

# BS/MS MBB co-terminal proposal

Version 2.4 4<sup>th</sup> Nov 2016

Approved by an ad hoc MBB steering committee with representation from biology chemistry and physics 18<sup>th</sup> Oct 2016.

Approved by the Biology department 20<sup>th</sup> Oct 2016

## Rationale

1. MBB has a significantly higher quality of student, who tend to be bound for graduate degrees, and an option to get an MS can position them to get into good graduate programs. This can help these students get into better programs and thereby **increase the success of our students**
2. Such students tend to be much better students than our usual MS students, particularly when considering mathematical and quantitative abilities and aptitudes. As such, this also provides us the opportunity to **boost the quality of our graduate programs**.
3. **We currently have one MBB student who is determined to pursue a co-terminal** (related to point 1 above, he is interested in a PhD program that does not accept student without an MS), However since we do not have an MBB co-terminal program, **he is being forced into changing majors**, which he does not want to do. This thus **serves student interests**.
4. We have designed the program to not require *any* additional resources. As such, any (even low) enrollment is a positive revenue stream. Many MBB type classes are low enrollment classes where even modest increase can **increase the viability of some of our classes**.

## Proposal

### Shared courses (9 ch)

1. *BIO402* substitutes for *BIO504*. This is identical to our other co-terminal degrees. These courses deliver virtually identical content, so overlap is indicated.
2. *BIO544* substitutes for *BIO 445*. This is identical to our other co-terminal degrees. These courses deliver virtually identical content, so overlap is indicated.
3. *BIO 400 level (choice of {404, 431, 446}) lab 3 ch* substitutes for *BIO501 2 ch + BIO595 1 ch*. These courses deliver similar content: *BIO 501* is UG level (or below) laboratory skill educations, and our 400 level *BIO* labs which are required for all our degrees require similar lab skills training as well as more sophisticated scientific interpretation and write ups (provided in the grad program in 533). In our other co-terms, the sub is less direct, in that "some 400 lab", 3 ch, subs for *BIO501 2 ch*. This ch mismatch is what we did, based upon a prior directive to pursue 'curricular integration' that has since been abandoned. Since the c.h. overlap is not identical on both sides, it caused difficulties in implementation. As such we are proposing to balance the c.h. by having also have it sub for *BIO595*, colloquium, as well. Colloquium deals largely with scientists discussing experimental work. The lab write-ups of *BIO4xxlab* are a discussion of scientific work. In this formalism, the experimental aspect of *BIO4xx lab* satisfies the LOs of *BIO501* (which has much more perfunctory write-ups) whereas the write up satisfy *BIO595*. In addition the student in this program are required to take two other colloquiums at the *BIO495* level. In both 495 and 595, students view the same lectures, so they will still receive that content, to an identical extent, as regular MS students do.

## Deviations

The following program deviations occur (relative to the individual degree programs) in this co-terminal:

Electives:

### *Overlap between MS required and BS MBB electives*

One of the BS MBB electives (BIO555) is required in the MS program, and one more (PHYS410) is part of a choice (see below). Since these are not double counted, this will thus force additional MBB classes to be selected for these electives. **This is by design – we do this so that students in this program will take additional MBB electives to increase the “MBB content” of the co-terminal.** Students will now at minimum take at least 3 of the MBB electives by taking BIOL55 in the MS degree.

### *Resolution of the Interaction of choice of in MS with the BS MBB electives*

In the MS MBB there is a choice of PHYS410 “molecular biophysics” OR BIO512 “advanced biochemistry” in MS MBB. PHYS410 is also in the list of BS MBB electives. In the merged co-terminal program, there is now no graduate biochemistry, and the MBB electives do not include any biochemistry (but all include significant biophysics). As such **we now restrict this choice by making 512 mandatory in the co-terminal, and leaving PHYS410** in the BS MBB electives. This also retains a sufficient choice in that pool (2 of 4 choices in the co-terminal program, down from 2 of 5 in the BS alone).

