

Addressing Chilly Climates in Science and Engineering PhD Programs:

Lessons from the Fisk-Vanderbilt Bridge Program



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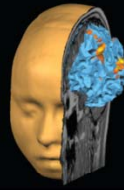
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Fisk-Vanderbilt Masters-to-PhD Bridge Program





Fisk-Vanderbilt Master's-to-Ph.D. Bridge Program

physics and astronomy • biological sciences



Bernadette Cogswell, nuclear physics

*Nothing worthwhile is ever easy.
We just help make it possible.*

you can
Reach for the Ph.D.
tú puedes

Who should apply

- Students with undergraduate majors in physics, biology, chemistry, computer science, math, and other science disciplines
- Students motivated to pursue the Ph.D., but who require additional course work, training, and/or research experience

How the program works

- Earn a master's degree at Fisk University, with full funding support.
- Along the way, receive valuable research experience with caring, dedicated mentors.
- Get fast-track admission to one of the participating Vanderbilt Ph.D. programs, with full funding support.

www.vanderbilt.edu/gradschool/bridge
www.fisk.edu/bridge



biomedical sciences • materials science • imaging science



Matthew Richardson, astrophysics



Brittany Kamai, astrophysics



Michael Williams, astrophysics



Nashville, Tennessee

Fisk-Vanderbilt Masters-to-PhD Bridge Program

Get the preparation you need to earn a PhD

1. Earn a Masters degree in physics, chemistry, or biology at Fisk, with full funding support.
2. Get valuable, paid research experience.
3. Receive preparation for the GRE.
4. Get fast-track admission to the Vanderbilt PhD program, with full funding support.
 - Physics & Astronomy
 - Biology and Biomedical sciences
 - Chemistry
 - Materials science and engineering

www.fisk.edu/bridge
www.vanderbilt.edu/gradschool/bridge

Snapshot of program outcomes so far

★ Since 2004:

- 67 Bridge students
- 61 Underrepresented minorities (all US citizens)
- 55% female
- Very high retention and persistence
 - 97% retention rate in STEM employment
 - 80% persistence to PhD (compare to 50% national average)

★ Since 2006:

- Fisk is top producer of Black MA degrees in physics, and top 10 producer of MA degrees in physics to US citizens

★ 2010:

- First Bridge PhD (now faculty at Alabama A&M)

★ 2012-13

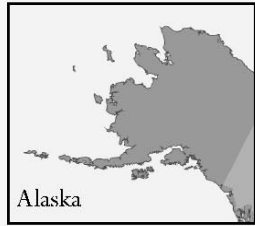
- Seven Bridge PhDs graduate (all received postdoc/faculty offers 6 months before graduation)
- STScI, Arizona, DOE, DOD, Intel, Johns Hopkins

