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## Minutes of the Regular Meeting of the Academic Council

Thursday, November 21, 2013

**Joshua Socolar (Chair of Academic Council/Physics):** Hi everybody, welcome, to our third meeting of the academic year. Our agenda is full today with proposals that require our approval, but we do have some experience with this now from last month and I am confident that we're going to manage it. I am guessing though, that when you signed up to serve on this Council, you expected to be involved in discussions of policies and actions of a different sort. So before we move into our agenda, I want to mention some topics that we'll take up at our next meeting and in the spring. ECAC is working to bring these topics forward, trying to strike the right balance in terms of the timing of Council discussions and committee work. We want the Council to make early contributions to discussions to help the relevant committees formulate agendas that will speak to our concerns. On the other hand, we'd like to have substantive committee reports when we have these discussions. So, there's a balance to be struck there and I appreciate hearing from any of you about ideas for agenda items. You can always just email them directly to me.

Here are several issues that have come to the fore this semester: First, the progress toward opening DKU. We will hear from Provost Lange and from Professor Haiyan Gao, the chair of the China Faculty Council, at our December 5 meeting. We'll also hear from the Executive Vice Chancellor of Duke Kunshan University, Mary Brown Bullock, at our Feb-

ruary meeting. These presentations will largely fall in the category of informational briefings, but we will reserve time for questions and substantive discussion as needed. Second, the development of online education efforts at Duke. At the December 5 meeting, after a presentation by Professor Hadley Cocks on our intellectual property policy as it relates to online materials, we'll hear from Scott Huettel, the chair of the Advisory Committee on Online Education. Scott's presentation will be a very short introduction to ACOE and its charge. And we'll then have a chance to discuss the direction that we think ACOE should pursue. So that will be December 5.

Third item, the proliferation of master's programs (laughter). There are several committees, including ECAC, APC, and a newly-constituted Graduate School committee, that are looking into the broader implications of the trend toward increasing the number of master's programs on campus. This topic will be brought up for discussion in the Council this spring. This is one of those questions of when we should have the conversation. Should we have it now or wait to let these committees do some background work and bring us a report that we can discuss? Finally, there's Duke's commitment to diversity. ECAC would like to promote a conversation about the diversity and inclusive campus culture that Duke's mission demands and how we might approach these issues as we move past the 50th anniversary of the arrival of the

first black students on campus. I'm not going to say anything more about that now, except that we're working to frame the issue for a Council discussion and we'd welcome your input. So stay tuned – and come to the Dec 5 meeting!

Let's start approving things. We'll start with an easy one. The minutes from the October 24th meeting stand ready (laughter). Are there any corrections or edits to the minutes?

(approved by voice with no dissent)

Next, we will hold votes on the three master's degree proposals that we heard at our last meeting. In accordance with our two-meeting rule for approving new degrees, our second item of business is to vote on the new degrees that we heard presented at our October meeting. For each of the degree proposals that we are voting on today the full proposal and supporting documents were posted again with today's agenda.

We'll first vote on the proposed master's degree in Medical Physics to be offered at DKU. Professors Fang-Fang Yin and Jim Dobbins are on hand to answer any questions anyone might have that were not addressed at that meeting. Are there any questions?

**Fritz Mayer (Sanford School of Public Policy):** So again, and maybe this is out of order, but I would like to raise the question I raised last time about the proliferation of these degrees. I appreciate that there's a process in place, and it sounds like that's a good thing, but it still feels a little bit cart-before-the-horse that we have three votes today, two other proposals lined up, I don't know how many others in the pipeline, I know of a few others. I guess I don't want to be obstructionist, I think these are fine proposals, but I'd like to hear a little bit more about what those committees are doing, at what point we

would hear a report, are there other proposals in the pipeline that would come to us before we get a report, just a little bit more of the context of this. I understand how these proposals arise and that they're faculty-driven, and I want to be supportive. But, I also think I'd at least like to hear the thinking of the administration and these committees about what our overall strategy is here.

**Socolar:** So, as I said, Dean (Paula) McClain is putting together, or has put together, a committee that will be looking into the data on how the master's programs might stress our resources in various ways and the impacts they might have, the influx that more master's students might have, on everything from residential issues to faculty responsibilities. I can't tell you exactly when that committee will have a report ready, and we don't necessarily have to wait for that report to have a discussion here in the Council. And so I'd be interested to hear from people about how we should approach this issue. I think the Provost might have some comment to make as well. Is that right, Peter?

**Peter Lange (Provost):** I can.

**Warren Grill (Biomedical Engineering):** Is there any time pressure then to vote on any of these proposals in advance of that broader discussion?

**Socolar:** Yes.

**Grill:** Why do we need to do these now?

**Socolar:** The reason for doing them now is so that these programs can start in the fall of 2014. Because the recruiting for them has to start happening as soon as possible, and that means they need to be approved by the Board of Trustees, and the meeting when that needs to happen is the December 6th meeting.

**Paul Baker (Nicholas School of the Environment):** I think for me the issue this raises is a very important issue. I'm not sure that the answer is going to be a data-driven answer. I think it's more of a philosophical question of what we want Duke University to be, where we want Duke University to go. It's a very big question. I don't know that it's going to have to do with credit hours and monetary value. I think it's going to be something bigger than that. I think it's a very important question. I don't know that we need to wait for it. I agree also that these are good proposals in front of us; I'm not saying anything specifically about them. But I think this is a hugely important question for the University.

**Dan Gauthier (Physics):** I suggest that we move forward with these. We've had a few proposals like this over the years come before us, and now we do see that there's a flux coming in, but why are we putting these at a disadvantage in comparison to the several others that have already come before this Council?

**Speaker:** Also because of the deadline, you're not going to see very many more (laughter). Basically once you get through these few, you can hold off, right? The next deadline is going to be next November.