### *BS MBB electives modified*

This means that the allowed BS MBB electives are restricted to 2 of {(PHYS410 or 304) PHYS420 CHEM538 CHEM553}. Students who had already taken BIO555 as an MBB elective at the time of entry (doubtful, since this is unlikely to have been taken by year 3, the normal entry point) will still get to count this class toward the degree, but now in the MS program.

## Tracks

We have 3 tracks for MS, {thesis, project, and non-thesis}. The project track was a response to a very high enrollment bolus that passed through a few years ago, and is being de-emphasized with the relevant courses (BIO522/523) probably not offered regularly. As such we do not propose to allow the project track. However, both thesis and non-thesis options are proposed:

### **Thesis**

Many or most students doing this, do so to gain a competitive advantage for good graduate schools, so this is anticipated as the most common option. To gain admission to a thesis track, students must gain admission to a lab and secure the consent of a thesis advisor prior to (or concurrent with) admission to the co-terminal program. Generally, this requires BIO491, undergraduate research. To formalize this, and to be consistent with our other co-terminal programs, we require XXX491, undergraduate research as one of the technical electives in this track. Students select take BIO491, CHEM491, or PHYS 491 depending on the primary affiliation of their research supervisor. Students then must also then take 6 c.h. of XXX591, MS research, and complete an MS thesis.

### **Non-thesis**

For students who for some reason do not want or cannot complete a thesis, the non-thesis track is available. In this case the requirements are BIO581, Biology Graduate Capstone, 3 c.h. and 3 c.h. additional electives, in lieu of the 6 c.h. of BIO591.

## Sample schedule

BIOL 100	2			BIOL 115	3		
BIOL 107	3			BIOL 117	1		
BIOL 109	1			CHEM 125	4		
CHEM 124	4			MATH 152	5		
MATH 151	5			HUM 200	3		
			<b>15</b>				<b>16</b>
BIOL 214	3			BIOL 210	3		
CHEM 237	4			CHEM 239	3		
PHYS 123	4			PHYS 221	4		
CS 104	2			H 3xx	3		
S 2xx	3			MATH 251	4		
			<b>16</b>				<b>17</b>
BIOL 401	3			BIOL 402	3		
CHEM 247	3			BIOL 544	3		
				<b>B/C/P 491</b>	<b>3</b>		
				or			
PHYS 224	3			<b>Tech Elect</b>			
MATH 252	4			CHEM 343	3		
Tech Elec	3			H 3xx	3		
			<b>16</b>				<b>15</b>
BIOL 495	1			BIOL 404	3		
BIOL 515	3			Grad Elec 5xx	3		
BIOL 512	3			Grad Elec 5xx	3		
MBB Elec	3			MATH 425	3		
IPRO	3			IPRO	3		
			<b>13</b>				<b>15</b>
				BIOL 451	2		
S 3XX	3			BIOL 533	3		
BIOL 4XX	3			CHEM/PHYS 495	1		
MBB Elec	3			H/S	3		
Grad Elec 5xx	2			S 3xx	3		
<b>B/C/P 591</b>	<b>3</b>			<b>B/C/P 591</b>	<b>3</b>		
or				or			
<b>BIOL 581</b>				<b>Grad elec</b>			
			<b>14</b>				<b>15</b>
				<b>TOTAL</b>			<b>152</b>
<b>thesis track blue</b>							
<b>non-thesis track green</b>							