★ 2014-

- Project 4-5 Bridge PhDs graduate per year

Historically Black Colleges and Universities

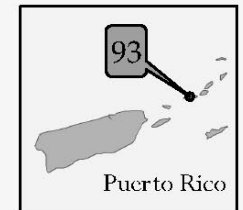
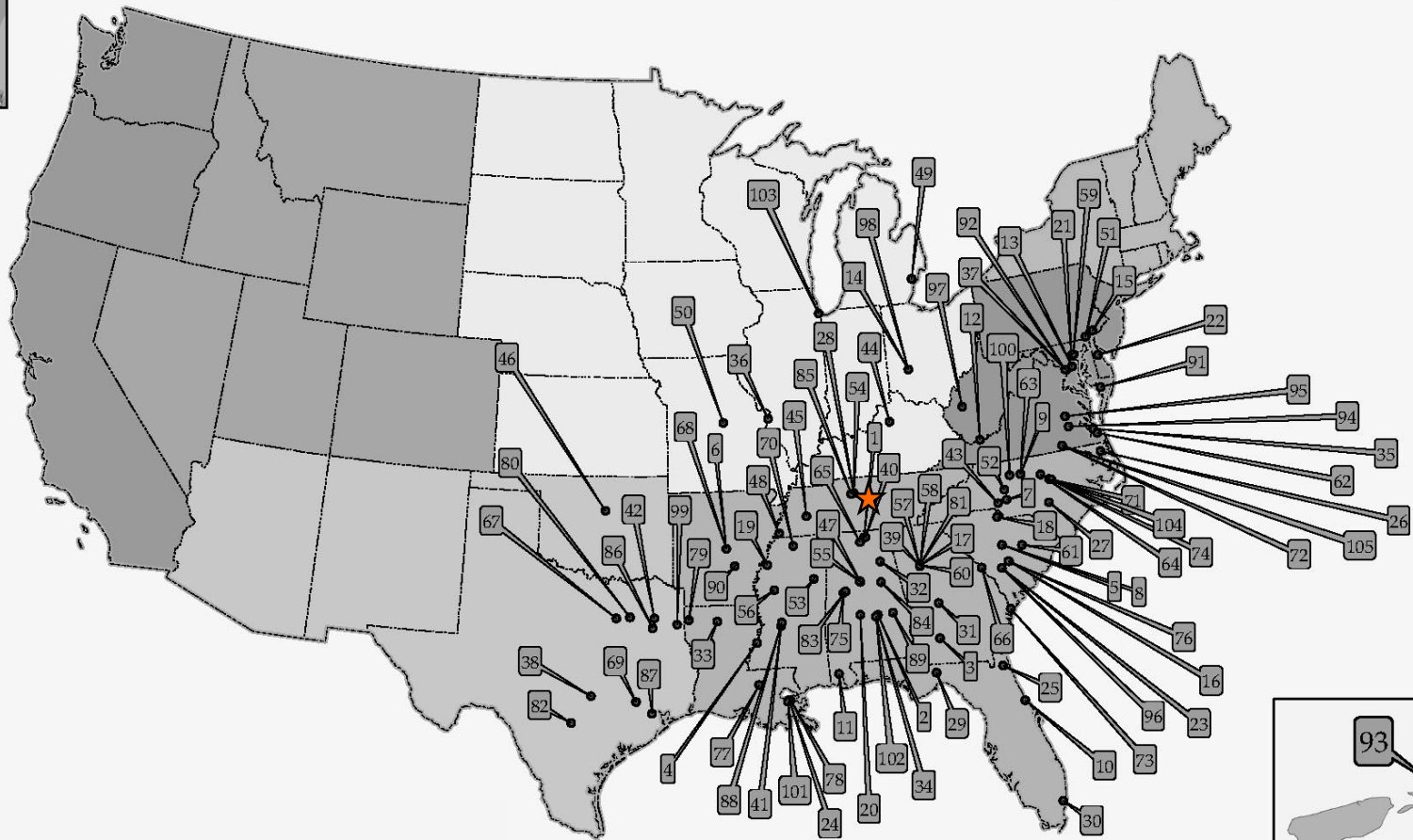
**Based on US Department of Education Statistics, 2003-2004