**Socolar:** That is the strategy we're pursuing (laughter).

**John French (History):** I was going to say that the question about growing master's programs in response to the financial crisis of 2008 is an issue that's been out there for a while, and if we haven't addressed it yet, it does seem to me it's something we need to address. Because it's been an issue in general, and I understand departmental logics, and now with the additional cuts that are coming to Arts & Sciences, many more departments

are talking about offering master's programs. So there really is a big issue here, and I don't think it's a matter of being the same as what-ever came before. There's a sort of a tipping point question as well, and I think that's something that we need to consider.

**Socolar:** I'm going to let Provost Lange say a word about that.

**Lange:** Okay, so there are two observations to be made. We reviewed with ECAC all of the existing master's programs that are in the Graduate School now, especially those that have arisen since the downturn. And it's very, very difficult to identify any financial motive (laughter) that could have driven any of those master's programs, with a couple of exceptions. There are a couple; I'm not going to go over them here. But very few of them projected making a significant amount of money that would return either to the departments or to Arts & Sciences or any of the other Schools. You also notice that the master's programs are relatively dispersed: they're not in A&S and they're not all in departments. Some are in the medical school; they're in various Schools. So I think it would be a little misplaced to attribute all of these to a financial motive on behalf of the units or of the faculty members who are driving them. A number of these have been driven by the intellectual interests of the faculty members involved. There's been relatively little administrative participation in most of the degrees that we've examined to date. Now I can't speak for the long-term, okay? And it may be that with the inclusion of time and perhaps, as John says, some perceived sense of new financial pressures there are some departments that are taking these up. I will tell you, of the masters programs we have, I would say less than twenty percent have a financial return that would justify the amount of work and contributions that the faculty members are making. They're entering into these mas-

ter's programs for different reasons. I'm not excluding financial motives, but I don't think that it would be appropriate to attribute the primary motivation to -- and I think when we were dealing with ECAC, I mean, ECAC members can speak for themselves, but I think that was pretty well confirmed by the review we did program by program with ECAC.

**Socolar:** This is certainly not the last word on this subject. We definitely will have further discussions of this issue in the spring, and I'll be working with ECAC and with Dean McClain to bring it forward in a productive way.

Okay, so where were we (laughter)? We were about to approve, or not (laughter), the DKU medical physics degree. Any further questions about the degree?

**Kerry Haynie (Political Science):** I understand the deadline and the Board of Trustee December 6th meeting, but I think that this Council should not be driven by those kinds of deadlines in the decisions that we make. In general I think it's wrong to push our decision-making because of a deadline of that type.

**Socolar:** Thanks, Kerry. Does anyone else have a comment? Okay. So can I have a motion to approve the DKU Medical Physics master's degree?

(motion summoned and seconded; degree approved with three abstentions and no opposition)

Thanks and congratulations to Jim and Fang-Fang.

The next vote is on the proposed master's degree in Historical and Cultural Visualization. Professor Hans Van Miegroet is here to

answer any questions that you might have about that one. Any questions for Hans?

All in favor of approving the master's degree in Historical and Cultural Visualization say aye? Opposed? Abstentions?

**Nan Jokerst (Electrical & Computer Engineering/ECAC member):** Did we skip the motion part?

**Sara Beale (Law School/ECAC member):** I'd like to move we approve it (laughter).

**Jokerst:** And I'll second it.

**Socolar:** Sorry, sorry (laughter). Thank you.

**Beale:** Nunc pro tunc.

**Socolar:** Well, as we've seen today, we don't always do things in the right order (laughter), but we'll get it to work.

(degree approved with three abstentions and no opposition)

And the last vote for today is on the proposed master's degree in Bioethics and Science Policy. Professor Farahany is here to answer questions about that. Are there any questions for Nita?

May I have a motion to approve?

(motion summoned and seconded; degree approved with one abstention and no opposition)

Okay, congratulations to all of those programs (applause).

Next, we have four proposals to hear: one department name change, two master's degrees, and a new PhD. All of these proposals and supporting documents were posted with

today's agenda and each has been reviewed and approved by the appropriate committees before coming to us today.

In order to complete our consideration of these proposals in time for them to receive final approval by the Board of Trustees on December 6, we will vote on them at our Council meeting on December 5. And I remind you once more, but probably not for the last time, that we need a quorum of Council members for those votes. So we need you here on December 5th.

First we will hear from Professor David Morgan, the chair of the Department of Religion, but not for long because there is a proposal to change the department's name to the "Department of Religious Studies." David?

**David Morgan (chair, Religion):** Thank you very much. This is not a momentous, precipitous change, but a change that is meaningful to us because it puts us in line very much with our field of religious studies. And we would like to make that connection. It's something where we've been de facto for a long time, so it's just a matter of updating.

**Socolar:** So there was a document on our website that gave a little bit more of the history and the reason for the change. Any questions for David? Okay, can I have a motion to approve the name change? Oh, I'm sorry. I have to wait for December (laughter).

**Tolly Boatwright (Classical Studies):** I have a question. How will that affect the graduate program?

**Morgan:** It will have no impact on the graduate program of religion. This is just the religion department's master's program, which is entirely its own and its undergraduate.

**Boatwright:** Thank you.

**Socolar:** Alright then. I'd now like to call on Professor Merlise Clyde, the chair of the Department of Statistical Science, and Mike West, if he's here, the director of Graduate Studies in Statistical Science, to give their presentation for a new master's degree in...Statistical Science.

