit information?

yeast-curator@genome.stanford.edu

candida-curator@genome.stanford.edu

SGD and CGD home pages

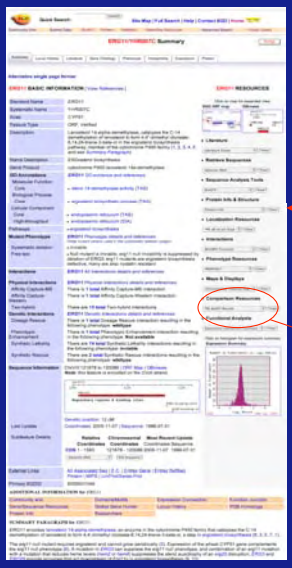
http://www.yeastgenome.org



http://www.candidagenome.org

Locus Summary page

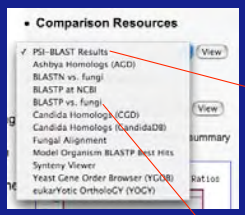
SGD



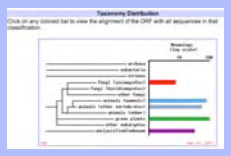
CGD

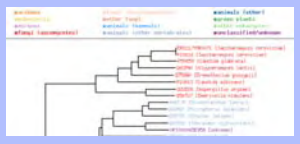
Potential orthologs in other fungi

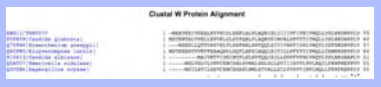
SGD



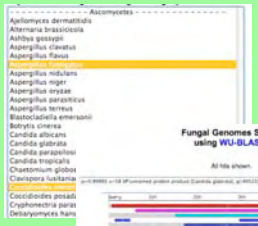
PSI-BLAST

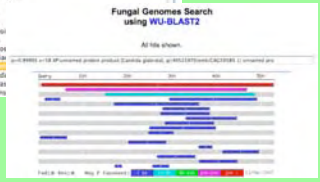




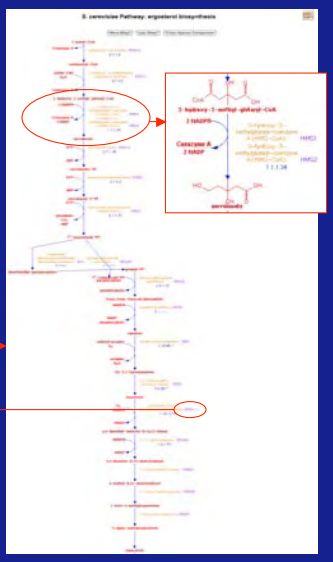


Fungal BLAST



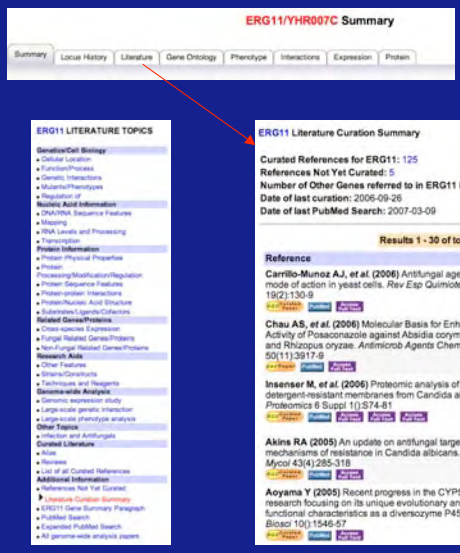


Graphical displays of biochemical pathways



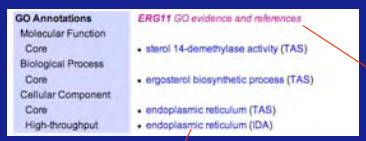
Literature Guide

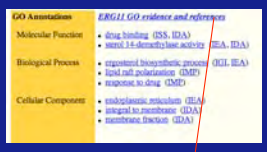
SGD



CGD

Gene Ontology annotations





GO Term Page

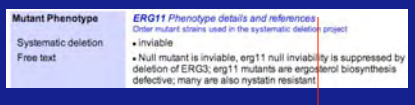
GO Evidence and References Page

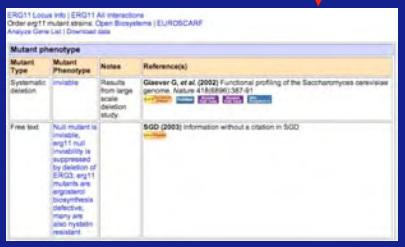
GO Workshop 12:15 PM Friday, Nautilus

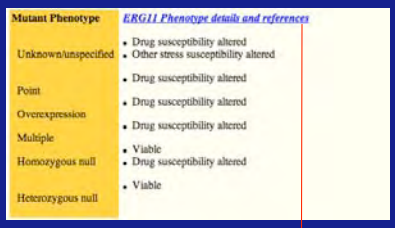
Mutant phenotype data

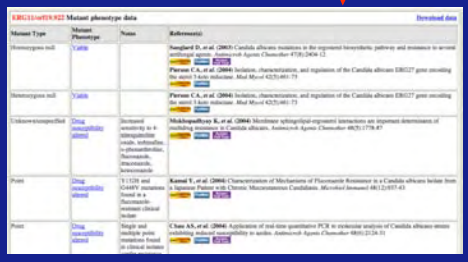
SGD

CGD

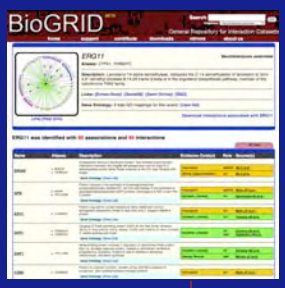




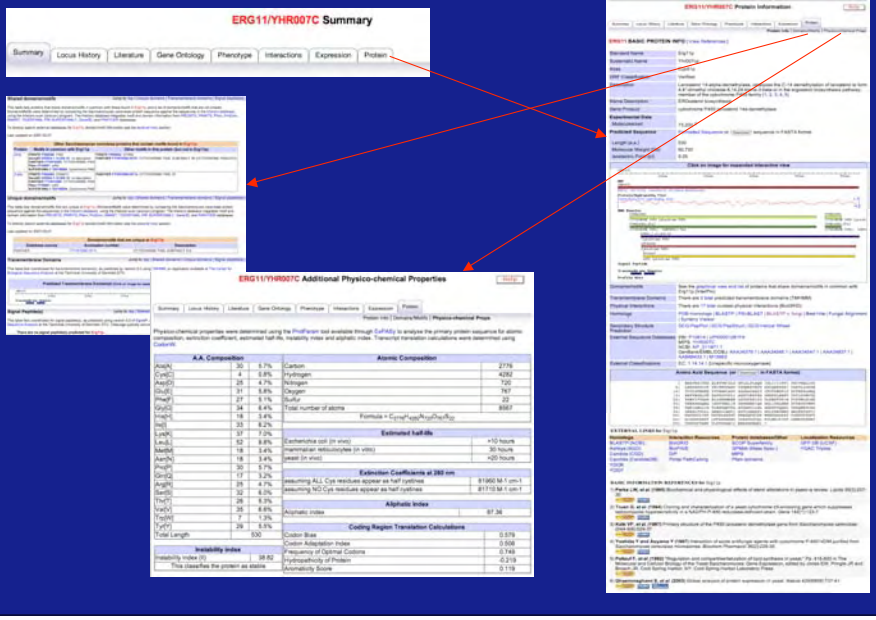




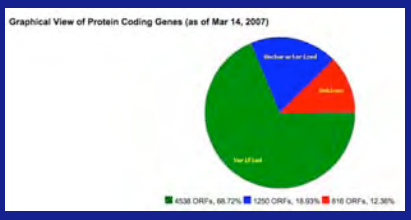
Genetic and physical interaction data (SGD)