Alaska

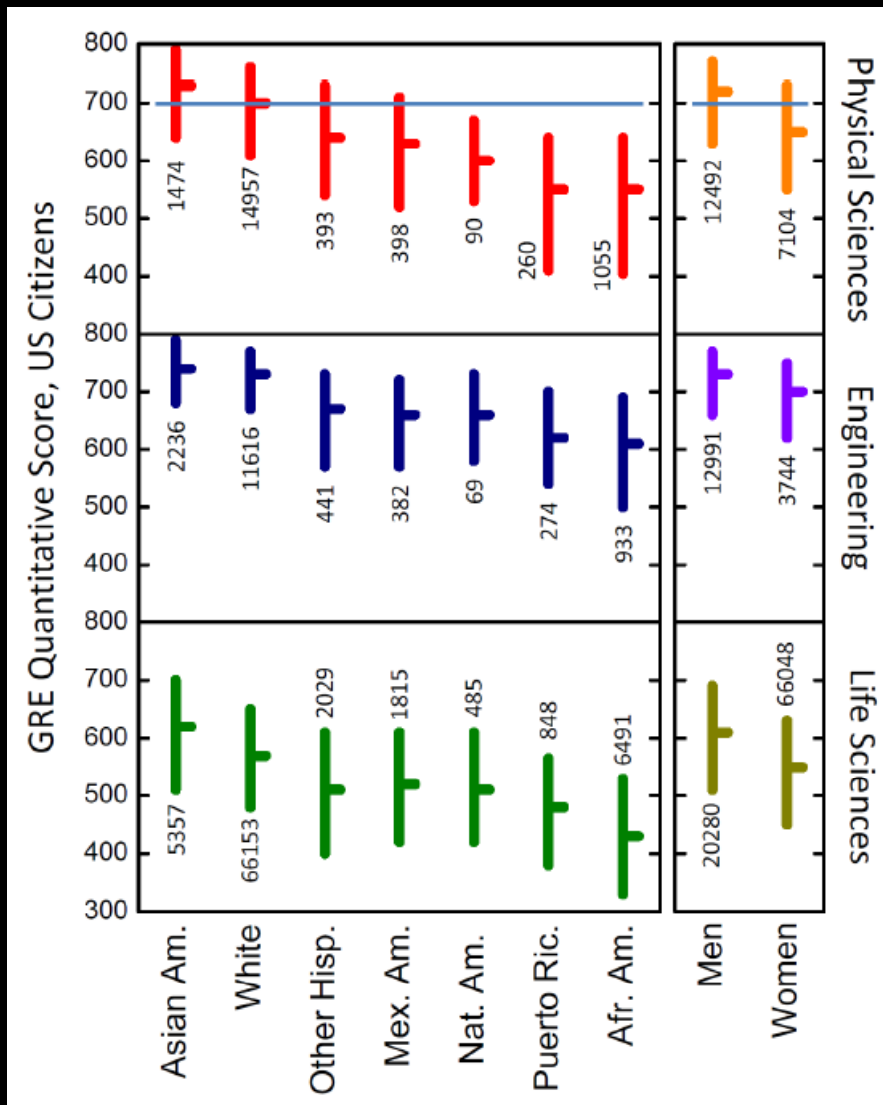


Hawaii



Puerto Rico

Misuse of GRE suppresses diversity



Miller & Stassun (2013, Nature, submitted)

- Use of GRE cutoff scores in grad admissions significantly impacts diversity.
- Can explain minority underrepresentation in PhD programs fully from GRE cutoff

Identifying Students Who Will Succeed

What roles are we looking for?

- * Commitment and academic potential
- * Productive, creative, entrepreneurial researchers
- * Effective teachers and mentors
- * Transformational leadership

What qualities predict success?

- * Passion, “fire in the belly”, “grit”
- * Ability to succeed in relevant courses
- * Ability in the laboratory
- * Persistence in the face of hardship (the “P” in PhD)
- * Entrepreneurial spirit

***Two most important elements in admissions:
(1) basic preparation, (2) grit***

“performance character”, “successful intelligence”

Applicant Interview Protocol

College Experience:

- High points
 - Describe the high points of your college experience.
 - What went well for you? / What are you most proud of?
 - Describe a time when you have faced a difficult academic challenge or hurdle that you successfully navigated. What was the challenge and how did you handle it?
 - What are you most proud of accomplishing?
- Low points
 - Were there any personal or academic obstacles or challenges that had a significant impact on your college experience?
 - Describe the low points./What didn't go well and why?
 - What failures did you have (a time also to probe for issues with the transcript)? How did you handle them?
 - What mistakes did you make?
 - What would you do differently?

Research Experience (in class, lab or other)

- Tell us about your most successful or interesting research experience, either in class, in the lab or at work?
- What was most challenging about it?
- How did you figure out what to do?
- What did you learn most from this experience?
- Who did you work with, and describe the working relationships.

Stassun et al (2011, Am. Journ. Phys.)

Key Relationships

- Who are the faculty or other mentors who have been most important to you during college? Would you tell us about that relationship—how it developed, how you work together, why it is important?
- If we talked to your mentor, what do you think he/she would say you are really good at?
- What would you say you could have done better?

Leadership/Service

- Have you had any experiences where you were playing a leadership or mentoring role for others?
- What did you do, and how did these experiences come about?

Goals and Objectives

- Why science? What is compelling to you about this opportunity with the Bridge program?
- Where do you want to take your career? What do you want to do long term?
- What concerns do you have?
- What will be the biggest challenge for you?
- Is there anything else we should know?

Stassun et al (2011, Am. Journ. Phys.)

