Forensic Biology: Integrating Social Sciences for Student Success

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and
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- M.S. in the Science of Instruction, Drexel University, Philadelphia, PA
- Ph.D. Genetics, Thomas Jefferson University, Philadelphia, PA
- Interest in forensic science
- Associate Professor, Biology Department, Community College of Philadelphia
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- B.S. in Biology, Drexel University, Philadelphia, PA
- Ph.D. in Molecular and Cell Biology and Genetics, Drexel University College of Medicine, Philadelphia, PA
- Previously worked as Autopsy Technician at Hahnemann University Hospital, Philadelphia, PA
- Assistant Professor, Biology Department, Community College of Philadelphia, Philadelphia, PA
- Adjunct Professor, Jefferson College of Biomedical Sciences, Thomas Jefferson University, Philadelphia, PA

Forensic Science Camp

- Offered Forensic Science Camps at Community College of Philadelphia for high school students in Summers from 2010 to 2012

BIOL 104 Forensic Biology

- Developed a new non-majors course at Community College of Philadelphia to teach science in context of law
- First sections offered in Fall 2013 at Main Campus and Northeast Regional Center (NERC)
- As of Fall 2016, 17 sections have run at both campuses

Majors Represented

- Predominant Student Populations Taking Forensic Biology:
  - Liberal Arts
  - Justice
  - Culture, Science & Technology
  - Psychology
  - Business Administration
  - Science

Course Description

This is an introductory course in the field of forensic science with a focus on forensic biology. Little or no prior knowledge of science is required. Lectures and assigned readings will supply enough background information to enable the student to understand topics and techniques used in forensic science. This course will cover several disciplines within forensic biology and expose the student to the breadth of the field of forensic science. In doing so, students will gain a basic understanding of the capabilities and limitations of the forensic sciences as they are presently practiced in the field.

Course Focus

- Although this is a course in Forensic Biology, students cover topics in:
  - Biology
  - Anatomy
  - Genetics
  - Chemistry
  - Physics
  - Math
  - Justice

Student Learning Outcomes

- Describe the basic principles and recognize the major fields of forensic science.
- Describe and demonstrate the techniques used to locate, collect, identify, and inventory relevant evidence found at a crime scene.
- Describe and demonstrate the value and necessity of ethics, integrity, and professionalism in forensic science.
- **Describe and demonstrate the techniques used for the gross examination of human remains.**
- Describe and demonstrate the techniques used to characterize trace evidence, including tissues and body fluids.
- **Describe and demonstrate the molecular techniques used in forensic science, including the analysis of DNA.**

Course Modules

- Module 1 Introduction and The Body
  - Introduction to Forensic Science
  - The “Crime Scene”
  - Individual and Class Evidence
  - Post-Mortem Examination

- Module 2 Tissues and Body Fluids
  - Fingerprints
  - Microscopy
  - Hairs and Fibers
  - Forensic Serology

