

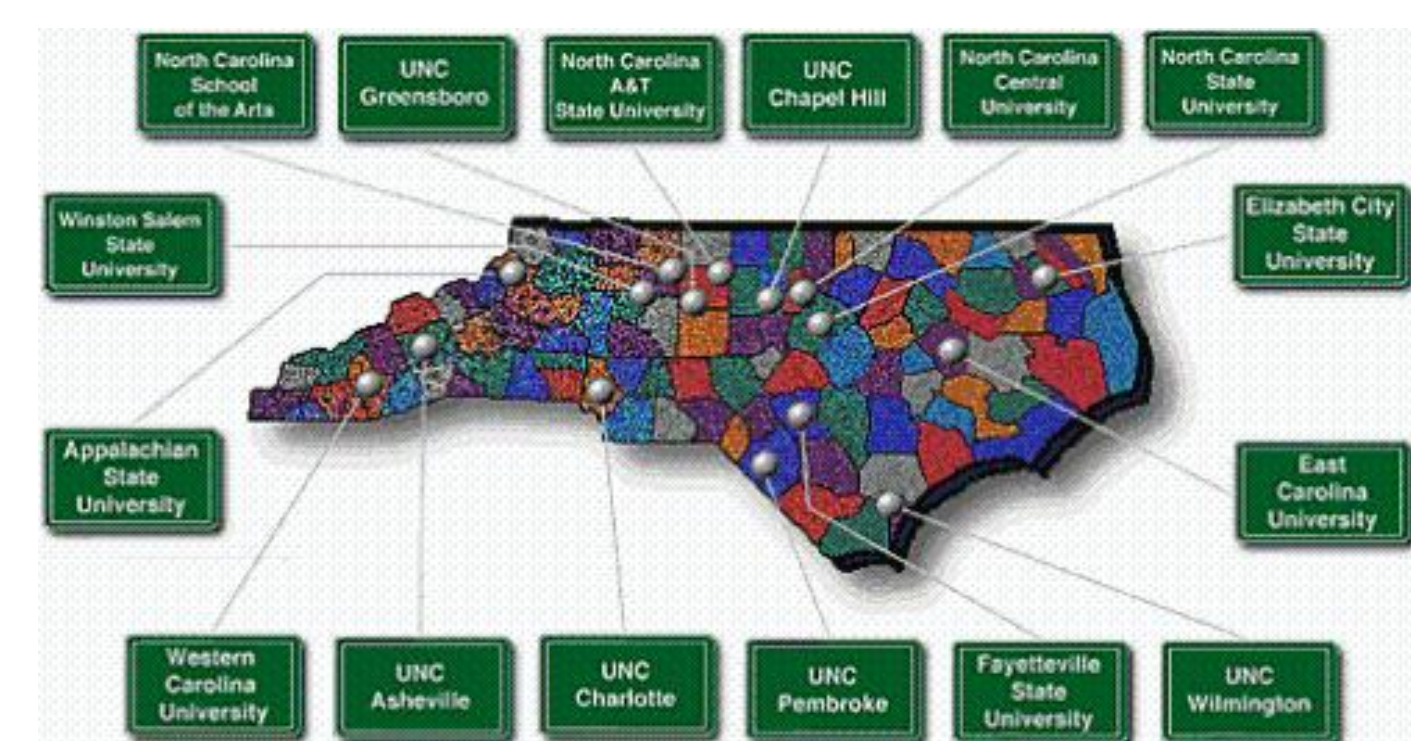
# DEVELOPMENT & INFUSION OF COURSE-BASED UNDERGRADUATE RESEARCH EXPERIENCES (CURES) INTO INTRODUCTORY CORE COURSES OF A BIOLOGY CURRICULUM