Appendix B. Candidate Evaluation Worksheet
Fisk-Vanderbilt Masters-to-PhD Bridge Program

Candidate Name	
Interview Date	
Interviewer	
Interviewer	

Candidate Assessment (Rate on scale of 1-4)

Academic Preparation	Perseverance/ Fire-in-the-Belly	Relevant Research Exp.	Leadership/ Outreach Activities	Communication Skills/Presence	Overall

EXPLANATION:

Strengths

Weaknesses

Probe Further

Topics/Areas Probed	Additional Notes

Stassun et al (2011, Am. Journ. Phys.)



Dear <...>,

Congratulations! On behalf of the Fisk-Vanderbilt Masters-to-PhD Bridge Program committee, I am pleased to report that we have voted to accept you in to the Bridge program. You should soon

Should you choose to join the Bridge Program, you will be joining a community of faculty, postdoctoral researchers, a network of collaborators at national labs and other universities, and of course your fellow students, all dedicated to mutual success in academics and research. Even as you will have opportunities to develop as a mentor to younger students and outreach, you will benefit from an extended "family" of mentors yourself, including the Bridge Program directors, the Bridge Program faculty steering committee, the faculty and postdocs who will advise and supervise you in research, the Bridge Program Coordinators, and of course your fellow students who will serve as peer mentors and in whom you will find cohort, camaraderie, and a friendly community of support. By joining the Bridge Program, you are committing to bring your hard work and passion for science toward achieving the PhD, representing the highest academic degree that one can achieve. We commit to match your passion and energy, and to support you every step of the way. As you progress through the program and achieve ever higher accomplishments -- your first research internship, your first published paper, completion of the Master's degree, admission to Vanderbilt, winning a prestigious fellowship, passing the PhD qualifying exam, publishing your dissertation, and ultimately walking in the PhD hooding ceremony with your family and friends looking on -- we will cheer you and celebrate you.

In short, we will challenge and stretch you, perhaps more than you ever have been, because we expect the most from you and are committed to helping you grow and ultimately to succeed at the highest level. We will be on you and after you, and we will be with you.

Fisk-Vanderbilt Bridge Program

- ★ Selecting students with the promise to succeed
- ★ **Professional Development Seminar: “insider knowledge”**
 - Time management: “40 hr/wk is not what we meant by ‘work hard’”
 - Network of mentors: “Mentors, advisers, friends”
 - Scientific productivity: “Always be writing”
 - Presence: “Being there is half the battle”
 - Leadership: “If you do exactly as you are told, you fail”
 - Identity formation: “Be worthy”
- ★ Active monitoring of performance and progress

Seminar example: Time Management

There are $7 \times 24 = 168$ hours in a week.

1. Sleep: 50-60 hours/week.
2. Eat: 30 hours/week.
3. Work: 50-60 hours/week.
 - Research
 - Courses
 - Other school related activities
4. Personal time: 10 hours/week.
5. Exercise/recreation: 7 hours/week.
6. Miscellaneous: 7 hours/week.
 - Grocery shopping, etc.

Fisk-Vanderbilt Bridge Program

- ★ Selecting students with the promise to succeed
- ★ Professional Development Seminar: “insider knowledge”
- ★ **Active monitoring of performance and progress**
 - Network of *research* support (postdocs, senior grad students)
 - Regular check-ins with course instructors, tutoring, crisis intervention
 - Community: “critical mass” and “tiered mentorship”

Checkpoint Timeline

Boot Camp Skills Assessment Test
 Fall Semester Y1 Mid Semester Check-In
 E-poster Session
 Fellowship Application
 Grades
 Spring Semester Y1 Bridge Path Meeting
 Setting up Committee
 Rotations for Chem
 Committee Meetings
 Mid Semester Check In
 General GRE Prep
 Grades
 Summer Semester First Round Physics GRE
 General GRE
 Summer Internships
 Fall Semester Y2 Fellowship Applications
 Round 2 Physics GRE
 Committee Meetings
 Mid Semester Check In
 DGS Meetings
 Identify Alternate Programs
 Grades
 Grad School Application
 Spring Semester Y2 Thesis Writing Workshop
 Mid Semester Check In
 Grades
 Committee Meetings
 Summer Semester Y2 Thesis Writing
 Thesis Defense