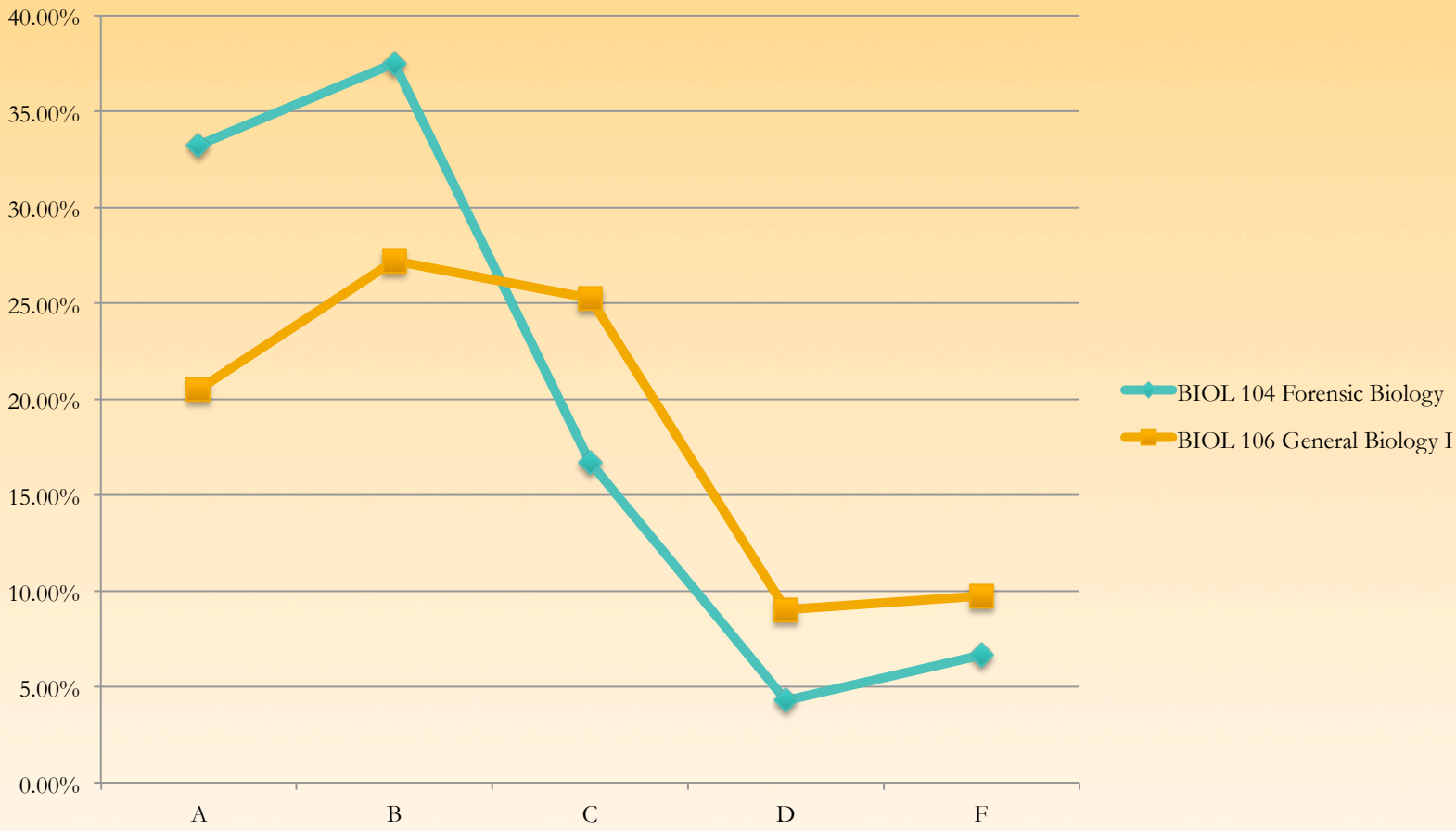
Course Modules (cont.)

- Module 3 Molecules- Drugs and DNA
  - Drugs
  - Forensic Toxicology
  - DNA and DNA Analysis