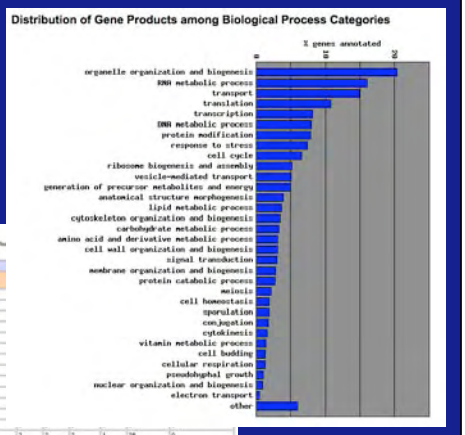


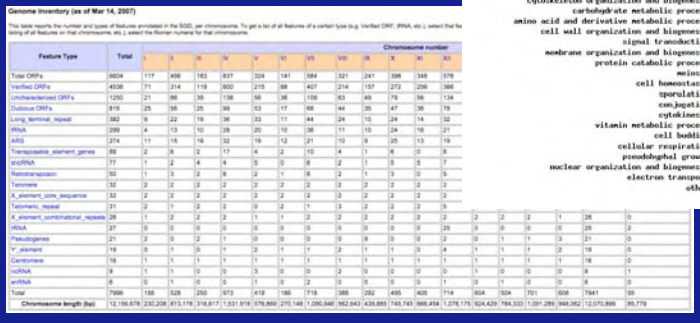
Protein information (SGD)



Getting an overview: SGD's Genome Snapshot

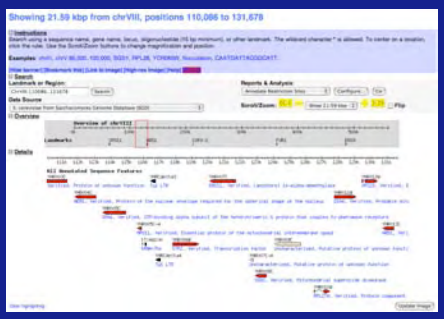






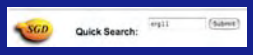
Genome navigation: GBrowse

SGD



CGD

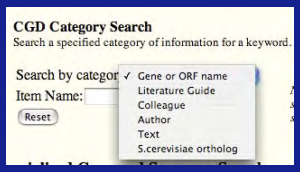
Finding information



- gene names
- gene products
- GO terms
- Colleagues
- authors
- biochemical pathways
- descriptions
- PubMed ID
- GO ID
- external ID

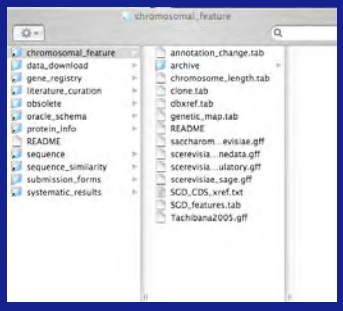
- gene names
- gene products
- GO terms
- Colleagues
- authors

SGD Advanced Search



Downloading information

SGD



CGD

SGD's Batch Download tool

Submitting information

Colleague information

Gene Registries

SGD community wiki

Contact us anytime!

yeast-curator@genome.stanford.edu

candida-curator@genome.stanford.edu

Best Practices & Trouble Spots - Round Table

Amy J. Reese
Cedar Crest College

Amount taught on fungi

- Time given to fungal biology/genetics:
  - Entire courses offered yearly
  - Courses offered periodically
  - A few days to a week in a semester
  - One day/lab in a semester
  - Other

Break into groups…

- Gather with others who teach:
  - Group A: Entire courses
  - Group B: A few days to a week
  - Group C: One day/lab in a semester

Within your group address:

- **Best practices:**
  - What approaches, assignments or labs work well?
  - What do students enjoy & learn from the most?
- **Trouble spots:**
  - What topics, assignments, or labs are not ideal?
  - What do students find boring & not learn?
- **What the other groups could help with:**
  - If you teach a full course, what introductory material do you wish students had already been exposed to?
  - If you only get a few days, what suggestions of highlights could you use from those who cover more?

Summary……

- Nomenclature: analogy w/best friend's name (not most interesting thing about them, but can use it on "My Space")
- Pathways: use as menonic
- Mycology for non-majors: title ("The Fungal Jungle"), book (Magical Mushrooms etc)
- Expts for non-majors: fungal Ames test w/ substances students provide (deep-fat fryer)
- Practical: start w/ unknown sequence-annotation; no "wrong" answers

Summary 2……

- What do students need to retain from intro courses? Experimental design, more understanding of plant biology needed for fungal biology
- Use of unsolved problems
- Student review papers, how improve quality? Websites as alternative to papers (see upcoming article in GENETICS about "secret paper")

Deleting *Aspergillus nidulans* checkpoint regulators in an undergraduate molecular genetics course

Steve James Department of Biology, Gettysburg College, Gettysburg PA
sjames@gettysburg.edu

Biology 351: *Molecular Genetics*

Enrollment: 12 students, mostly junior/senior Biochemistry/Molecular Biology majors

Prerequisites: *Genetics* (Bio 211) and *Cell Biology* (Bio 212).
Core requirements for the Biology and BMB majors

Format: 3 one-hour lectures, one 4-hour lab x 14-weeks

Curriculum: Core requirement for the BMB major, elective for Biology
Fulfills the capstone requirement in Biology and BMB

Laboratory budget: ~ $3500.00

Three advances in technology make it feasible for pairs of students to delete a gene in one semester

1st **The *Ku70* knockout eliminates nearly all ectopic integration. Most integration events occur by homologous recombination**

Gene Targeting in Aspergillus

B

Flanking DNA	Transformants tested	Histone H1-RFP	% Positive Transformants
2000 bp	60	54	90%
1000 bp	50	46	92%
500 bp	36	32	89%

DOI: 10.1534/genetics.105.052563

A Versatile and Efficient Gene-Targeting System for *Aspergillus nidulans*

Tania Nayak,* Edyta Szewczyk,* C. Elizabeth Oakley,* Aysha Osmani,* Leena Ukil,* Sandra L. Murray,† Michael J. Hynes,† Stephen A. Osmani* and Berl R. Oakley*,‡

*Department of Molecular Genetics, The Ohio State University, Columbus, Ohio 43210 and †Department of Genetics, The University of Melbourne, Parkville, Victoria 3010, Australia

Manuscript received October 17, 2005
Accepted for publication December 23, 2005

2nd Double-joint PCR, aka 2-way and 3-way fusion PCR

Deletion & tagging constructs can be produced using PCR only, w/o DNA cloning. Resulting DNAs can be transformed directly