**Merlise Clyde (chair, Statistical Science):** The podium hasn't gotten any shorter.

**Lange:** No, it's inexcusable, that podium (laughter)! The next provost better be taller than I am.

**Clyde:** If only we had funds for lowering it. Alright -- thank you Council members for inviting us here today to talk about our proposal for a master's in statistical science. Just a little bit about the background, you might know that Duke's statistical science is a world leader in Bayesian statistics. We are a top five research department. We're ranked nationally. We also have a top ten PhD program, and this is from a program that was launched in 1990. We've had a research-engaged undergraduate major since 2007 when we became an official department at the university. And in 2012 we launched our first official admitting master's program that was joint with the economics department, so it's a joint masters in statistical and economic modeling. At this point in time, we consider it to be the right point to launch a master's in statistical science. At this point we can leverage the reputation of the department in terms of international strength. We've got unique strengths in Bayesian statistics as well as computation strengths in complex modeling motivated by interdisciplinary applications, and we can build on our network of professional collaborators as well as our alumni in many companies across the country and world. This addresses the large and growing demand for statisticians and data

scientists in industry, government, and academia. You may have heard the quotes about statistics being the sexiest job you've never heard of, so that's us (laughter). Another aspect of the program is that this provides a bridge or pathway to the PhD program, both here at Duke as well as PhD programs at our peer institutions, as well as leading to a professional career in statistics. In terms of applicants, we're looking for individuals who may have a background in statistics, mathematics, computer science, any of the natural or social sciences, engineering, you name it, you could probably come and you may be interested in getting a degree in statistics. What we need is someone who has a background in undergraduate probability, calculus, linear algebra, and then of course computational interest. What we're looking for is the next generation of problem solvers that can come in and start this degree.

Our goal, once we're up to steady state, is to bring in twenty-four students a year, and it will be a two-year program. So we'd have forty-eight students in residence at a time. There are really two interlinked goals with the program. One is more of a professional track, and the idea is that students will be interested in going on to various IT, e-commerce companies, like Facebook, Google, LinkedIn, Yahoo, as well as the more traditional business analytic companies, like IBM. Students will also find positions readily at national labs, like Los Alamos as well as EPA, non-profit agencies, such as RAND, as well as the traditional employers of master's level statisticians, so big pharma as well as research biotech companies. Another goal of the program though, is to be a bridge for individuals coming from undergraduate degrees to transition into a PhD program. Many students do not discover statistics until late in their undergraduate career. This gives them a chance to develop additional coursework background in statistics so that they

could then decide that this is the path that they want to follow or perhaps they want to go into a PhD in some other area where the quantitative training that they get as master's in statistics will be very beneficial.

So the program structure is, again it's a two-year program. The first year is really focusing on core courses. This has twenty credits. Part of the program is developing several new targeted courses for the MS. We expect students between the first year and second year to be involved in summer internships or summer research experience with faculty here in residence, and they will be able to get credit for that experience. The second year will be spent taking more electives. These will be drawn from new courses, some of our selected PhD courses, or other non-statistics courses across campus, as well as being involved in really mentor-independent research. All the students are expected to have an applied statistics experience. So this can be fulfilled by either summer internships, applied research, mentored research, or formal consulting, as well as a detailed, kind of applied experience that would be involved in projects with some of the courses in the program. For the completion exercise that will be evaluated by three faculty members, there are two options. One is a portfolio of their applied statistics experience in other coursework or the MS thesis. And again the goal is that those who are interested in the more professional track will probably take more courses while those who are interested perhaps in going on to the PhD will be more interested in getting deeply involved in research and would do the thesis.

All of our current, regular-rank faculty will be involved in the program and will be involved in developing and teaching the new courses. We will be using visiting and adjunct faculty during the first year as replacement teachers on some of our existing courses so that our

regular rank faculty can be involved in launching the program. We'll be adding three new regular rank positions over the first three years to help with the, again, increased teaching, mentoring, and advising that we provide the master's students. Because we will have forty-eight students in residence as a part of this master's program as well as our joint MSEM, we'll have an expanded role for our master's director.

So, the financial model. We're expecting to bring in twelve students in the first year and then twenty-four students per year thereafter. The program pays for all costs, and this is all coming from the statistical science share of that revenue. So we're expecting financial aid and hoping to support at least one in six students, again this is to try to bring in underrepresented groups as well as those students that we would like to try to attract to the program. It also provides for the new faculty, teaching assistants to support the courses, as well as new space to support the program. This also includes administrative support in terms of the master's director, as well as staff, to help with aspects of the program. Overall it then returns one million to the graduate school once it's up and running at a steady state in year three. And if you want more of the financial details, all of the numbers you can see. Thank you.

**Socolar:** Questions for Merlise?

**Baker:** Are the three regular rank faculty, are they tenure-track faculty?

**Clyde:** That has not been decided yet, so that will be in the coming discussions to organize searches for those positions. Ideally we would have regular rank on the roll, we'd like that in terms of research and advising and to have tenure-track to help with teaching...

**Haynie:** So you want to get to a steady state of forty-eight. Will the size of the faculty be able to handle that many master's students in addition to your econ and PhD program? And I assume you have undergraduate majors as well?

**Clyde:** We have undergraduate majors as well that are also doing research. That's what we are hoping. And we may also end up involving post-docs in terms of handling small group activities. Not everybody will be doing a thesis, and so many of the projects will also be involved in the classes. Yeah, we'll see. Otherwise we may come back and may be changing the model here to bring in more faculty; we'll have to see. So again, this is the proposal, and once it's up and running we may have to adjust for that as we go.

**Mike West (Director of Graduate Studies, Statistical Science):** All models are dynamic (laughter).

**Pat Halpin (Nicholas School of the Environment):** Are you considering any other joint programs with the professional schools? Just curious, on the horizon.

**Clyde:** We have not at this point. We're trying to get this started. We've had other people approach us, and more or less until, I think, the discussion on master's programs is finished...oh sorry (moves closer to the microphone). We haven't entered in to discussions yet with other professional schools.