## Required courses

### Bachelor of Science /Master of Science in Molecular Biochemistry and Biophysics

Required Courses	Credit Hours		
	<i>UG</i>	<i>grad</i>	<i>total</i>
<b>Biology Requirements</b> BIOL100, 107, 109, 115, 117, 210, 214, 401, <b>402*</b> , 4xx†, 451, 495, <b>1 of {404, 431, 446, 491‡}, 495, 512, 515, 533, 544*, 555</b>	<b>34</b>	<b>21</b>	46
<b>Chemistry Requirements</b> CHEM124, 125, 237, 239, 240, 247, 343,344, 485 (or PHYS 495)	22		22
<b>Mathematics Requirements</b> MATH151, 152, 251, 252, 425	21		21
<b>Physics Requirements</b> PHYS 123, 221, 224 (or 223)	11	or 12	11 or 12
<b>MBB Electives</b> Two of {(PHYS410 or 304), PHYS420, CHEM538, CHEM550}	6		6
<b>Track options – select one</b>			9
<i>a. thesis</i> research BIOL/CHEM/PHYS <b>491 3ch, 591 6 ch</b>	<b>3</b>	<b>6</b>	
<i>b. nonthesis</i> BIOL581 BIOL/CHEM/PHYS <b>300 or higher</b> BIOL/CHEM/PHYS <b>500 or higher</b>	<b>3</b>	<b>3</b> <b>3</b>	
<b>Technical Electives</b> BIOL/CHEM/PHYS 300 or higher BIOL/CHEM/PHYS 500 or higher	3	or 2 5	3 or 2 5
<b>Computer Science Requirement</b> CS104 or 105 or 110 or 115	2		2
<b>Humanities and Social Science Requirements</b>	21		21
<b>I PRO</b>	6		6
<b>Total</b>	<b>129</b>	<b>32</b>	<b>152</b>
	<i>129 + 32 – 9 = 152</i>		

\*Courses in bold are shared courses between undergraduate and graduate curricula (BIOL402, 1 of {404, 431, 446, 491‡}, 544; 9 ch)

† new class not yet numbered

‡ in thesis track, 491 is not eligible here as it is taken elsewhere

# Curriculum

## Proposed MBB co-terminal

	BS MBB		coterm BS/MS MBB		MS MBB	
			BS	MS		
		129	<i>shared in red</i>		32	32
			129			
BIOL	100	2	100	2		
	107	3	107	3		
	109	1	109	1		
	115	3	115	3		
	117	1	117	1		
	210	3	210	3		
	214	3	214	3		
	401	3	401	3		
	402	3	402	3	3	504
	445	3	544	3	3	544
	{404,446,431,491}	3	{404,446,431,491*}	3	3	501
	4xx lab	3	4xx lab	3		595
	451	2	451	2		
	495	1	495	1		
			BIOL 515		3	515
			BIOL 533		3	533
			BIOL512		3	B512 or P410
			BIOL 555		3	555
CHEM	124	4	124	4		
	125	4	125	4		
	237	4	237	4		
	239	3	239	3		
	247	3	247	3		
	343	3	343	3		
{chem phys}495		1		1		
PHYS	123	4	123	4		
	221	4	221	4		
	223	4	223	4		
	E1	3	E1	3		thesis: 491
	E2	2	E2	2		PHYS410 or 304
CH ELECTIV	B 1	3	MBB1	3		chem553
	B 2	3	MBB2	3		PHYS 420
			grad elec		3	chem538
			grad elec		2	
			track		6	
MATH	151	5	151	5		thesis: 591 6 non-thesis 581 3 capstone
	152	5	152	5		grad elec 3
	251	4	251	4		
	252	4	252	4		
	425	3	425	3		
CS	104	2	104	2		
H	1xx	3	1xx	3		
	3xx	3	3xx	3		
	3yy	3	3yy	3		
S	1xx	3	1xx	3		
	3xx	3	3xx	3		
	3yy	3	3yy	3		
H/S	1xx	3	1xx	3		
I/PRO	497	3	497	3		
	497	3	497	3		

**double counted classes**

sub 402 for 504

sub 544 for 445

sub 4xx for 501+595

thesis: 491

PHYS410 or 304

chem553

PHYS 420

chem538

thesis:

non-thesis

591 6 581 3 capstone

grad elec 3

\*NB in thesis track force E1 as 491 UG research