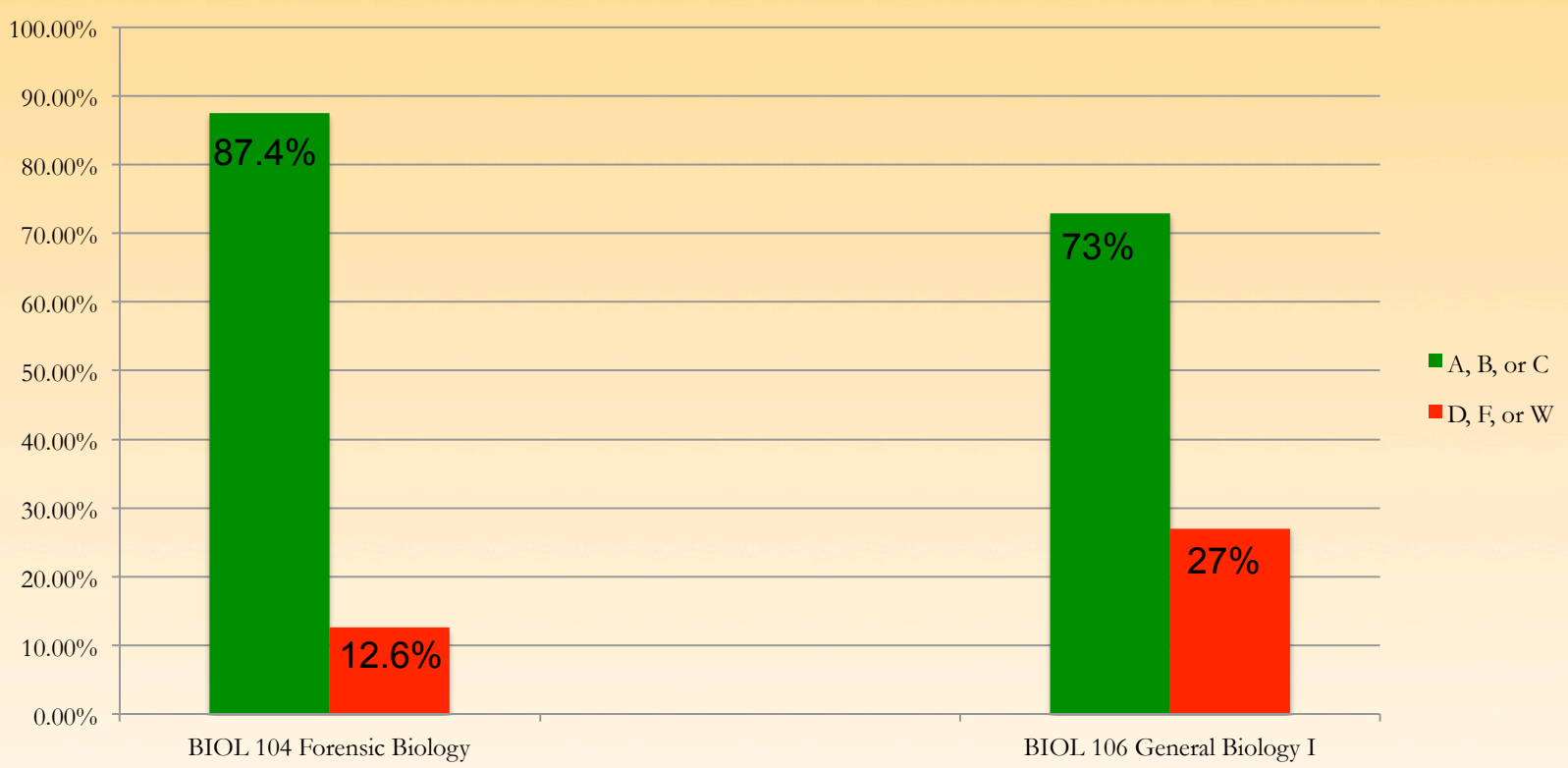
Student Success

	A	B	C	D	F	W	Total
BIOL 104 Forensic Biology	100 33.25%	118 37.49%	54 16.70%	11 4.28%	23 6.67%	6 1.61%	312 100%
BIOL 106 General Biology I	1280 20.49%	1682 27.19%	1590 25.27%	593 9.03%	645 9.74%	568 8.25%	6359 100%

Student Success



Student Success



Student Comments

- “BIOL 104 has a bright future. I really enjoy(ed) the course because of the labs.”
- “Enjoyed this new course.”
- “I did not think I would enjoy the class as much as I did...”
- “Easily my favorite course I’ve taken at CCP.”
- “Fun class. Almost made me want to switch majors.”
- “I am more interested in Forensic Biology after taking your class.”
- “I’m actually sad that this class is ending.”
- “The course was very challenging but very informative.”
- “I’d recommend anyone to take this class.”
- “Made me appreciate science as a non-science major.”
- “Interesting topics and fun labs.”
- “Autopsy and DNA labs were pretty cool.”