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## ABSTRACT

The introductory science course is the first opportunity wherein students experience the academic rigor of college science (Daempfle, 2002) and according to the National Science Foundation the sciences have the highest attrition rates of any major (National Science Foundation, 1996). Undergraduate research experiences have been widely credited as an effective mechanism for enhancing the undergraduate experience (Lopatto, 2004), particularly the ability to enhance retention rates in pursuit of the undergraduate degree (Gregerman et al, 1998). As college educators, our main teaching goals are to increase student learning and improve student retention for our science majors. The Biology Department at North Carolina Central University (NCCU) with the support of Howard Hughes Medical Institute (HHMI) has created a mechanism for producing student success by integrating course-based undergraduate research experiences (CURES) into the curricula and training new and current faculty in the development and delivery of engaging curricula. Our goal is to improve first year retention rates from Biology I to Biology III; help students better apply scientific concepts; and provide students with an early exposure to basic research techniques. Our prior participation in the HHMI Phage Hunters Advancing Genomics and Evolutionary Science (PHAGES) program provided a foundation and experience which was useful as we determined what would work and not work in scaled-up research-infused introductory courses for all of our majors. Our new inquiry-based learning model is currently being implemented in 3 core biology classes using yeast as a common organism. We have adapted the modular concept within the course such that each course begins with an Introduction to Research module, followed by a module incorporating authentic research experiences. This is supported by a common set of basic techniques and relevant experimental designs alongside peer led teaching and learning activities.