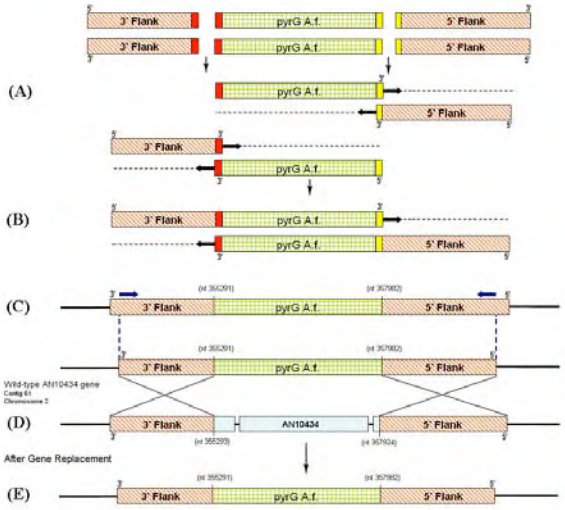


Diagram courtesy of Nick Boire, '07, BMB major

3rd An inexpensive & reliable source of cell-wall degrading enzymes

Vinoflow® FCE winemaking enzyme

100g, ~ $40.00

Use: approximately 3-4 g per experiment

The laboratory project in Molecular Genetics, Fall 2006

Each 2-person team will ---

(1) delete a gene and study the phenotypic consequences

(2) clone the gene to an inducible promoter for overexpression

AN4279: RAD53/Chk2 checkpoint kinase

AN8255: Rad9^{Sc} & *Hu*53BP1-related;
transducer of DNA damage checkpoint signal

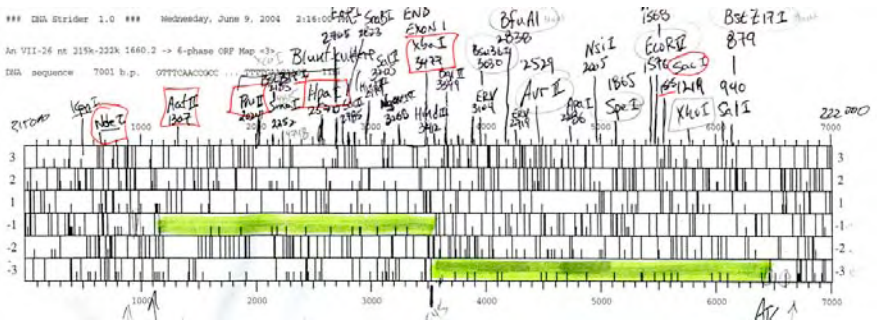
AN6303: RFC1 subunit of the PCNA clamp loader

AN10434: RTT107/ESC4^{Sc} & BRC1^{Sp}-related;
DNA damage tolerance and repair

Week 1: Design gene deletions

The early design phase is a bit messy & can be overwhelming…

….*just as it should* (to stimulate higher-order thinking?)...



Assignment for Friday:

1. Locate and mark the START and STOP codons for your gene on the Full Restriction Map.
2. On the Full Restriction Map, locate and mark all of the following restriction enzyme cut sites:

- *Kpn*I - *Sph*I - *Pst*I - *Mlu*I - *Sna*BI - *Bam*HI - *Eco*RI - *Sal*I - *Hind*III - *Xho*I

- *Sty*I - *Avr*II - *Nhe*I - *Xba*I - *Bxt*XI - *Pml*I - *Apa*I - *Sca*I - *Eag*I - *Not*I

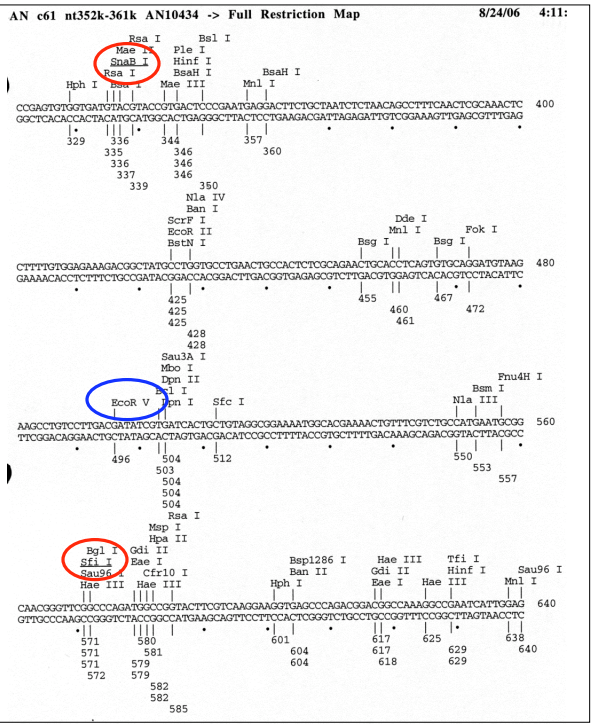
3. On the 6-phase ORF Map, pencil in the position of each of the sites above. Include the nucleotide number along with the enzyme name at each position.
4. Using the *A. nidulans* Database, determine on which chromosome your chosen gene resides and its approximate location. Print out the chromosome map and draw the location of your gene on the map.

Example of a
Full Restriction Map

Shows…

-- dsDNA sequence

-- Restriction Enzyme cut sites



Directory of site usage

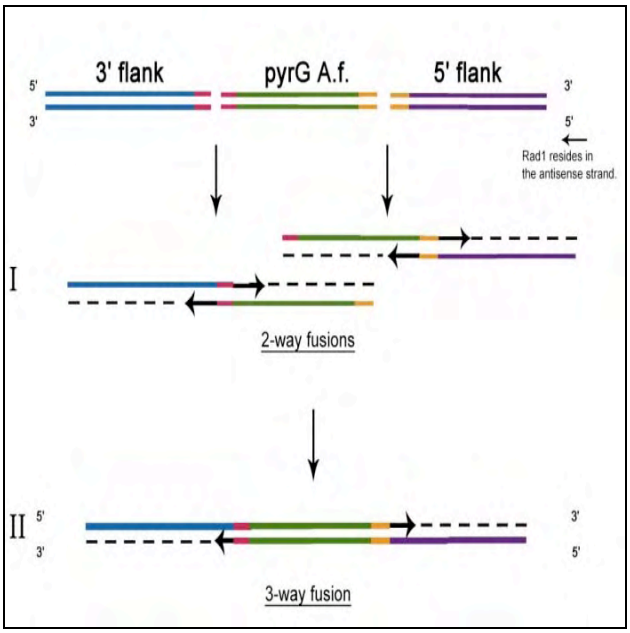
Restriction Endonucleases site usage

Aat II	3	Bsp1286 I	14	Gdi II	8	PflM I	1
Acc65 I	-	BspD I	-	Gsu I	2	Ple I	17
Acc I	3	BspE I	2	Hae I	7	Pme I	1
Aci I	44	BspH I	1	Hae II	9	Pml I	1
Afl II	1	BspM I	3	Hae III	25	PpuM I	3
Afl III	5	BspM II	2	Hga I	17	Pst I	2
Age I	2	Bsr I	17	HgiA I	8	Pvu I	-
Aha II	7	BssH II	3	Hha I	44	Pvu II	2
Alu I	35	Bst1107 I	1	HinC II	8	Rev prim(a)	-
Alw I	13	BstB I	2	HinD III	5	Rev prim(b)	-
AlwN I	4	BstE II	2	Hinf I	38	Rma	21
Apa I	-	BstN I	20	HinP I	44	Rsa I	21
ApaL I	2	BstU I	30	Hpa I	2	Rsr II	3
Apo I	10	BstX I	1	Hpa II	36	Sac I	2
Asc I	-	BstY I	8	Hph I	17	Sac II	-
Ase I	-	Bsu36 I	2	Kas I	2	Sal I	1
Asp718	-	Cfr10 I	8	Kpn I	-	Sau3A I	32
Ava I	9	Cla I	-	Mae I	21	Sau96 I	23
Ava II	15	Dde I	36	Mae II	19	Sca I	2
Avr II	3	Dpn I	32	Mae III	25	ScrF I	37
Bal I	3	Dpn II	32	Mbo I	32	Seq prim(a)	-
BamH I	1	Dra I	2	Mbo II	50	Seq prim(b)	-
Ban I	6	Dra III	-	Mlu I	-	Sec I	28
Ban II	7	Drd I	-	Mnl I	107	SfaN I	29
Bbe I	2	Dsa I	4	Msc I	3	Sfc I	9
Bbs I	12	Eae I	11	Mse I	12	Sfi I	1
Bbv I	21	Eag I	4	Msp I	36	Sma I	2
Bbv II	12	Eam1105 I	3	Mun I	4	SnaB I	1
Bcl I	4	Ear I	8	Nae I	3	Spe I	-
Bcn I	17	Ecl136 II	2	Nar I	2	Sph I	1
Bgl I	5	Eco47 III	4	Nci I	17	Spl I	-
Bgl II	3	Eco57 I	7	Nco I	1	Ssp I	3
Bpm I	5	EcoN I	1	Nde I	1	Stu I	1
Bpu1102 I	6	Eco0109 I	4	Nhe I	2	Sty I	7
Bsa I	5	EcoR I	-	Nla III	29	Taq I	40
Bsa I	6	EcoR II	20	Nla IV	22	Tfi I	21
BsaB I	2	EcoR V	4	Not I	-	Tth111 I	-
BsaH I	7	Esp I	6	Nru I	1	Tth111 II	9
BsaJ I	28	Esp3 I	5	Nsi I	3	Xba I	2
Bsg I	7	Fnu4H I	40	Nsp7524 I	9	Xca I	1
BsiE I	5	FnuD II	30	NspB II	10	Xcm I	1
BsiW I	-	Fok I	26	NspH I	9	Xho I	3
Bsl I	31	Fsp I	2	Pac I	-	Xma I	2
Bsm I	5	Fsp II	2	PaeR7 I	3	Xmn I	6
BsmA I	18						