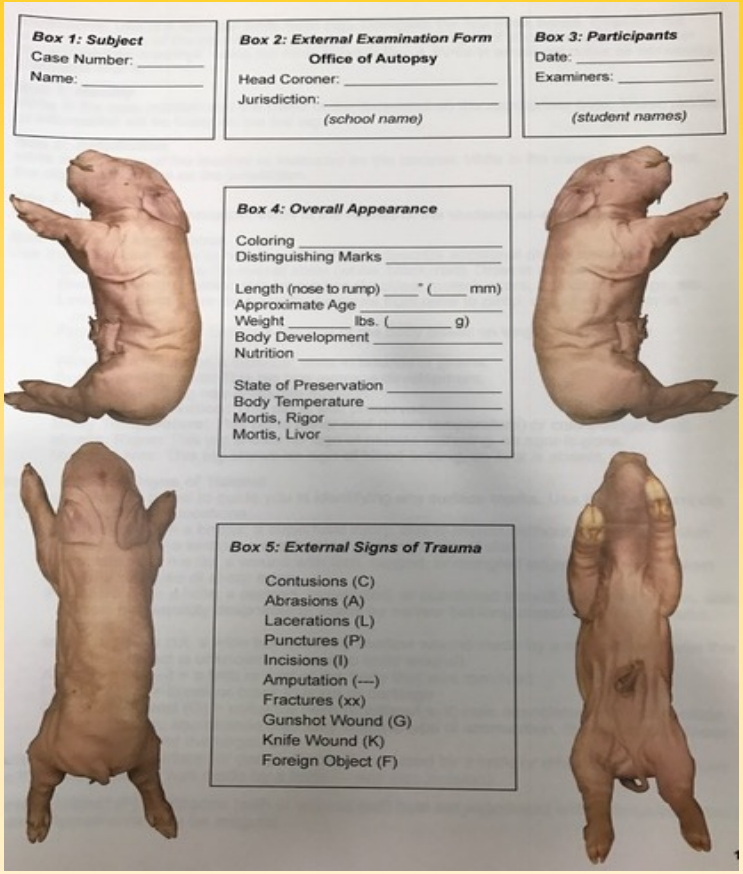
Labs – Custom Lab Manual (*Morton Publishing)*

- Lab 1 Scientific Measurements
- Lab 2 Locard's Principle
- **Lab 3 Autopsy**
- Lab 4 Fingerprinting
- Lab 5 Hairs and Fibers
- Lab 6 Blood
- Lab 7 Drugs and Poisons
- **Lab 8 DNA Extraction**
- **Lab 9 Pipetting and PCR**
- **Lab 10 DNA Fingerprinting**

Lab 3: Autopsy

- **Two-week lab using Nasco (#LS03825M) – Cause of Death Autopsy Investigation Kit: "Who Killed the Three Little Pigs?"**
  - Outcomes of this lab allow students to:
    - Perform external examination and document any findings
    - Perform internal examination (dissection), examining all internal structures and documenting any findings.
    - Generate an "official" autopsy report and determine a cause of death.
    - Potential causes of death are: Stab Wound, Gun Shot Wound, Cervical Dislocation ("broken neck")

Lab 3: Autopsy (cont.)



Box 1: Subject
Case Number: _____
Name: _____

Box 2: External Examination Form
Office of Autopsy
Head Coroner: _____
Jurisdiction: _____
(school name)

Box 3: Participants
Date: _____
Examiners: _____
_____
(student names)