## ABOUT NCCU

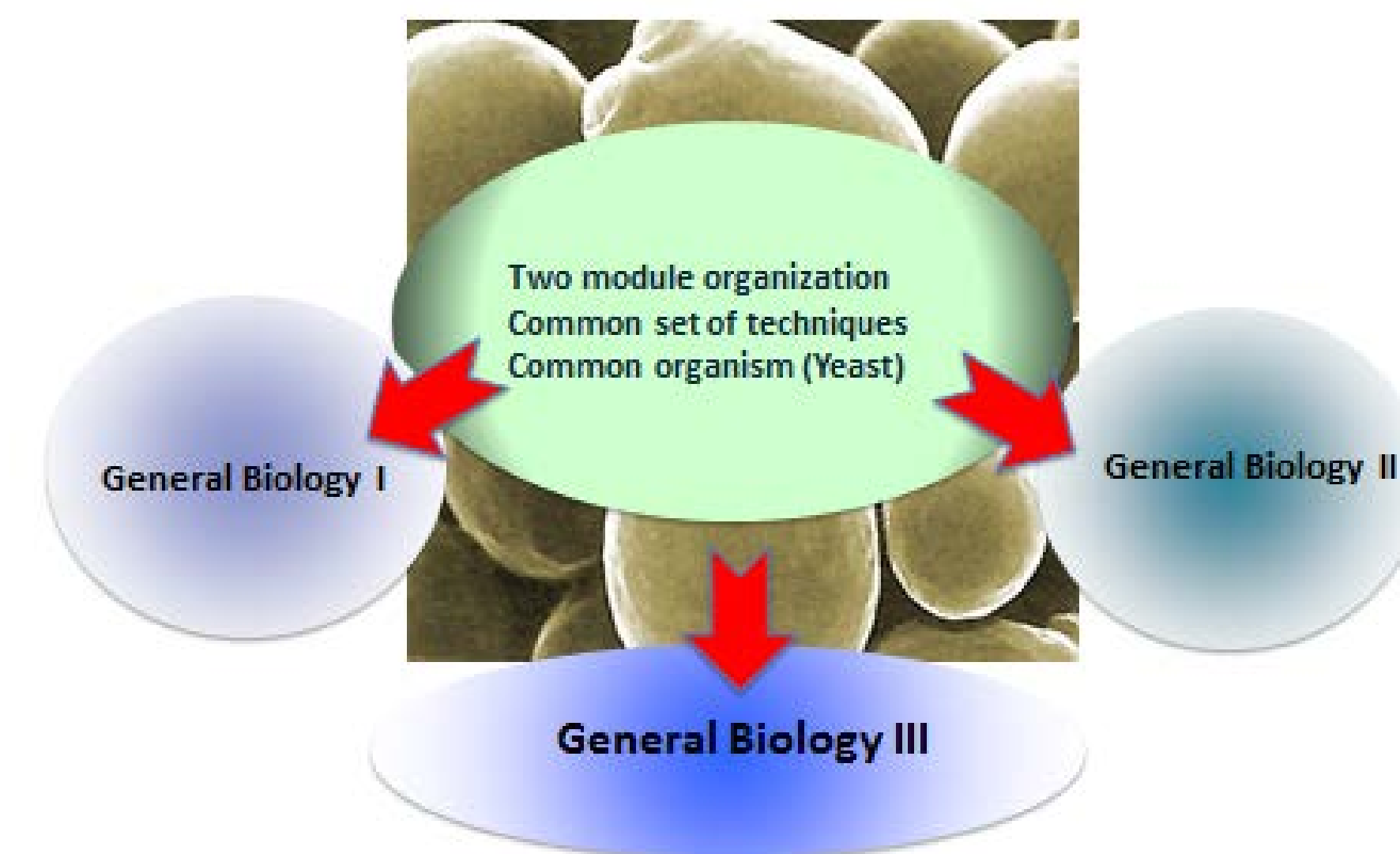


- An HBCU located in Durham, NC
- A comprehensive liberal arts institution
- One of the 16 constituent institutions of the state university system
- Undergraduate Student Enrollment of 8500 with 400 Biology Majors
- Approximately 90% of the students enrolled in our institution are first generation college students
- Average SAT score for combined Math & Critical Reading Sections = 852 (Math = 428 & Critical Reading = 424)

## Traditional vs Course based Undergraduate Research Experiences (CURE) Labs

	Traditional Labs (Non-CURE )	Research Infused Labs (CURE)
<b>Organization of Labs</b>	16 separate labs	2 Modules
<b>Skills</b>	No focus on skills	Introduction to Research Module
<b>Experimental Design</b>	No focus on skills	<b>General Biology I and II</b> Apply Scientific Method  <b>General Biology III</b> Requires students to plan experiments before using it
<b>Pre-Lab Quizzes</b>	Hard copy	Online
<b>Objective Lab Exams</b>	Yes	No
<b>Lab Notebooks</b>	No	Yes