Location of restriction sites

Enzyme	Site	Use	Site position (Fragment length) Fragment order		
Afl II	c/ttaag	1	1(2404) 2	2405(6597) 1	
BamH I	g/gatcc	1	1(7329) 1	7330(1672) 2	
BspH I	t/catga	1	1(8443) 1	8444(558) 2	
Bst1107 I	gta/tac	1	1(1327) 2	1328(7674) 1	
BstX I	ccannnnnn/ntgg	1	1(8342) 1	8343(659) 2	
EcoN I	cctnn/nnnagg	1	1(4850) 1	4851(4151) 2	
Nco I	c/catgg	1	1(5921) 1	5922(3080) 2	
Nde I	ca/tatg	1	1(8830) 1	8831(171) 2	
Nru I	tcg/cga	1	1(8599) 1	8600(402) 2	
PflM I	ccannnn/ntgg	1	1(3412) 2	3413(5589) 1	
Pme I	gttt/aaac	1	1(8384) 1	8385(617) 2	
Pml I	[illegible]	1	1(6131) 1	6132(2870) 2	
Sal I	g/tcgac	1	1(1540) 2	1541(7461) 1	
Sfi I	ggccnnnn/nggcc	1	1(570) 2	571(8431) 1	
SnaB I	tac/gta	1	1(335) 2	336(8666) 1	
Spl I	gcatg/c	1	1(6660) 1	6661(2341) 2	
Stu I	agg/cct	1	1(4497) 2	4498(4504) 1	
Xca I	gta/tac	1	1(1327) 2	1328(7674) 1	
Xcm I	ccannnnnn/nnnntgg	1	1(7707) 1	7708(1294) 2	
Age I	a/ccggt	2	1(4021) 2	4022(4417) 1	8439(563) 3
ApaL I	g/tgcac	2	1(5423) 1	5424(1621) 3	7045(1957) 2
Bbe I	ggcgc/c	2	1(2239) 3	2240(4097) 1	6337(2665) 2
BsaB I	gatnn/nnatc	2	1(1437) 3	1438(2044) 2	3482(5520) 1
BspE I	t/ccgga	2	1(1936) 2	1937(6864) 1	8801(201) 3
BspM II	t/ccgga	2	1(1936) 2	1937(6864) 1	8801(201) 3
BstB I	tt/cgaa	2	1(1762) 3	1763(5037) 1	6800(2202) 2
BstE II	g/gtnacc	2	1(4017) 1	4018(1021) 3	5039(3963) 2
Bsu36 I	cc/tnagg	2	1(1001) 3	1002(2744) 2	3746(5256) 1
Dra I	ttt/aaa	2	1(6428) 1	6429(1957) 2	8386(616) 3
Ecl136 II	gag/ctc	2	1(3326) 2	3327(3418) 1	6745(2257) 3
Fsp I	tgc/gca	2	1(3844) 1	3845(2986) 2	6831(2171) 3
Fsp II	tt/cgaa	2	1(1762) 3	1763(5037) 1	6800(2202) 2
Gsu I	ctggag	2	1(5160) 1	5161(3698) 2	8859(143) 3
Hpa I	gtt/aac	2	1(4660) 1	4661(2195) 2	6856(2146) 3

Strategy for 3-way fusion PCR



For example, here is how two of the primers will be oriented:

5' FOR: 5'GCGATTTGCTGAAGGCACGAATCTTTG 3'

+

5' REV + pyrG A.f. marker tail:

5'GAGGGTGAAGAGCATTGTTTGAGGCGACGGGTATTTATTGTATGTGGTGTTCTA 3'

5' Forward primer

5'**GCGATTTGCTGAAGGCACGAATCTTTG** 3'

5'GCGATTTGCTGAAGGCACGAATCTTTG…….. ~ 2 kb of 5' flanking region …….
3'**CGCTAAACGACTTCCGTGCTTAGAAAC**……..

……..**.TAGAACACCACATACAATAAATACCCG**…..**3'**
…….... ATCTTGTGGTGTATGTTATTTATGGGC…….5'

3'ATCTTGTGGTGTATGTTATTTATGGGCAGCGGAGTTTGTTACGAGAAGTGGGAG **5'**

5' Reverse + marker tail

…by the end of Week 2, students have learned how to design PCR primers for 3-way fusion PCR…

Table 2: Primers used in PCR for the amplification of both 5' and 3' AN3620.2 flanking regions. The underlined and color coded portions represents the part of the sequence overlapping with *pyrG A.f.*

Name	Primer Sequence	Tm °C	Annealing t °C
5'FOR	5'GCGATTTGCTGAAGGCACGAATCTTTG 3'	72.8	62.0
5'REV	5'GAGGGTGAAGAGCATTGTTTGAGGCGACGGGTA TTTATTGTATGTGGTGTTCTA 3'	86.9	62.0
3'FOR	5'CATCACGCATCAGTGCCTCCTCTCAGACAGCAGT AAGGGATGATTTGGAGTGAA 3'	90.7	62.0
3'REV	5'ACTGCCTATGATACTTGGAAGCGTCTCA 3'	68.0	62.0

The sequences in **black** are gene-specific and will differ for each deletion

Two of the primers will incorporate the *pyrG* A.f. sequences shown in blue

Biology 351 Laboratory
Week 3

Tuesday, 9/12/06

Part I of 3-way fusion PCR:

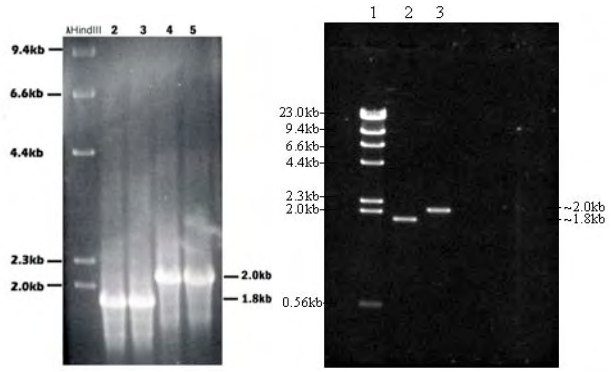
Amplify *A. nidulans* 5' and 3' flanking regions