Box 4: Overall Appearance

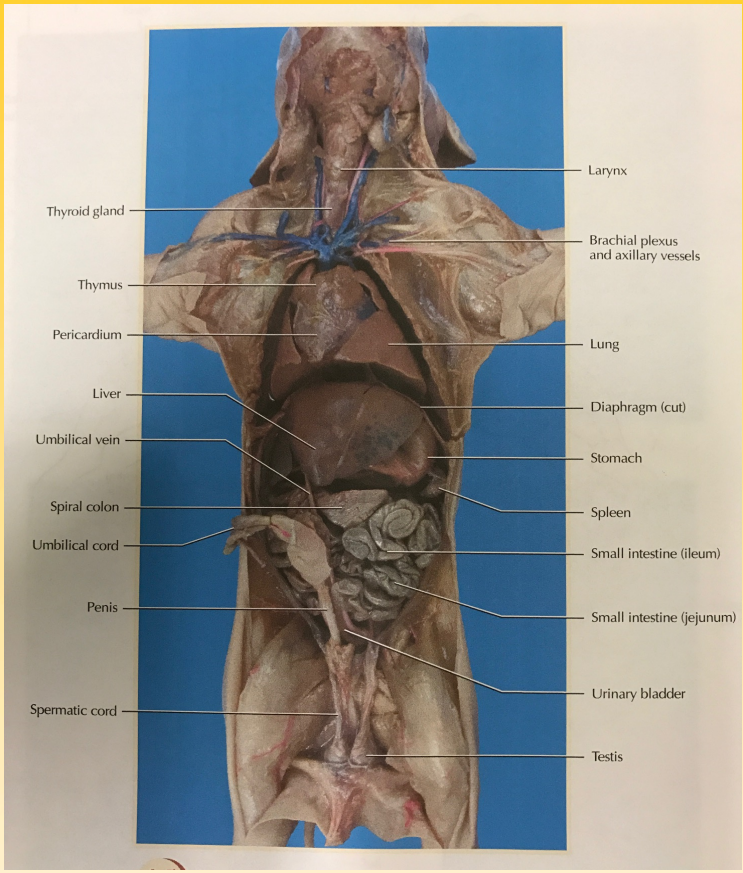
Coloring _____
Distinguishing Marks _____

Length (nose to rump) ____" (____ mm)
Approximate Age _____
Weight _____ lbs. (_____ g)
Body Development _____
Nutrition _____

State of Preservation _____
Body Temperature _____
Mortis, Rigor _____
Mortis, Livor _____

Box 5: External Signs of Trauma

Contusions (C)
Abrasions (A)
Lacerations (L)
Punctures (P)
Incisions (I)
Amputation (---)
Fractures (xx)
Gunshot Wound (G)
Knife Wound (K)
Foreign Object (F)



Lab 3: Autopsy (cont.)

Autopsy Report

Forensics Biology
Medical Examiners Office

Philadelphia, PA 19130

NAME:	AUTOPSY NO:
AGE:	DATE:
SEX:	TIME:
PROCESCUTOR: ASSITANT:	MEDICAL EXAMINER:

ANATOMICAL FINDINGS:

CAUSE OF DEATH:

MANNER OF DEATH:

_____ _____

COMPLETED BY **DATE**

CIRCUMSTANCIAL SUMMARY

DOCUMENTS AND EVIDENCE EXAMINED

IDENTIFICATION

CLOTHING AND VALUABLES

EXTERNAL EXAMINATION

Labs 8-10 DNA Fingerprinting

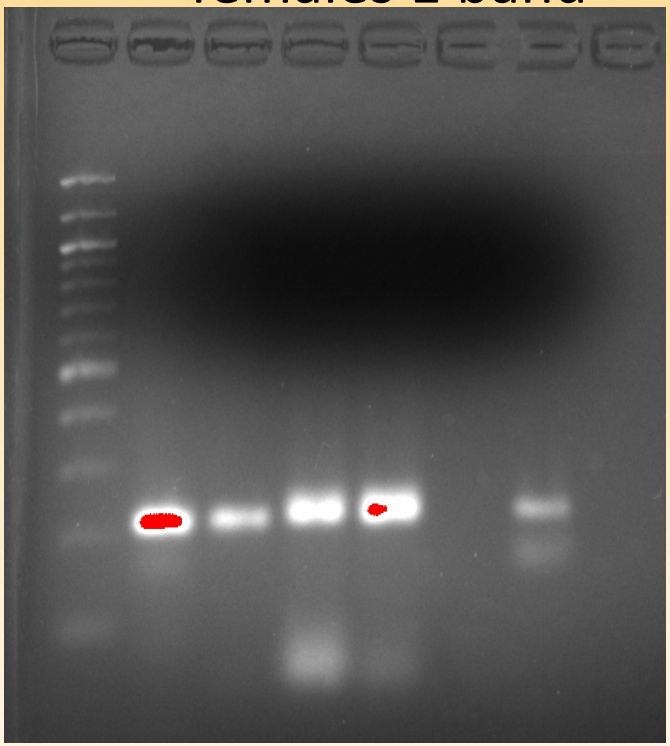
- Developed Forensic STR Kit with Paratope Technologies
- “Science Departments and Technology Companies: Successful Academic-Industry Partnerships” with Dr. Nicholas Siciliano on Monday