**Jesse (Pate) Skene (Neurobiology):** So to follow up on that, is this program a pipeline for students who might be looking at PhD programs in workforce statistical background PhD programs that are not themselves particularly math oriented; they might be math oriented. Things like political science or a joint program with economics or other social sciences. Or would that be separate,

would that be something else that would be an unfilled gap?

**Clyde:** So right, we could expect to admit students who may have an undergraduate degree, like in political science, have the prerequisites, would like to come in and become much stronger in statistics, and do this master's degree. And then at that point, they might decide, "okay I want to go back and do my PhD in political science" or they might decide "no, I want to keep following and do a PhD in statistics but my research is going to be motivated by problems in statistical science." And so we foresee either of those paths as being a potential option.

**Skene:** Can I ask, particularly for the first year courses, whether you're going to have a mix of students, I mean, they'd have a certain threshold statistical background, but would you have a hard time balancing students who may be looking for a PhD in statistics and students who may be looking to shore up their statistics background?

**Clyde:** Most of the courses here are--so there's one course that is going to be more on the theory side--but most of these courses are more about modeling and applications. Some of them are preparation for the PhD, but it's really courses at this intermediate level that would balance there. So they're courses that you would take before you get to the PhD, but not necessarily just prep work for the PhD. So I think it would satisfy both of those audiences if they come in with the right probability and math backgrounds.

**Boatwright:** I just wanted to follow up on a couple of questions. How many faculty are now in your department and how many adjuncts do you have? I'm just thinking about the demands and the challenges of having forty-eight new students.

**Clyde:** So we currently have eighteen, technically eighteen point five, regular rank faculty in the department. We have one adjunct and then we have some other secondary positions, and we're currently...

**Boatwright:** And so the adjuncts are going to be just for the first three years and you'll transition to having...

**Clyde:** Right, exactly. So we try to hire more regular rank as routine teachers. We have a number of post-docs who come in, and that's--I'm trying to think, I think we have currently maybe five, actually it's hard to count how many post-docs we have--but some of the post-docs are also involved in maybe teaching one course as part of their support so that they can have additional teaching experience as well.

**Michael Gustafson (Electrical & Computer Engineering):** Is there any concern about the post-six year sustainability of the program given, I'm sort of noticing where the stat sci net hits this lovely peak, and then the grad school says "and now we want five percent more," and all the costs continue to go up. Further out than that does it sustain itself?

**Clyde:** So this is one scenario and one horizon, again all of the kind of agreements and approvals everything is to look at this after three years and re-evaluate. So we'll be at that point. You change some of these spreadsheets, you change, you know bringing in one more student or one fewer student and it can change quite a bit.

**Gustafson:** Statistics!

**Clyde:** Yeah, it's statistics (laughter). This is projected based on expecting a certain number of students that will not stay in the second year, expecting a certain number that will finish in three semesters as opposed to



four semesters. I did not put any kind of confidence or creditable intervals on these numbers, if you'd like, but that would take a few more lines on the spreadsheet.

**West:** I do have a slightly different answer. I think the real answer is it depends on who the provost is and who the dean of the graduate school is in the third year. I mean, this is where we are with the current negotiations that involve several schools, several deans, and central administration about how graduate programs that do generate tuition share the wealth, and as Merlise has said, you can change those red numbers in the middle line and the bottom line of the departments and school levels all up and down. So it's part of the conversation at the graduate school level that was alluded to earlier. It is presumably about, you know, financial models. And what the financial model is in five years' time one would expect to be different than now.

**Lange:** Just to be clear, the provost is not involved in any of these negotiations (laughter).

**Clyde:** That's true, yeah.

**Lange:** Thank you.

**Mayer:** I was curious whether, as you know there is considerable demand on campus for statistical courses including our doctoral students. I was in a meeting this morning wrestling with this, so the question I have is, to what extent are the courses that you offer as part of this program, and those that are being created, will they be available to students in other graduate programs at Duke?

**Clyde:** Well this has been an on-going issue that our department has faced. And so there will be space for some PhD students to come in and have seats in these courses, but again it's a question of resources from the Graduate

School and support for teaching missions of programs to provide, again, either additional faculty to teach more sections or to at least provide additional FTEs for PhD students to have additional TAs to really support these classes. So we will try to accommodate students to the best we can, but there is a growing need for more support to help us meet the PhD students who want to be in our classes.

**Socolar:** Okay, thanks very much, Merlise. We will see you on December 5th.

I'd next like to ask Professor Charlie Becker, associate chair of the Department of Economics, and Professor Carlo Tomasi, chair of the Department of Computer Science, to give their presentation for a new master's degree in Economics and Computation. And I think you'll see that this is a rather different scale, different type of program, we get a little sense of the variety of things we're talking about when we talk about new master's programs.

**Carlo Tomasi (chair, Computer Science):** Thank you for inviting us. This is all the voice I am going to have today, so I hope it's enough. Can you all hear me? Thank you. Where are the slides? Yeah, the proposal is for a Master's of Science in Economics and Computation by our two departments. The starting point is the emergence of a new field, which has its new journal, the *ACM Transactions on Economics and Computation* of which our Vince Conitzer is editor in chief with Preston McAfee of Google Research. And the field comes from new needs that have arisen recently. On one hand the economists need to understand computation much more broadly and more deeply than they have been used to in the past because data is becoming big data and both the logistics and the opportunities of accessing big data are changing the landscape very dramatically. On the other side,

computer scientists design systems that are electronic markets or contain or subsume electronic, that's our economic markets, and subsume economic principles. There are economic incentives at work. I just wanted to have a familiar example, and that's why I added the clutter to this slide. When you type in a search to Google, you get results back but you also get a column on the right hand side, which are ads relevant to your query. The way that happens is that in the few milliseconds between the time you hit the return key and you get the query results, there is an electronic auction taking place where the companies that are interested in advertising to you will bid money to have their ad appear in an order they desire on that right column. And as a result of that auction, the ads are retrieved and displayed and Google gets some money, both from the bidders and from the click-throughs if you actually click on the ad itself. This is one example of an electronic market, an electronic system that underlies something we do every day and in order to understand what's going on you need to understand both the economics, the behavior, and the technology of these systems. There are many other examples that I could get into, I will just mention perhaps Netflix, EBay, and other systems like that that have economic incentives that work together with the very complex technological access systems. And we already have courses in both departments that address many of the topics that are central to this area.