Learning goals for this week's lab:

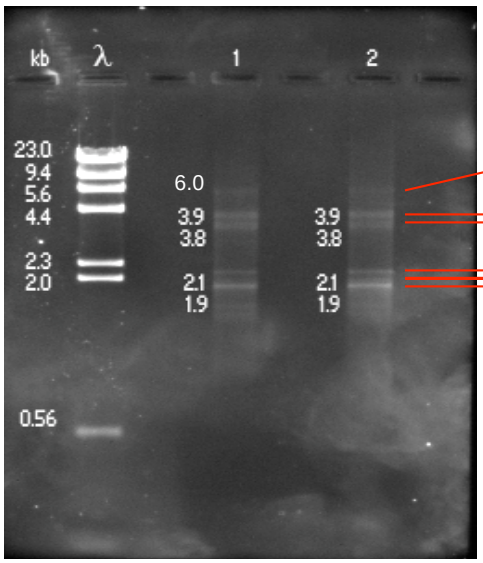
1. **Prepare four oligonucleotides for PCR –** dilute to appropriate concentrations.
2. **Plan two PCR reactions –** design two PCR reactions and understand the role of each component in the reactions.
3. **Learn how to program and use the Bio-Rad thermal cyclers for PCR**
4. **Perform the first set of amplifications to obtain 5' and 3' flanking genomic DNAs**
5. **Cast a large-format gel, electrophorese the amplified DNAs, and excise the desired PCR products from the gel.**
6. **Use the QIAEX II kit to extract and purify each 5' and 3' flanking PCR product.**
7. **Check for recovery of your PCR products using an agarose mini-gel.**
8. **Quantify recovery of your PCR products using the DyNAQuant 200 Fluorometer.**
9. **Use Powerpoint to assemble a publication-quality figure, including a complete legend, for your DNA gels; and perform a simple *in silico* analysis of your favorite gene.**

Week 3: PCR Step I - Amplify & purify flanking DNA regions on either side of the target gene

Figure 2A: PCR amplification of *rad1* 3' and 5 flanking regions: *Aspergillus nidulans* strains used were PCS439 (*riboA*1 *yA*2) and SWJ400 (*pabaA*1 *yA*2; *nimO*18). ~2.01kb and ~1.83kb *rad1* 3' and 5' flanking regions were amplified in two separate PCR using 2 sets of primers 3'FOR and 3'REV, 5'FOR and 5'REV. Primers 5'REV and 3'FOR incorporated complementary *pyrG* tails, which were to be used in a 3-way fusion PCR with *pyrG*. **Key to lanes: 1** λ*Hind*III markers (625ng) , **2,3 *rad1*** 5' flanking region, **4,5 *rad1*** 3' flanking region **Figure 2B:** 3' and 5' *rad1* flanking PCR products were excised and QIAEX purified. Duplicate products were pooled and quantity was assessed by electrophoreses of 2μof each amplified flanking region. **Key to lanes: 1** λ*Hind*III markers, **2** Pooled ***rad1*** 5' flanking DNA, **3** Pooler ***rad1*** 3' flanking DNA.



Week 4: PCR Step II - 3-way fusion PCR

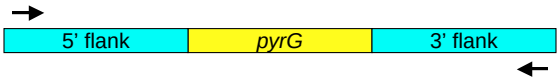


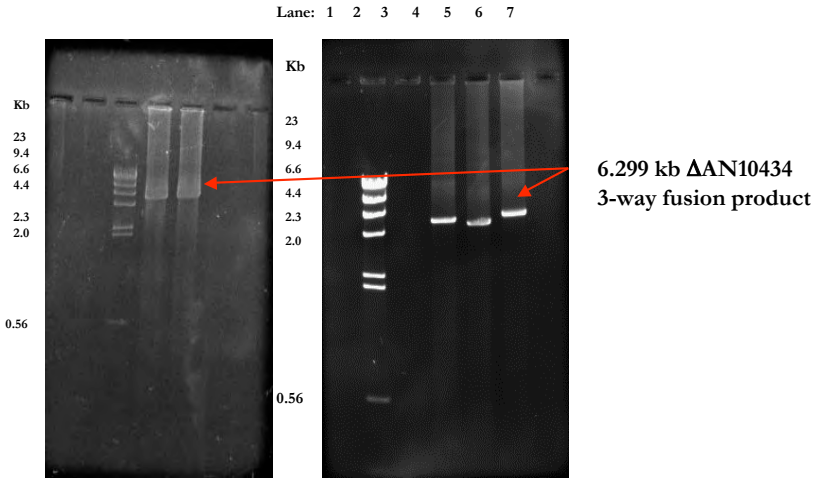
6.0 kb 3-way fusion

2-way fusion products

Individual flank DNAs + *pyrG* A.f.

Week 5: PCR Step III - Nested PCR to prepare for transformation





6.299 kb ΔAN10434
3-way fusion product

Week 6: Transform *A. nidulans* with deletion constructs

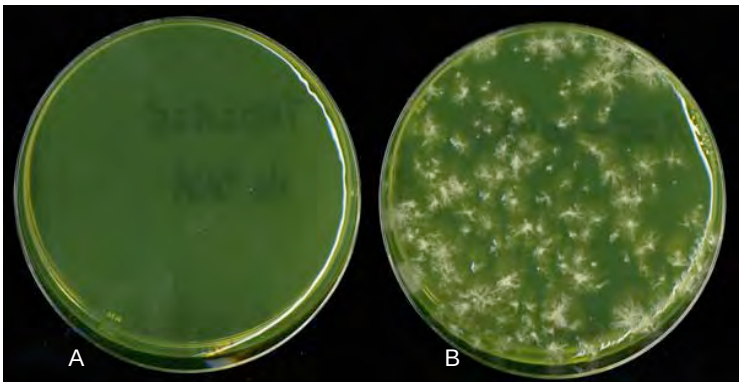
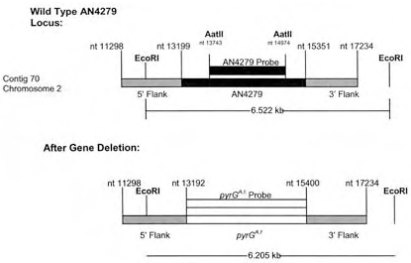


Figure 5. Successful transformation of *A. nidulans* with ΔAN10434 deletion construct

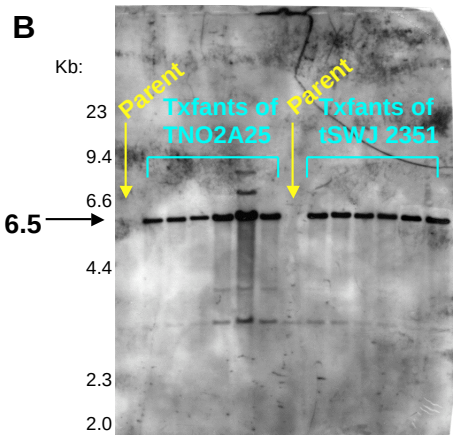
The purified 3-way fusion construct was transformed into TN02A25 (pyrG89 pabaA1; ΔnkuA::argB; riboB2). Transformants were plated on medium lacking uridine and uracil as a means to screen for the successful integration of the *pyrG A.f.* fusion construct. Equal numbers of protoplasts were plated in A and B. Plates were grown for 3 days at 29ºC. (A) No DNA control transformation. (B) Transfomation with ΔAN10434.