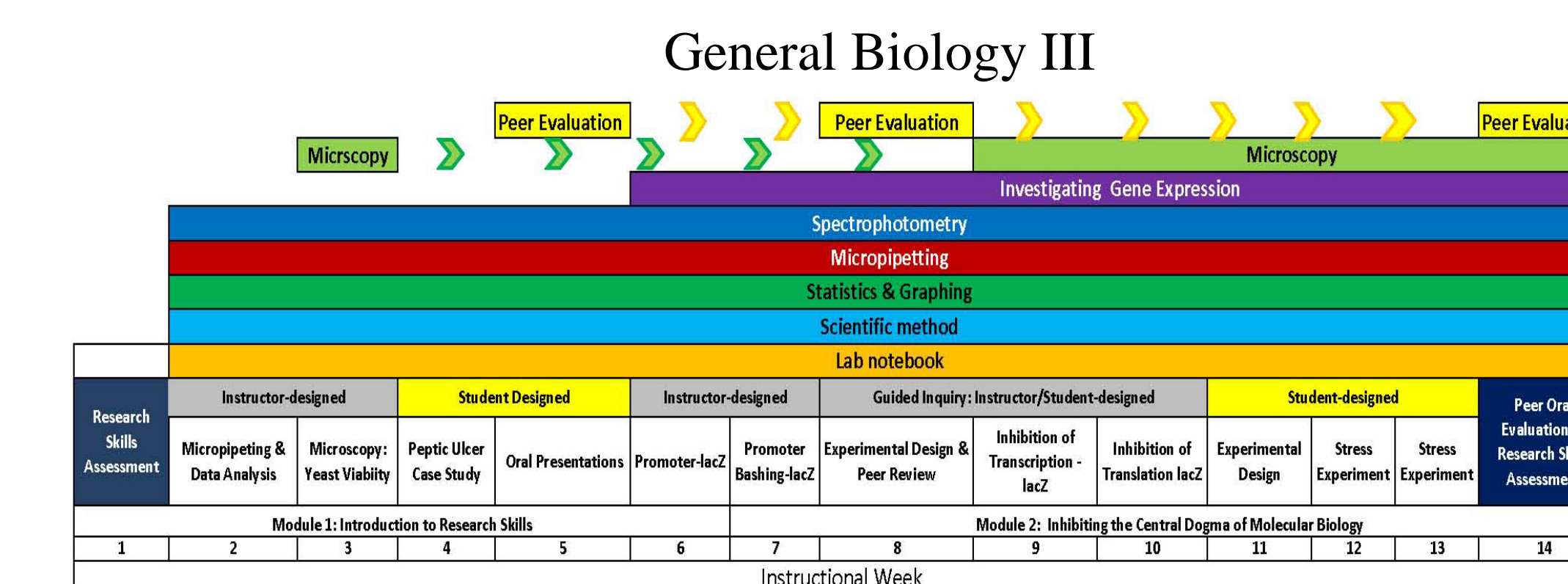
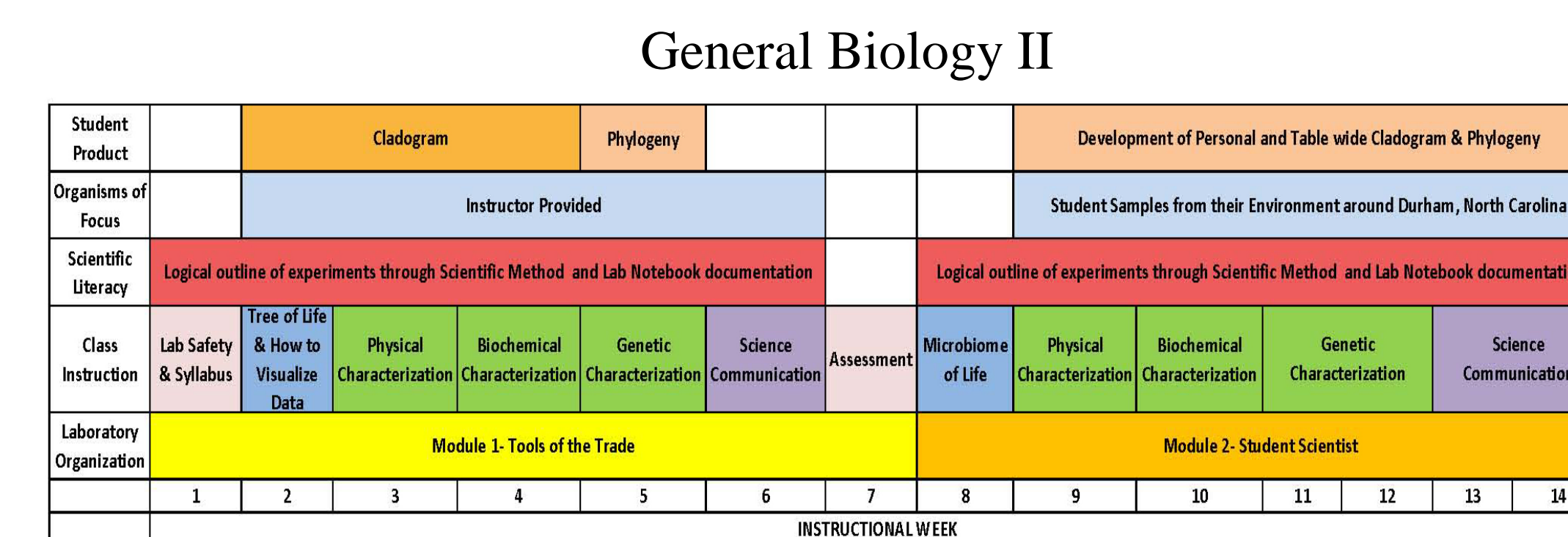