Purpose

Determine Academic Preparation
 Determine Academic Progress
 Engage Faculty and Assess Preparation for Research
 Professional Development and Promote Understanding of Project
 Assess Academic Performance
 Identify and Engage Vandy Advisor- Identify Target Test Scores
 Identify and Engage Vanderbilt Advisor
 Connect with potential PhD mentors at Vanderbilt
 Engage Vanderbilt Adviser/Confirm Research Plan
 Determine Academic Progress
 Ensure Test Preparation
 Assess Academic Performance
 Assess Progress toward Target Scores/ Identify gaps in knowledge
 Assess Progress toward Target Scores/ Identify gaps in knowledge
 Professional Development/Research Training
 Professional Development and Promote Understanding of Project
 Acquire Score for Application
 Engage Vanderbilt Adviser/Assess Research Performance and Plan
 Determine Academic Progress
 Present research and performance to Vanderbil DGS
 Assist in successful Bridge to PhD
 Assess Academic Performance
 Assist in successful Bridge to PhD
 Professional Development/Initiate Thesis Prep
 Determine Academic Progress
 Assess Academic Performance
 Engage Vanderbilt Adviser/Assess Research Performance and Plan
 Assess Understanding of Results and Ability to Synthesize Information
 Assess Understanding of Results and Knowledge Base

Research Rubric

May 15, 2013

Indicator	"A" Grade	"B" Grade	"C" or Lower Grade
Defines Objectives	Is actively involved in defining aggressive and achievable objectives that thoroughly addresses fundamental project needs.	Aids in defining objectives. Some may be too simplistic or unrealistic.	Takes little initiative in defining the project.
Demonstrates Technical Awareness	Clearly demonstrates an awareness of the works of others and establishes a context for the project. Shows an understanding of information from multiple literature sources.	Shows understanding of the work in the field, but has limited depth and breadth. Knowledge is limited to faculty provided materials.	Fails to demonstrate an awareness of the works of others and the significance of their project.
Obtains Appropriate Results	Obtains meaningful results with minimal wasted effort.	Produces some results but not enough (or too many).	Generates few meaningful results.
Interprets Data Appropriately	Provides thorough and correct analysis of data.	Provides analysis but partially incorrect or not sufficiently thorough.	Little meaningful analysis of data or blatantly incorrect.
Formulates Supportable Conclusions	Formulates and adequately supports meaningful conclusions.	Needs significant help in formulating meaningful conclusions or lacks sufficient support for their conclusions.	Conclusions are absent, wrong, trivial, or unsubstantiated.
Organizes Tasks	Effectively organizes project tasks to minimize wasted time and effort.	Identifies relevant tasks but may struggle with setting priorities and planning.	Has difficulty converting broad objectives to specific tasks.
Meets Deadlines	Consistently meets deadlines.	Misses some deadlines despite reasonable effort.	Routinely ignores deadlines.
Executes Project Plan	Effectively executes the project plan. Makes significant progress. Modifies the plan as necessary.	Executes the project plan but has difficulty overcoming setbacks.	Works haphazardly with little chance of achieving project objectives.
Keeps Detailed Records	Keeps detailed records easily followed by others. These records include a laboratory notebook, computer files, purchase records and others	Keeps a lab notebook but records lack organization or contain omissions.	Keeps poor, sketchy or no records.
Written communication	Written and oral communication is of high quality, student clearly expresses the questions and findings in his/her research.	Written work is clear and adequately complete, but may lack precision and/or concision.	Cannot elucidate research questions and cannot adequately present data.
Professional Conduct	Consistently behaves in a professional manner (shows up for meetings prepared and on time, treats vendors, technicians, team members and staff with courtesy and respect, external communications are formal and businesslike) Always dresses appropriately (long pants and safety glasses in labs, business attire for industrial meetings and presentations, etc.)	Usually behaves in a professional manner (shows up for meetings prepared and on time, treats vendors, technicians, team members and staff with courtesy and respect, external communications are formal and businesslike). Usually dresses appropriately. Does not repeat errors	Frequently fails to behave in a professional manner (shows up for meetings prepared and on time, treats vendors, technicians, team members and staff with courtesy and respect, external communications are formal and businesslike) Frequently fails to dress appropriately.