Weeks 7-11: Purify transformants, prepare gDNAs, identify deletions by Southern blotting

A

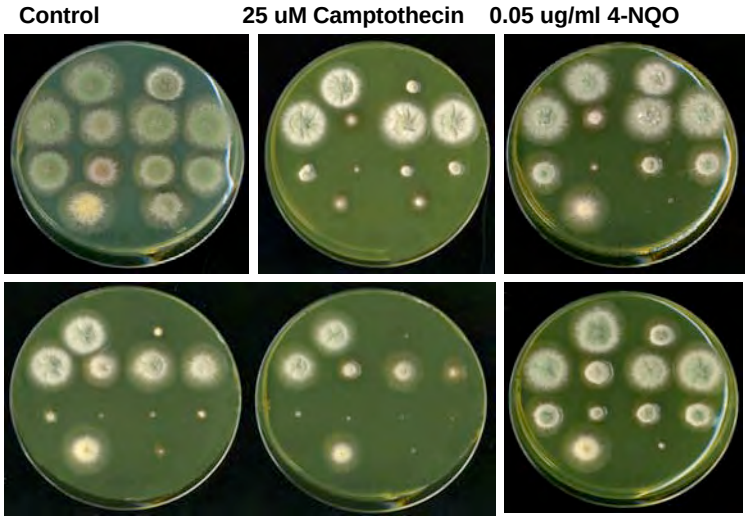


B

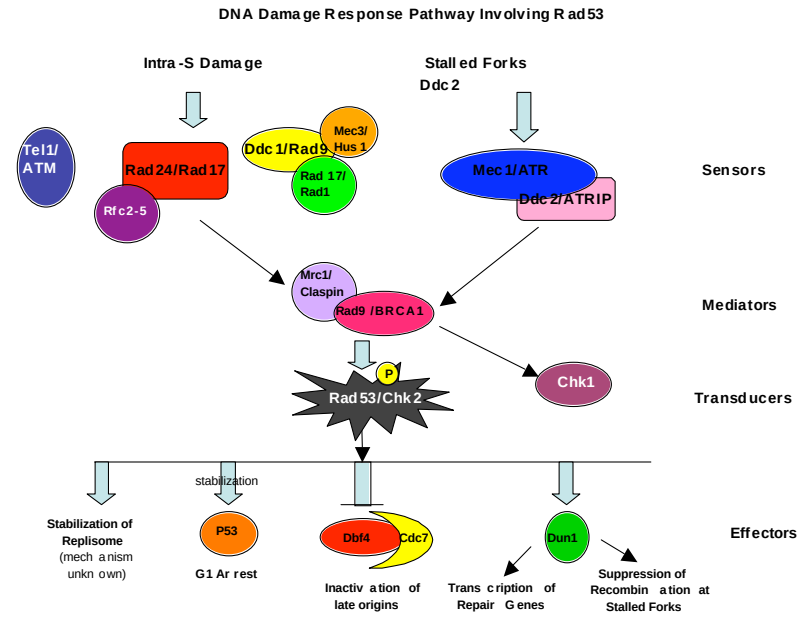


*EcoR*I digests probed with *pyrG A.f.*

Week 12: Phenotypic analysis to test for sensitivity to DNA damage agents



Adapted from Branzei & Foiani 2006, Sancar 2004



Summary:

To complete the project, students…

1. **Create a pathway diagram to describe the function of their gene within the context of DNA damage control**

2. **Write a 1-2 page abstract that describes everything known about their gene**

3. **Write a complete scientific paper, as-for-publication, to document their semester-long efforts**

MOLECULAR GENETICS (Biology 351) - Fall, 2006

Course objectives: The Central Dogma of Molecular Biology describes how information flow occurs, from DNA to RNA to protein, in all living systems. This course examines the mechanisms by which the elaborate processes of life, governed by complex machines made of protein and/or RNA, are derived from a linear, digital DNA codex; how the integrity of the genetic endowment is maintained and how DNA is replicated faithfully despite constant injury and the threat of mutation; how sophisticated regulatory mechanisms are able to sense changing environment and respond by altering the genetic program; and how disease states may perturb both the overall structure of the genetic material and the control of individual genes. By examining current research in topical areas of molecular biology, and by applying methods of molecular biology to study eukaryotic gene function, students will deepen their understanding and appreciation of the beauty, complexity, and subtlety of life at the level of molecule and gene.

Student learning objectives: Students in this course will develop the following competencies:

1. Develop a complete and detailed understanding of the Central Dogma of Molecular Biology, elaborated through the study of current research problems; understand the mechanisms by which DNA is replicated, transcribed, translated, repaired, and recombined; understand the basic techniques for studying nucleic acids and proteins, and how they are applied.

2. Develop an appreciation for the complexity of living processes at the molecular level; understand how gene expression and protein function can be rapidly altered in response to environmental stimuli, and how these changes, controlled by intricate regulatory circuits, modify behavior at the level of cell and organism.

3. Become proficient at reading, analyzing, and understanding original research articles in the field of molecular biology; develop an understanding and appreciation for the *experimental* approach, *i.e*., how the varied tools and methods of molecular biology can be used to ask, and answer, scientific questions that reveal new insights about biological processes.

4. Become proficient at laboratory techniques for DNA isolation, manipulation, cloning, and analysis.

5. Develop the ability to write a complete scientific paper, as for publication. During the writing process, students will learn how to (a) synthesize the data from a variety of experiments into a cohesive summary, (b) analyze their experimental results, and (c) integrate their findings into a theoretical framework, namely checkpoint control and the DNA Damage Response (DDR) in eukaryotes.

Capstone experience: *Molecular Genetics* integrates learning from a number of different foundational courses, including *Genetics* (Bio 211), *Cell Biology* (Bio 212), *Bioinformatics* (Bio 251), *Microbiology* (Bio 230), and *Biochemistry* (Chem 333, Bio/Chem 334). In addition, *Molecular Genetics* shares significant disciplinary approaches and principles with *Immunobiology* (Bio 332) and *Evolution* (Bio 314). Furthermore, *Molecular Genetics* provides the opportunity for students to demonstrate proficiency at communication conventions of their major, through the writing of a comprehensive scientific paper. This comprehensive paper is linked with the semester-long research project that forms the basis for the laboratory component of the course. For these reasons, *Molecular Genetics* may be used in fulfillment of the **capstone experience** for majors in Biology or Biochemistry and Molecular Biology.

MOLECULAR GENETICS (Biology 351) - Fall, 2006

Lecture:	MWF	9:00 am	356 Science Center (Chemistry seminar room)
Laboratory:	T	1:10 - 5 pm	252 Science Center
Instructor:	Steve James		255 Science Center x6170 e-mail: sjames@gettysburg.edu

Text: Molecular Biology, 3rd edition. By Robert F. Weaver. McGraw-Hill, 2005

Additional readings will be assigned, copies of which will be housed in 252 SC.

Lectures: Advance preparation and class participation is expected. Textbook and reserve readings must be completed prior to the class for which they are assigned. Problem sets will be assigned during the semester to aid in learning and exam preparation. These problem sets will be graded.

Laboratory: The laboratory consists of a multi-faceted, semester-long project in which the student will use molecular genetic techniques to perform a gene deletion and then characterize the phenotypic consequences of the gene knockout. Due to the length and scope of some experiments, students will work semi-independently and will occasionally need to work outside of the scheduled laboratory. The student will write a comprehensive scientific paper to analyze the results of the project, and integrate these results into a theoretical framework related to the maintenance of genome integrity.

Course Grade:

Three one hour exams	13.3% each
Final exam	15% (1/4 course review)
Homework and quizzes	10%
Lab assignments	20%
Laboratory paper	15%

(Note: overdue assignments will reduce by one letter grade for each day late)

Attendance in lecture and lab is mandatory. A student with more than three unexcused absence from lecture, or from one laboratory, will be invited to leave the course.