Forensic STR Kit

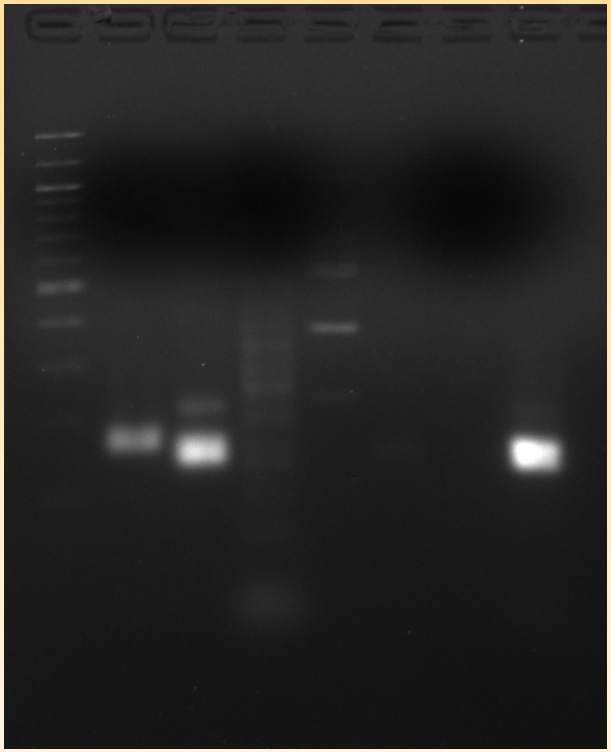
- Module 1 (Lab 8): **DNA Extraction**
  - students extract their own DNA using a buccal swab
- Module 2 (Lab 9): **Pipetting and PCR**
  - students learn to use micropipetters and then set up 3 Polymerase Chain Reactions (PCRs):
    - Amelogenin (Amel)- molecular sex determination
    - von Willebrand factor type A (vWA)
    - D13S317
- Module 3 (Lab 10): **DNA Fingerprinting**
  - students load samples onto agarose gels
- lab/class
  - students analyze results

DNA Fingerprinting Results

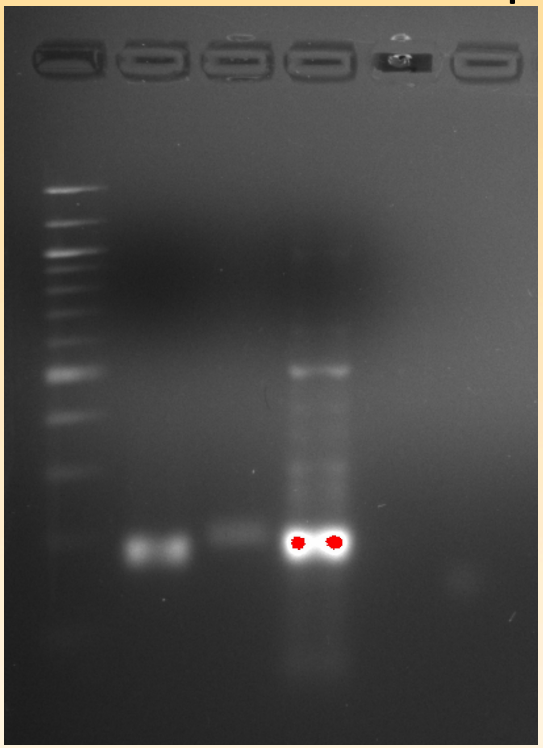
Amel: males 2 bands, females 1 band



vWA: 123-181 bp



D13S317: 157-201 bp



Recommendations

- Continue to offer BIOL 104 Forensic Biology course at Community College of Philadelphia (and other community colleges)
- Use BIOL 104 Forensic Biology in Guided Pathways leading to Justice and Paralegal Curricula
- Develop other lab science courses to teach science in context for non-Science majors (e.g. food science for Culinary Arts students)

Questions?

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