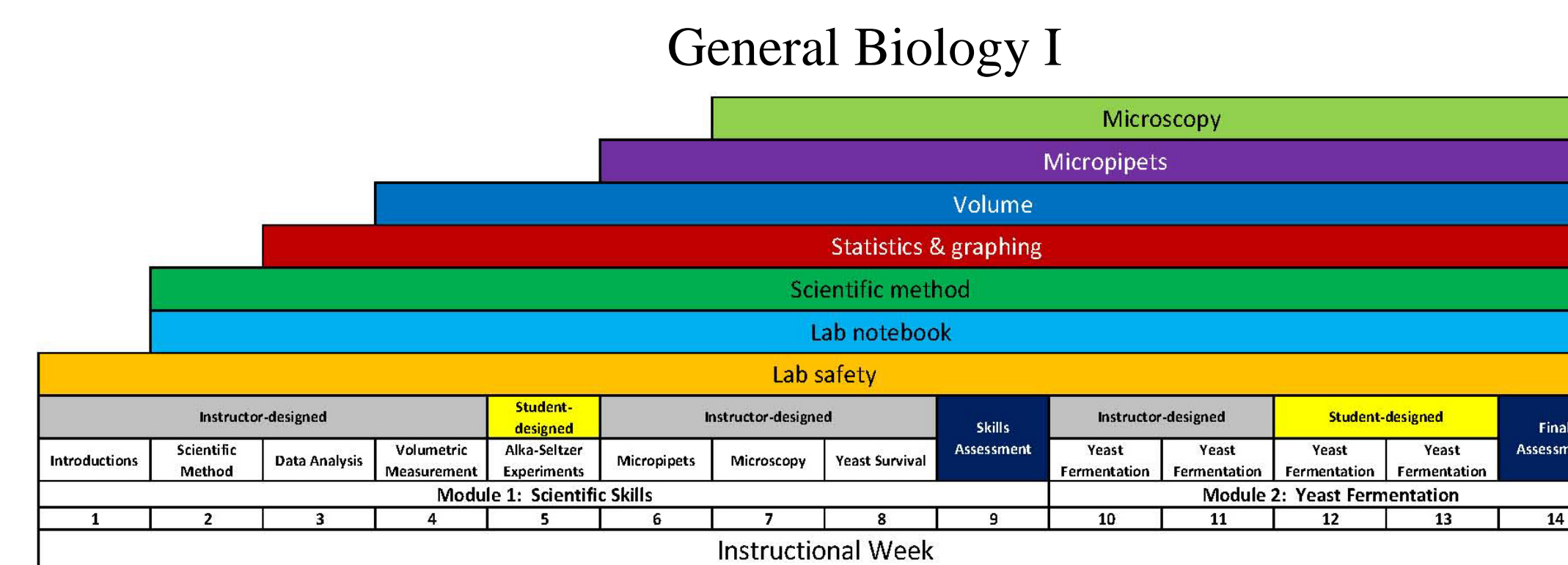
## Scaffolding approach