We intend to target both students who go forward with their PhDs and students who want a terminal degree for the professional market. And the companies that are listed on this slide are just a few of the companies that we've talked to, and they've told us that they need experts in this area to design e-commerce systems, electronic auctions, to analyze big data for the government or for companies, who understand the data privacy as it

comes to accessing very large repositories of data, and so forth. This is a very, very small program. We target initially three to five students per year, and the degree is what you see on this slide. The structure of the program is very standard: thirty graduate courses, twelve at least from each department and these are graduate courses. And then the students will have a portfolio of work; depending on what their future interests are it's going to be either a capstone course with a strong project component or a written master's thesis or project report and that's developed through an independent study. And either way, the portfolio will be examined by a committee with participation from both faculty.

This is a slide that lists only the faculty who have been intensively involved in the conversation so far. There are many others in both departments who are willing and interested in both hosting students in their courses and being on the advisory committees for these students. The financial structure, you'll see we don't do this for the money. We basically don't need anything new in terms of new faculty hires or new courses, at least in the current shape of the program. We'll have some added burden to some of our faculty, to actually most of our faculty, serving on master's committees and more administrative burden on our DGS and GS coordinators who are administrative resources. And if the program were to grow--but we need to feel our way through this because it's a very new area--then we plan to use revenue to fund additional staff, but we'll need to see across the bridge once we get there. It's a standard revenue sharing plan I understand, I'm not entirely sure, but it's half graduate school and a quarter to each of the departments after accounting for financial aid. And there is again, one of those cartoons of projected revenues that depend on too many factors to be completely accurate. This is what I wanted to say,

I don't know if Charlie wants to add or if we just take questions at this point.

**Charlie Becker (associate chair, Economics):** I would add just very briefly that this program is similar to, but smaller than, our joint economics program with statistical science and that has proven highly successful. Actually relevant for both programs, this past year for the nine entering students we had in the MSEM program we had 365 applicants. And so even getting off to a late start, I'm reasonably confident we'll be able to fill our target for these coming years. Demand should be out there; we're getting bombarded with inquiries from industry. But honestly the motivation of economics is certainly not financial, nor would it be for computer science, because if it were, we would simply expand our own master's program. Rather, we see this as a way to improve our PhD placements and that's been a focus of MSEM to a large extent and a focus of our own master's program. This year I count fifteen of our master's students who have gone on to PhD programs who are on the academic job market, and who are completing their PhDs on the market (see article). There are probably another twenty-five MA and MSEM students entering PhD programs this coming fall, and these programs are what it will take to make Duke's master's programs preeminent in this area. My final comment is that the other schools that are moving in these growing areas, Stanford and Carnegie Mellon, Chicago, Northwestern, are what we would normally consider to be peer institutions.

**Socolar:** Questions for Carlo and Charlie? Okay -- very good.

And now for something completely different: a PhD program. Our final proposal today will be presented by Professor Liz DeLong, the chair of the Department of Biostatistics and Bioinformatics and Professor Andrew Allen

to give their presentation. They're here to give the presentation, as I said, for a PhD in Biostatistics.

Liz? Andrew?

**Liz DeLong (chair, Biostatistics & Bioinformatics):** I brought propaganda (distributes handout) (laughter) to backup Merlise's assertion that statistics is sexy (laughter) and actually it is well known.

We really appreciate this opportunity, and I speak for my faculty in saying that everybody's very excited about this program. It's taken us a while to get to this point. Our vision is to respond to a critical shortage for biostatisticians. We really need to be able to train PhD biostatisticians to meet the challenges of the avalanche of big data that is coming our way. They need to be able to develop methods to meet those challenges, and they need to be able to insightfully apply those methods. We also want to leverage our master's. We've had a very successful master's degree, and we feel that we can leverage that and also enhance it with this PhD. To understand our training platform you really need to understand our lifestyle. We have sort of a split personality. We need to be able to develop methods and understand biomedical studies to the extent that we can understand that there are some unsolved problems and we need to be able to work on those unsolved problems, especially with the avalanche of new types of data. But we also need to be collaborators. We spend a lot of our time collaborating with other investigators on their studies, so we have to understand their problems, we have to be able to apply, adapt or develop the appropriate methods, and communication is key. We need to be able to understand, not only the words, but also the underlying disease process and how that relates to whatever statistics we need to use to solve the problem. So we have a lot of

opportunities to place our students. As a matter of fact, as I said, there's a real shortage. There are a lot of biostatisticians, PhD biostatisticians with the FDA and in other places in the government. Certainly in industry, especially with pharma, and of course academia, we need more teaching to train the new generation. So what we do--it's almost a repetition of what I've been telling you--we have to do independent research, we need to recognize methodological problems that arise and develop solutions, we're responsible for designing studies and designing analysis strategies for those studies, we apply for our own investigator-initiated grants, and we're responsible for writing the methods--actually we want to take that responsibility--for writing the methods on our investigator grants and also to supervise those who might be stats statisticians who might also be analyzing data and writing methods sections.

So Andrew actually did a fair amount of research into the top programs in biostatistics, and he designed our curriculum. And he's going to present the next few slides.