BIOLOGY 351 – FALL, 2006

Molecular Genetics

COURSE SCHEDULE

Steve James
255 Science Center
337-6170
sjames@gettysburg.edu

Science Center 356
MWF 9 – 9:50

LAB: 252 SC, T 1 - 5

Date	Lecture topic	Laboratory
Aug 28 30 Sept 1	First class: Orientation to Laboratory project How (and why) to delete a gene (continued) CDMB: Alkaptonuria unites molecular biology from fungi to man	Choose partner: Begin designing gene deletion - bioinformatic surveys
Sept 4 6 8	Molecular and *in silico analysis*: homogentisate dioxygenase gene Building blocks: discovery of nucleic acid structure Nucleic acid chemistry	Design and order PCR primers for gene deletion (3-way PCR)
Sept 11 13 15	Nucleic acid metabolism and related disorders Physical behavior and topology of DNA molecules Topoisomerases, DNA topology, cancer & bioterrorism	Polymerase Chain Reaction (PCR), Step 1
Sept 18 20 22	Analysis of Chen *et al*. 1996. Gyrases, antibiotics, & DNA cleavage Analysis of Chen *et al*. 1996. Gyrases, antibiotics, & DNA cleavage Translation of proteins in prokaryotes & eukaryotes: initiation	Step 2 of 3-way fusion PCR to prepare gene deletion construct
Sept 25 27 29	**EXAM 1** Translation of proteins: elongation and termination VIDEO: Human genome project	Final step of fusion PCR/clone construct - DNA-DNA ligation: create recomb. DNA
Oct 2 4 6	Ribosomes and transfer RNA Genetic Code: degeneracy, wobble, & tRNA suppression The other Genetic Code: Aminoacyl tRNA synthetases & evolution	Restriction enzyme analysis of recombinant plasmids
Oct 9 11 13	**READING DAY** Post-translational controls: MPF and the cell cycle Analysis of Gould & Nurse, 1989: Phosphorylation/dephosphorylat'n Control of cell cycle progression by regulated proteolysis	DNA-mediated trans-formation of *Aspergillus* - *purify transformants*
Oct 16 18 20	Analysis of papers: the Anaphase Promoting Complex (APC/C) Checkpoint control and the cell cycle Checkpoint control: the DNA Damage Response (DDR)	Prepare genomic DNA from transformants; screen phenotypes
Oct 23 25 27	**EXAM 2** The replicon and initiation of DNA replication in *E. coli* *dnaA*, *dnaB*, *dnaC* and the initiation of DNA replication Control of	Southern blot analysis of transformant DNA Part I

	30	The replisome and DNA synthesis in *E. coli*	Southern blot analysis of transformant DNA Part II
Nov	1	DNA synthesis in eukaryotes: G1/S transition	
	3	The CHIP assay: Analysis of Aparicio, Weinstein, and Bell (1997)	
Nov	6	Analysis of Aparicio, Weinstein, and Bell (continued)	More phenotypic screening; prepare figures for final paper
	8	Maintaining genome integrity: mutation and DNA repair	
	10	Base excision repair and Nucleotide Excision Repair	

Nov	13	Mismatch repair in prokaryotes versus eukaryotes	Finish experiments; draft final laboratory paper
	15	Recombination repair and the SOS response	
	17	Double-strand break repair	
Nov	20	**EXAM 3**	Submit draft of paper
	22	**THANKSGIVING RECESS**	
	24	**THANKSGIVING RECESS**	
Nov	27	Prokaryotic transcription: RNA polymerase & promoters	Field trip: Armed Forces DNA Identif'n Laboratory (AFDIL)
	29	Gene Expression in prokaryotes: σ factors and regulators	
Dec	1	The *lac* and *trp* operon models for gene regulation	
Dec	4	*lac* operon: DNA-protein interactions	Finish laboratory paper
	6	*lac* operon (continued)	
	8	Terminating transcription: Attenuation in the *trp* operon	
FRI, DEC	**15**	**FINAL EXAM, 1:30 - 4:30 pm**	

Additional topics that could be covered in place of other syllabus topics:

The end-replication problem: Telomere structure/function
Telomeres and telomerase in cancer and aging
Telomeres and telomerase: analysis of research papers

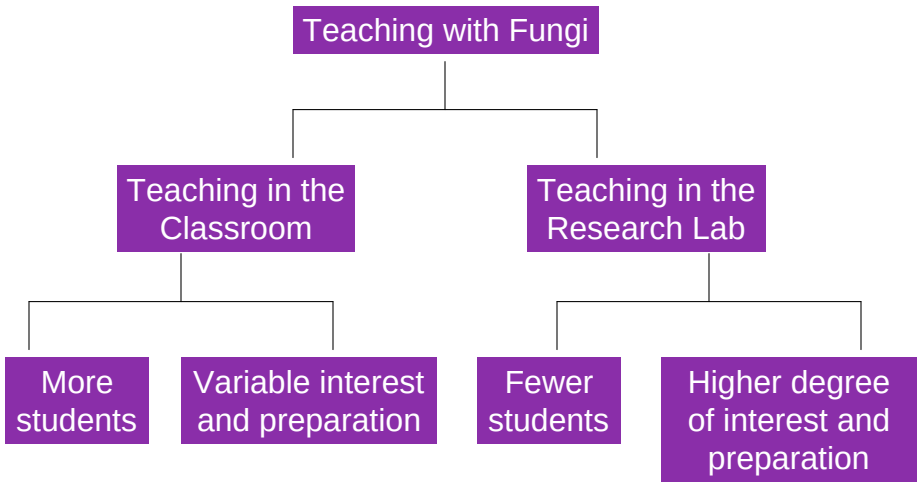
MILLSAPS COLLEGE

Teaching with Fungi: From College Freshmen to Seniors

Sarah Lea McGuire

FUNGAL GENETICS
ASILOMAR MARCH 2007

MILLSAPS COLLEGE



MILLSAPS COLLEGE

Teaching Goals

- Teaching in the Classroom
  - Demonstrate cellular processes, structures, phenomena; teach scientific method and reasoning
  - Stimulate Imagination
- Teaching in the Research Lab
  - Stimulate Imagination
  - Teach research methods, data analysis, experience scientific community

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Teaching in the Classroom

Freshmen

Sophomores

Juniors/Seniors

http://www.fgsc.net/teaching/labfungi.htm

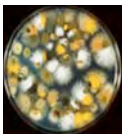
MILLSAPS COLLEGE

Types of Activities

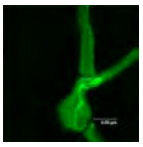
Freshmen

- General aseptic technique

- Scientific method/classic experiments
- Genetics: Analysis of cross progeny



- Cell Biology: cytoskeleton, nuclei, and other subcellular structures



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Lessons Learned

Teaching in the Classroom: What Doesn't Work

Freshmen

- Using unclear phenotypes
- Asking students to design/conduct a series of experiments with several new skills
- Expecting students to understand how to make solutions before you teach them
- Asking students to write a full scientific paper on their experiments before they've learned the various parts of a paper

Teaching in the Classroom: What Works

- Choose easily visualized markers
- Teach students one skill at a time
- Prepare solutions/media for the students
- Have students analyze results of experiments
- Teach writing one section at a time

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Types of Activities

Sophomores

- **Biochemistry: Classic location of point of block of a biosynthetic pathway (*Neurospora*)**
- **Genetics: Gene mapping, epistasis, mutant analysis (*Aspergillus*)**
- **Molecular Biology: Transformation (*Saccharomyces*)**
- **Cell Biology: Effects of mutations on cell structures (*Aspergillus, Saccharomyces*)**