Fisk-Vanderbilt Masters-to-PhD Bridge Program Active Students –January 2013

Student	Comments/Actions
Aretha Koval	
Paul Weatherholt	On Department Probation
Bella Gordy	
Solange Olivarez	
Latricia Gould	
Myrna Cavanaugh	
Elene Ryant	
Louvenia Scroggins	
Brande Wardwell	
Markita Mooneyhan	
Emmaline Toledo	
Lorraine Hoffert	
Sherril Funk	
Leota Ganz	
Grover Tullier	
Nickie Paton	
Ruthie Prouty	
Janice Johnston	Still not clear if she will generate the data to complete research thesis
Lahoma Spargo	
Leonora Clingan	
Anibal Shires	
Thurman Arn	
Andrew Kehrer	Working to keep him motivated
Greg Hyman	
Leonor Wellner	Improving in Research, still not grasping concepts well
Lyle Gauthier	
Alec Mincey	
Tawny Cantara	

Fisk-Vanderbilt Bridge Program

Rodolfo Montez Jr.:

Hard to believe, but I actually began my secondary education as a business major after a misguided attempt by my high school counselor to steer me in a more fruitful direction. After two years, I craved application of the scientific method and it was a comment made by a friend that sparked the new direction. She remarked on how I talked non-stop about the introductory astronomy course I took to fulfill my science credit. I began my new course at the University of Texas at Austin where I received a BA in Astronomy and a BS in Physics. I honed my interests with a few summer Research Experiences for Undergraduates (REU) programs in radio astronomy and instrumentation, evolved stars, and HST/STIS observations of Jupiter's aurora. I began my PhD studies at the University of Rochester and Rochester Institute of Technology, where I received training in physics, astronomy, and imaging science. As a result I have used the Interactive Data Language (IDL) to perform Bayesian classification on data sets to image reconstruction. My primary interests resides in multi-wavelength observations of young and evolved stars. In my spare time I enjoy bird watching and the nuances of a freshly-roasted cup of coffee.

Basic skills: research (observational multiwavelength astronomy, data mining, data visualization), programming (IDL, tcl/tk, shell), web development (HTML, CSS, Javascript, PHP, MySQL), presentation and writing (tips and critique).

Jillian Bellovary:

After studying astronomy, physics, and philosophy at the University of Wisconsin-Madison, I joined the U.S. Peace Corps and taught physics at Gambia College in The Gambia, West Africa. I did my PhD at the University of Washington in Seattle, focusing on the formation and evolution of massive black holes in cosmological simulations. I did a two-year postdoc at the University of Michigan before coming to Vanderbilt. In addition to simulation work, I've dabbled in infrared and X-ray observations as well as SDSS data. The main questions I want to answer are How do massive black holes form? How do they grow to form supermassive black holes? What happens to the black holes that don't end up in galaxy centers? I am proficient at IDL, C and LaTeX, and I have rudimentary skills with perl and python. In my free time I like to play roller derby and knit socks.

Basic Skills: running and analyzing large-scale hydrodynamic simulations, analyzing and plotting anything in IDL, giving very good talks, CV and personal statement critiquing, manuscript editing, pep-talking

Fisk-Vanderbilt Bridge Program



Postdoc Meeting Record- Post Doc Jane Bell, mentoring Fisk first year student Bryce Camp.

5/13/13

Final Grades in E&M I and Quantum I were B+ and A- respectively. He has spoken to the professor about the E&M grade and plans to do some additional work in that area this summer.

Research progress has been minimal. Needs to define more specific goals with Advisor. Will come back next week with research goals and a plan for GRE studying over the next couple months.

Bryce is planning on applying for the NSF fellowship next year. We are starting to brainstorm some volunteer opportunities for broadening participation.

4/2/13

Defend in July 2013.

Action Items

- Get thesis outline to Norm on 11th or 12th
- Send paper to collaborators this weekend.
- Submit by Friday
- Issue with laptop (crashes once a day with a signs of hardware failure. Battery needs to be serviced and CD-Rom no longer works. Macbook Pro; Files are backed up)