**Andrew Allen (Biostatistics & Bioinformatics):** Thank you, Liz. So the first thing to recognize when thinking about candidates for this program is that there are essentially no undergraduate programs in biostatistics. There may be a couple, but it's very limited. Therefore we are training students to be biostatisticians essentially *de novo*. We need to identify candidates based on specific capabilities and backgrounds. Candidates need a certain mathematical sophistication; they need to have mathematical training up through advanced calculus including linear algebra. The ideal candidate would also have background in biology, so that they could understand the biomedical problem and communicate with biomedical scientists. But the overarching thing that they need to have is a sincere interest in working at the interface of

quantitative science and biomedicine using and/or developing quantitative methods to address biomedical research problems. So, in framing the curriculum, we started by investigating top biostatistics programs throughout the country, your Harvards, your Stanfords, etc. And we wanted to be true to the spirit of these traditional programs, but at the same time we saw this as an opportunity to look to the future in training our graduates to handle emerging big data problems, for example. So this novel course in methods for learning and discovery, right here, is a direct result of that sort of future-looking perspective.

So, as Liz said, we need to train individuals who can create new methodology in response to emerging problems, and as a result, we need to ensure that the students have a firm foundation in statistical theory, so that they can modify existing methods or develop new methods. And you can see this running through our program. So in the first couple of years there is a theory sequence that covers the entire year, and it's capped off with an advanced theory course in the third year. But we not only need to develop new methods, we also need to train students to be effective collaborators, and this requires that we train them in the breadth of biostatistical methodology. So we need to train them in, maybe not the totality of biostatistical methodology, but important biostatistical methodology, as well as instructing them in biomedical foundations. So a unique aspect of this course is that we actually have a course that addresses biological foundations of disease. And this is augmented with a cognate course program where students take courses that are relevant to their dissertation focus. So if you have an individual who's interested in statistical genetics, they may take additional coursework in genetics, population genetics, etc. And then the last two points are just some structural things that we think will greatly

enhance the experience. First of all, we have a student research seminar, which progresses in terms of student participation. So early on students will be sitting in the seminar and maybe not presenting in the seminar, and as time goes on they'll be presenting their research. So this will be an opportunity to present and see what the students are working on. And we will be operating under the assumption that the dissertation will be comprised of publication-quality chapters, at least one of which will be submitted before graduation.

**Delong:** So our faculty. We have fifty-one faculty currently in the department, but we're expanding. Thirty of these are already involved in our master's program. I should remind you that we do not have a PhD in biostatistics and I'll also tell you that because the demand for biostatisticians is so great, we hire faculty biostatisticians directly out of graduate school. So many of the faculty that we have had not had the opportunity to be a PhD dissertation director, but twelve of them actually have experience as a primary or co-primary dissertation director. Many of our faculty supervise post-docs, and with the new faculty we've been hiring, we're shifting the balance, so that we have a better balance of theory and application among our faculty.

So funding for the PhD program, we need two different buckets of funding. We need support for the students, and because of the enormous medical research enterprise that Duke is, there are no paucity of assistantships available to work on existing studies. Some of our faculty actually have methods grants that a graduate student could work on. There are limited teaching assistantships, and there are a number of traineeships that we will apply for and hopefully be successful. The funding for the teaching and the administration will be coming from the revenue from our master's program. I mean to mention in here that

we will be accepting no more--well we hope, I guess it's hard to calibrate--but we hope we will be admitting no more than four students a year for a steady state of about twenty students if they all do a five-year program. And we will have revenue from the master's program consisting of about forty students, and we also have central funds supplied by the dean for this purpose. So, we welcome questions.

**Socolar:** Questions for Liz and Andrew?

**Anna Lisa Crowley (Cardiology):** As you know, a lot of the people in medicine collaborate very well with biostatisticians. Do you think with the combined MD/PhD program in the medical school that this would be something that would be applicable to those students? Or is that not your intent?

**Delong:** That would be terrific. If an MD were to apply, we would be glad to train that person given that he or she has the relevant credentials.

**Crowley:** Because normally as a part of that MSTP program...

**Delong:** Oh, I think that involves another administrative step to do that, doesn't it?

**Crowley:** I just didn't know if that had been explored or if that was sort of, you know, it seems like it would be a natural fit. Because some of those people are jumping ship and going to UNC, so it'd be great to keep them here for those years.

**Dennis Clements (Pediatrics and Global Health / ECAC member):** They could enter directly the first year or they could be accepted later, I think up through their second year.

**Delong:** So, we should talk to the MSTP people?

**Speaker:** Yeah, Chris Kontos.

**Skene:** Just to comment on that. I think for graduate PhD programs that are any component of medical school departments, we understand that the MD/PhDs are, specifically when they are getting a MD/PhD, they are considered admitted to the biomedical PhD programs. So it might be worth figuring out whether they're comfortable, would want to have that addition part of their MD/PhD or make that a separate...

**Clements:** Preferentially they're admitted that way, but occasionally an opening comes up because somebody withdraws or something, so there's now a space to add somebody who might be interested. Preferentially you enter from the beginning.

**Delong:** Okay, so that's certainly something we should look into.

**Gauthier:** One question and maybe a comment or question. The first is just on the total number of courses that you have. And I think that kind of goes counter to having a student part of the MD/PhD program. You're really, really course-heavy. And I've been a proponent in my own department of trying to limit the number of courses, or at least creating flexibility there. So I hope you look into that. The student has a background that's really optimized; requiring them to take that many course versus getting into research sooner, I think would be a mistake. So trying to find flexibility where the committee of the student could work with them to really design the curriculum that's optimized for their background.

**Delong:** Sure, the theory courses are definitely required because if they want a PhD in bio-

statistics, they really need that foundation. In terms of some of the other courses we would have to attack that on an individual basis.

**Gauthier:** But for the MD/PhD program, I think you only have three years to complete your PhD. I've worked with a couple of students through that program trying to get everything done in three years.