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Lessons Learned

Teaching in the Classroom: What Doesn't Work

Sophomores

- **Asking students to design a complete set of experiments at the beginning of the semester**
- **Having students prepare all of their media**
- **Using unclear phenotypes**

Teaching in the Classroom: What Works

- **Have students carry out and analyze all experiments**
- **Link weekly activities to teach students how to design a progression of experiments aimed at a specific goal**
- **Teach literature review and write a complete paper in sections**

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Types of Activities

Juniors/Seniors

- **Combine molecular, genetic, biochemical, and cell biology techniques through semester-long projects**
- **Generate/analyze sets of double mutants and to determine/characterize genetic interactions (*Saccharomyces*)**
- **Use strains from the research laboratory and have students design/conduct experiments to analyze these**

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Lessons Learned

Teaching in the Classroom: What Doesn't Work

- **Requiring too *little* of the students**
- **Unclear expectations**
- **Too little support**

Juniors/Seniors

Teaching in the Classroom: What Works

- **Set high expectations**
- **Approve experimental design before allowing students to perform experiments**
- **Have students prepare scientific papers reporting their findings**
- **Have students make oral or poster presentations of their work**

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Teaching in the Research Lab

Goals

Teach critical thinking skills and scientific thought

Help students master a variety of techniques and understand their applications

Help students explore scientific research as a career prospect

MILLSAPS COLLEGE

Teaching in the Research Lab

Teaching in the Research Lab: What Works

- **Provide students with projects that have attainable goals and have a high likelihood for success**
- **Involve students in all aspects of the lab—from media prep to literature review and experimental design**
- **Start less experienced students with appropriate activities**
- **Make certain that students understand how their project fits into the overall goals of the lab**
- **Provide students with opportunities to present their data at scientific meetings**

MILLSAPS COLLEGE

Millsaps College Fungal Genetics Research Team

Research for now…

Research for the future.

Yulon Stewart | Michael Yablick | Sarah Lea McGuire | John Gibson | Kirk Jackson

Bringing student inquiry and research into your courses by collaborating with graduate research consultants or advanced undergraduates

Patricia Pukkila

Professor of Biology and

Director, Office of Undergraduate Research

XXIV Fungal Genetics Conference, 2007

Goals for session

- Assumptions
- Use collaborative learning model to address a complex problem
- Resources

Assumptions

- Goals as educators include facilitating student progression from “novice” to “expert”
- We can each recall an example from our own experience when we made such a transition

Start with your experience

- Grads and postdocs: when you first made the transition to viewing yourself as a professional
- Insight: “they can’t be right about that”
- Insight: “whoops, there is a better way for me to think about this”

2 minutes to discuss your novice→ expert transition with person next to you

Problem for today

Students rely on memorization, assimilation, imitation (“novice” approaches)

What might work to encourage original inquiry (“expert” approaches)?

5 minutes to discuss with person next to you

Summary

- Motivation to actually learn the material and be excited to learn more
- Guide the students to design the experiment but to be flexible when things don’t work and be willing to learn from that and know that is ok and a part of the process. Don’t be afraid to try! Experiment works, may learn something new.
- Could give experiment that won’t work to learn and trouble-shoot (boost ability)

Summary - 2

- Give project where chance to revise and redo to improve and make better and build that into the process. Allow them to help and make the process better.
- Avoid detachment from the real world. Make work applicable and tied to the real world.
- Students having the ability to present or teach their work and to demonstrate their knowledge to others. The realization that they know what they are talking about.

Resources-GRC model

- Collaborative teaching enables collaborative learning (value of peer perspectives)
- Graduate research consultants (GRCs) enable separation of educator/evaluator roles (GRCs do not participate in grading)
- GRC model encourages small-scale changes (student presentations→student proposals)

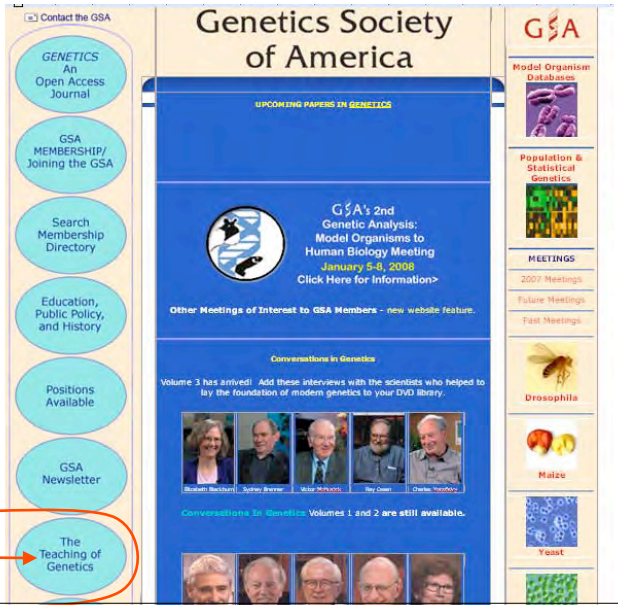
Resources-Campus reaccreditations

THE UNIVERSITY
OF NORTH CAROLINA
AT CHAPEL HILL

MAKING CRITICAL CONNECTIONS

QUALITY ENHANCEMENT PLAN

Resources: publications http://www.genetics-gsa.org/



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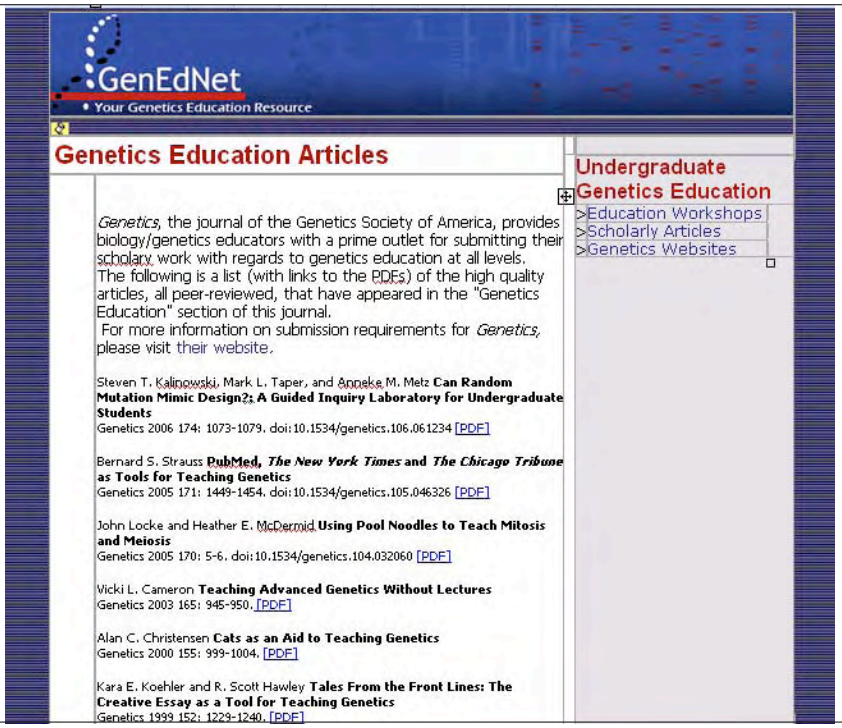

Dynamics I experienced

- Joys of moving from novice to expert in science
- Peer discussion (importance of trust)
- Collaborative learning
  - Focus on the different ways we can seek solutions
  - Develop our abilities to improve as educators

Thank you!