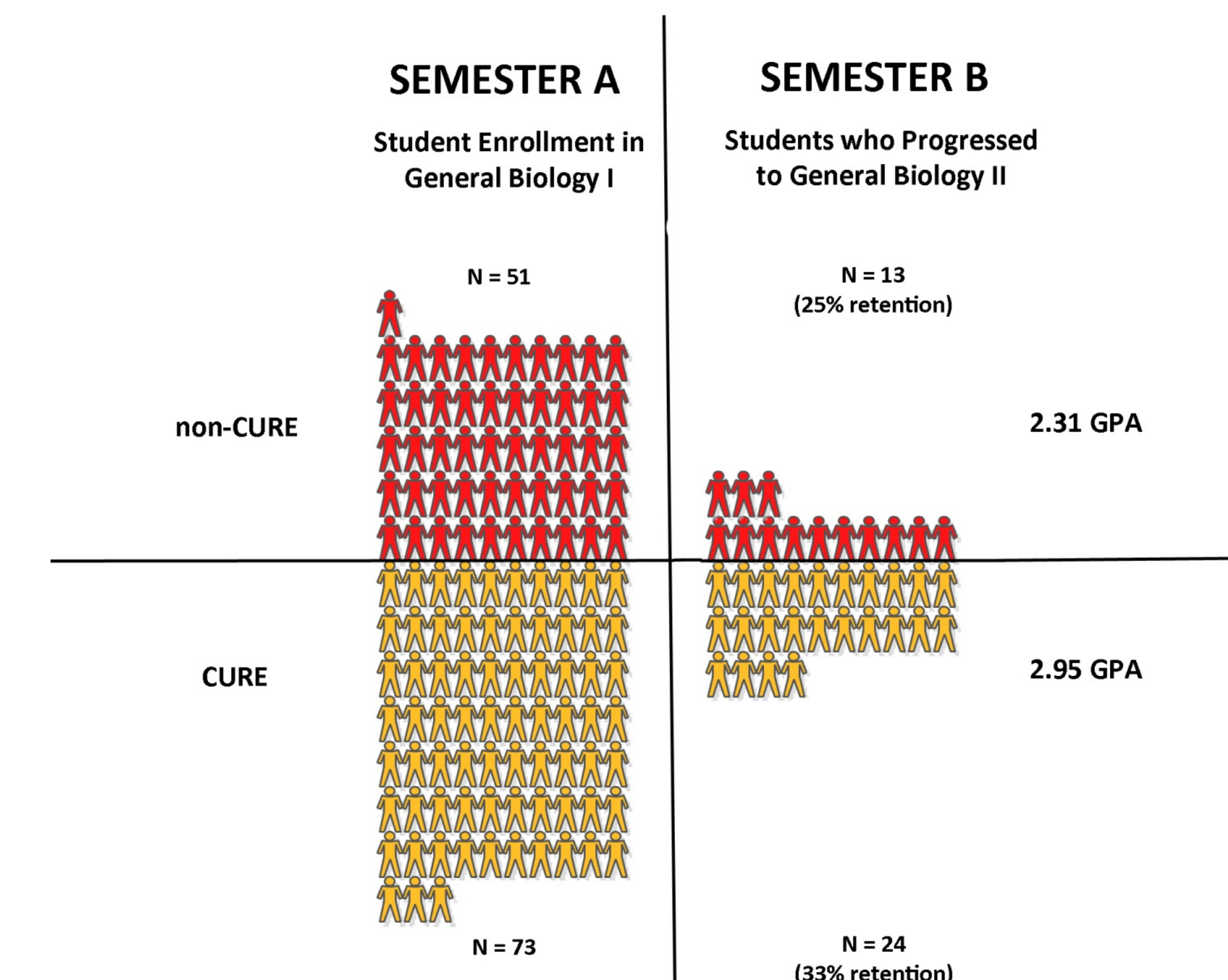
## Module Overview

	GENERAL BIOLOGY I	GENERAL BIOLOGY II	GENERAL BIOLOGY III
<b>Module 1</b>	Introduction to Research	Scientific Method Measurements Pipetting	Application of Scientific Method Measurements Pipetting
		Microscopy	Microscopy with Spectrometry
<b>Module 2</b>	Yeast Research	Phylogeny Genomic Comparison	Central Dogma of Molecular Biology
<b>Evaluation</b>	Written Lab Report	Written Lab Report	Oral Presentation

## Detailed Diagrams of the Science & Communication Skills Emphasized in the CURE Labs Throughout the Semester



## Research Infused Laboratory Increases Student Retention in Biology



Research Infused Laboratory Courses Enhance Students' Performance		
	Non-CURE Lab Sections (N=74)	CURE Lab Sections (N=89)
% of Students earning grade of A or B	17.5%	31.5%
% of Students earning grade of C	23.0%	33.7%
% of Students earning grade of D or F	59.5%	34.8%

p < 0.0001 by  $\chi^2$  test of these groups.  
p = 0.0026 by Fisher's exact test comparing passing (A, B, C) vs. failing (D, F) grades.

## PEER LED TEAM LEARNING



In this course implementation, we have utilized peer led team learning communities to enhance faculty teaching and ensure effective development and implementation of innovative curricula. Each team consists of a faculty member, a post-doctoral fellow, a graduate assistant, and an undergraduate assistant.

## CONCLUSIONS

As our university looks towards the future, this model will improve STEM teaching and learning assuring that students at NCCU are not only attracted to the sciences, but retained and graduated as scientifically curious, confident, and literate students, prepared to make contributions to a global society.

## REFERENCES

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