**Robert Drucker (Pediatrics):** Actually, there isn't a time limit. I've worked in the med school, and we've had some students who've been five, six years on their PhD side before they finish med school.

**Gauthier:** So maybe it's the students telling me that (laughter). Sorry, one other comment. There's a large big data initiative already here on campus, probably aiming to be one of the strongest groups in the world. So have you thought about how you can have synergy with the big data group?

**Delong:** Oh sure, as a matter of fact, there's a meeting tomorrow afternoon with a group that I think involves Bob Calderbank.

**Socolar:** Anymore questions? Okay thanks very much, Liz and Andrew.

So in view of the questions that were raised at the beginning of this meeting, I'd like to open the floor now for discussion. It would be quite helpful I think for the Provost, for ECAC, and for Council members to hear a little bit more about what kinds of concerns there are, or thoughts about what's at stake in the discussion of the master's programs, and the number of them that might be optimal, or the danger of having too many. So, if there are people who would like to offer some thoughts about that, now would be a good time.

**Baker:** I guess I would say--and I haven't thought this through so it won't come out very clearly, I suppose--but, you know, I think community colleges do have a very valuable role in society, four year colleges have a very valuable role, the state universities have a valuable role. Duke University--I would like it to be global, I would like it to be the top university in the world. I would like our mission to be pushing the frontiers of knowledge, pushing the frontiers of what we know, becoming the best there is. And I realize that these master's programs have a very important role and they produce--I'm from a school that has a ton of for-profit, probably, master's students, and I think that's a great program, and the students tend to get jobs, and we've done something useful--but I don't know that that's what I want Duke University to do. And that's the main thing I'm thinking about. And then I think these master's students, these master's programs, they detract in many ways from our ability to become the best university in the world. Because, you know, we've heard that there's a burden on us when we're teaching PhD students, and undergrad students, and then we have a whole extra burden with a lot of master's students. So, I mean, in a lot of the metrics where we would measure if this is going to be the best university in the world, I think those metrics are going to go down. The numbers are going to be a little bit worse, bit by bit, in, you know, students per faculty, applications versus numbers accepted, etc, etc. So that's what I'm thinking about.

**Gauthier:** I understand the concerns that you have, but I'm trying to relate to my own experience. I was in more of a technical school, and there was a five year program. It was a three-two program, undergraduate/master's program. I got very excited by that, applied to it, and by the time I got into that and started taking graduate courses, I didn't even know what research was really about when I was

an undergrad. I was doing a little bit of it, but I really didn't fully appreciate it. And getting into the graduate courses and interacting with the PhD students really opened my eyes to what life as a researcher could be. And so, I really think the master's program can serve a very useful purpose of getting students who really just don't know. As an undergrad they don't have the maturity to decide if they really want to get a PhD, and so this gives them an easier chance to explore that in a lower risk situation before they make the leap and join a PhD. So to me, I just want the best students I can get. And if I can grab a few additional students and have the opportunity to check them out in the master's program first before deciding to bring them to the PhD, I'm all for having a master's program. Now you're worried about these other things, we just have to make sure that the standards are very high for accepting students into the master's program. And I don't have any data to suggest whether Duke has been doing that or not, but if we have the admissions standards very high, I think this could be an excellent way to get the very best students to come to Duke.

**Lori Bennear (Nicholas School of the Environment):** We have a very large professional master's degree program that I think is appropriately a master's degree program in the sense that the types of jobs that students get when they come out of our program require something more than an undergraduate degree can provide but something less than, or different from I should say, what a PhD program would provide. So when thinking about master's degrees, I'm not particularly concerned about the number of them, per se, but that there's a legitimate purpose for us to be offering a master's degree in this subject. And we've seen this with the proposals that have come through so far, there's a legitimate demand for skills at that level of training and that Duke faculty are enthusiastic about

providing it because it does take time away from other things. And in the process you will find some students who then say, "oh this is so cool I want to get a PhD," but I don't think that we want to use them as the farm team. So I think that we want there to be master's programs because there's a need for that master's degree.

**Grill:** This is my ninth year at Duke University, and I'm teaching a course this semester that I taught my first semester here at Duke. And that first semester there were about fifteen students in that class, twelve of them were PhD students and three of them were senior undergraduates. This semester there are thirty, and the difference is fifteen master's students. So in the school of engineering our dean has instituted a policy where there's a huge incentive--in fact a mandate some would argue--for departments to grow master's enrollment. Because by having master's students we earn faculty slots, and that's the only way to hire a new faculty member is to have sufficient master's enrollment. So there's a big incentive to have master's students enrolled. But the impact on that class that I teach has been dramatic. It's no longer a deep intellectual discussion, it's much more superficial. And Dan, we have worked incredibly hard to recruit high quality students and we cannot --well some of them, but the distribution is much broader than the caliber of student that we recruit in our PhD program. So my word of warning is not that we shouldn't do this, but we need to be very careful about the impact that those master's students have on other activities that we have going on in our department. In my view in biomedical engineering, we have compromised our doctoral program and the courses that we offer to our doctoral students in trade for a large master's enrollment.

**Mayer:** So I came to a PhD program by starting at a master's program. I directed a mas-

ter's program in Public Policy for many years. I think they're terrific. I have nothing against master's programs! But I do think that--I don't know what I'm worried about exactly--the issues that you've identified that these committees are going to look at seem like the right issues, and I think there are these questions in the air about the systemic effects of this. Each one of these programs from everything I've heard has a really great mission, people are interested in them, and they're going to create value for students. I don't have any problem with that. But I do think that there's enough of this happening that it's worth us stepping back and asking these big questions. And if that's not been done to date, then we really, really ought to do that.

**Peter Feaver (Political Science):** One challenge that I've seen--that is maybe limited to political science, so I'm asking more is it a question that's broader than just us?--is that there's a dramatic difference in the verbal skills of our master's student versus the undergrads and the PhDs, so writing in English, speaking in English. They are very skilled in the other aspects that are required in political science but less skilled in the aspect of writing. So, I think if you have a big master's program, you have to build into that a large tutorial or assistance program in English as a second language. So I assume that all these other programs have done that. But is this a wider problem? And then how are we supposed to deal with the inevitable pressure on us to recognize that it's a different language. They're better in this than I am in Korean or whatever the other is, so I give a lot of grace. But at some point I'm giving a master's from an American university for someone who's ability to write is not at the master's level in English.

**Lange:** I know I'm sometimes thought of as a data-hound, so I actually did look at some data before this meeting. So the average selec-



tivity in the master's programs we have now--not the professional master's programs, the Graduate School master's programs--is thirty-eight percent with a substantial number in the mid-twenties or below, which is selectivity that would be similar to the Graduate School PhD programs. With respect to Peter, I can answer your question. Your program has one of the highest percentages of foreign students of any outside of the engineering school, which I think is germane, Warren, to your--or may be germane, Warren--to the point...

**Grill:** No, I'm afraid not. Our master's program is still dominated by US students.

**Lange:** Well I don't know. I'll look into that.

**Craig Henriquez (chair, Biomedical Engineering):** Well, ours is. Electrical Engineering is more dominated...

**Lange:** Yeah, electrical engineering is very high.

**Henriquez:** The BME is about half.

**Jane Richardson (Biochemistry):** Just a quick question: when you look at selectivity you also have to consider the quality of the total pool.

**Lange:** What, say again? Oh, yeah I agree.

**Jokerst:** I have a lot of master's students do research with me, and there's actually a decent place for the master's students. Because I do so much collaborative research people will come to me to say, "can you build this little optical system for me?" and, you know, this is not PhD level research, but it's perfect for a master's student. And so in my group there's actually a significant position research-wise for master's students who are going to be here between three to four se-

mesters to do a research project that enables me to collaborate with colleagues across the campus. The other thing we've noted in our classes in ECE is that we're able to offer more graduate classes because we have more students wanting to take classes. So some classes that didn't meet the requirement--the minimum number of students in a class requirement--before, as we grew our master's program, now those classes can be offered. And so faculty actually like the diversity of classes that they're able to offer. Now I will say, I agree with Warren. In some classes that previously met the numbers and have now expanded, what we've done in those cases is we've created a second class that is a lower level number and is more geared towards master's students and our undergraduate students who want to take a graduate course. And we moved the course number into a higher course and changed the course a little bit to address our PhD student needs better. So, you know, the curriculum has to evolve with how our student population evolves, and at least in electrical and computer engineering, there's a real need for the master's degree from an educational standpoint.

**Lange:** I looked up the numbers. So engineering is interesting because it's all relative, okay? So BME said that they don't have that many foreign students. They have actually forty percent; forty percent of the students in BME are foreign, okay? But as Craig said, in electrical engineering, ninety-one percent of the students are foreign. In mechanical engineering, thirty-three percent of the students are foreign. And in civil engineering about eighty-three percent of the students are foreign. And this is going to reflect the global mix of students going into those fields, and I think in engineering, primarily the quantitative skills that they bring in the application process. The selectivity across these programs is not dramatically different, although the sizes are substantially different. It will be

interesting. When this review happens, what is going to happen is there's going to be a lot of data, and the data is actually pretty interesting, and a lot of it is not entirely, I think, consistent with presuppositions that people bring about these master's programs. There's a heck of a lot of variability across the programs since they're diffused across the whole university. It will be interesting to see what the review committee comes up with.

**Halpin:** Getting back to your original question on the proliferation of master's programs. I think, I work personally with our professional program and with PhD students, and I think we work fine, they're just very different. But one thing I see with master's programs is keeping it relevant and fresh is very different. They work on a different type time-scale, and the need for review and the need to sunset programs that are not relevant anymore is a much bigger issue. So I think that's something that we need to address, is that master's program are great, but we need to be looking at them more carefully and more frequently than other kinds of programs.

**Lange:** So the PhD programs are never reviewed for sunseting, the master's programs would be reviewed every five years or less. All the new master's programs have review procedures.

**Gauthier:** I'm concerned about what Warren said, and I've had one experience of teaching a graduate level PhD course soon after the master's program started, I think it was either BME or electrical engineering, and a couple of the students who were first brought in were very, very low level. So I'm wondering how do we tease out--Josh, you're asking for advice of what do these committees need to do as part of their charge--how do we tease out, how do we collect data to verify or to see how many faculty like yourself feel that the intellectual engagement in your class-

room isn't as high? And that's a big concern to me if that's what's happening. So, I'm not quite sure right now how I would, other than a survey of faculty that are teaching these classes.

**Richardson:** It seems pretty clear that there is enormous variety, as has been said, and that in some departments this would be very suitable and in others it really shouldn't. And I'm not sure if I can decide what the criteria are for setting that, and that would be one of the questions for this committee.

**Socolar:** Okay. Oh Nan, you want to...

**Jokerst:** One last thing...

**Socolar:** ECAC gets the final word (laughter).

**Jokerst:** Okay, fair enough. So one of the things that came up in APC is if we take master's programs between two departments we could have a virtually infinite number of combinations on campus, and some of this is what we're seeing, right? And so we may think about eventually a more fluid master's program, sort of like the undergraduate double degree, where two departments agree and admit based on a dual degree at the master's level between the departments. So that we don't have to approve every pair of departments for a master's degree that want to create a new master's. So there are lots of things to think about here, including the structure of how we organize these programs.

**Socolar:** And how we review them (laughter).

Okay, thanks very much for being here, and I will see you on December 5th. These comments have been quite helpful. I will also take them to Dean McClain as she prepares to study them.

