

Evaluating the Use of Green Embalming in Anatomical Education for Pathologists' Assistant Students

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INTRODUCTION

- Traditional cadaveric specimens are embalmed with formaldehyde-based solutions to provide robust preservation but compromise to tissue pliability and coloration.
- Green embalming employs an alcohol-based solution intended to retain tissue flexibility, texture, and color.
- Quinnipiac University (QU) has been exploring implementing green-embalmed donors within its anatomy department.
 - The class of 2027 pathologists' assistant (PathA) students at QU had 6 total donors to dissect during their anatomy lab semester, with one being a green donor.
 - Students were split into groups of five and assigned one donor per group for the semester.
- This study analyzes how the QU students perceived the green donor, including its effectiveness towards their anatomic education, accuracy to unfixed tissue, and aid in clinical preparedness.

GREEN EMBALMING OVERVIEW

FIXATION SOLUTION - Ethanol-based solution (Proprietary mixed employed by QU). - Requires slower perfusion and cure time (2 weeks to 6 months).¹	MAINTENANCE - Refrigeration not necessary. - Donors are prone to drying out via alcohol evaporation. - Must be checked every 2 days to moisten or refresh fixation.¹
APPEARANCE - Maintains color preservation of skin, muscle, and organ tissue. Skin is supple and retains elasticity.⁵ - Joints are flexible and easily maneuverable.	COST - Increase in cost compared to traditional cadaver based on: - Required maintenance. - Volume of fixation solution needed per donor.
DURABILITY - Proper embalming technique and continual maintenance will affect longevity. - Will last 24-36 weeks in an anatomical education setting.¹ - Difficulty in larger donors maintaining preservation standards. - Proper brain fixation also presents current challenge.	SAFETY - Decreased health risks: - Ethanol-based solution is non-toxic and safe for long-term exposure.² - Antimicrobial properties remain similar to formaldehyde-based solutions³
CURRENT APPLICATIONS - Anatomical education - Surgical procedure practice - Imaging practice	ENVIRONMENTAL IMPACT Ethanol breaks down into non-harmful substances, effectively reducing pollution of ecosystems after disposal.

METHODS

- The class of 2027 QU PathA students, attending their first clinical rotations at the time of this project, were asked to complete an electronic survey to evaluate their experience with the green donors during their 2025 summer semester of human anatomy.
 - While students were assigned to a specific group, they were free to observe other group's donors during anatomy lab, therefore all students had some exposure to the green donor.
 - The survey asked all students to rank statements about the green donor on a 7-point Likert scale (ranging from strongly disagree to strongly agree).
- A total of 25 responses were collected (N=25), with 20 being from students assigned to a traditional donor and the remaining 5 being students who worked with the green donor.

RESULTS

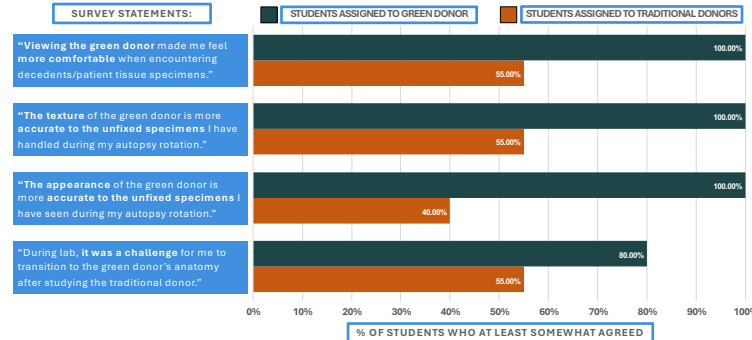


Figure 1. Student responses that at least somewhat agreed to the survey statements, by donor type. Students who were assigned the green donor reported overall higher satisfaction and correlation of their laboratory experience to their current clinical rotation experience.



Figure 2. Photographs of a green donor in QU's anatomy lab. (A) External appearance of anterior and posterior torso. (B) Adduction of right arm demonstrating joint maneuverability. (C) Reflection of chest and torso adipose tissue. (D) Exposed abdominal cavity with viscera. (E) Exposed chest cavity and viscera.

"My donor successfully prepared me to handle working with unfixed tissue during my clinical rotation."

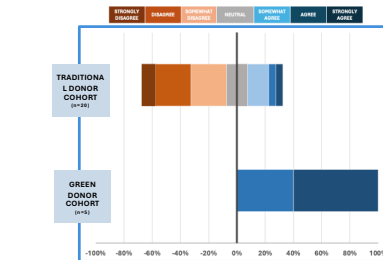


Figure 2. Comparison of student's perceived clinical preparedness based on donor type. 100% of the green donor students agreed or strongly agreed their donor prepared them to handle unfixed tissue during clinicals, compared to only 10% from the traditional donor cohort.

85%

of students assigned to traditional donors at least somewhat agreed they needed more exposure to unfixed tissue prior to beginning clinical rotations.

CONCLUSION

- Students assigned to green donors strongly perceived their donor as having a texture and appearance closely resembling that of unfixed tissue.
- Students assigned to traditional donors had mixed opinions, however 80% of these students spent 15 minutes or less per a 2-hour lab studying the green donor anatomy.
- Students assigned to green donors reported greater clinical preparedness when handling unfixed tissue during clinical rotations.
- 80% of all respondents supported a future role for green donors in the anatomical education of PathA students.
- Limitations of these results included:
 - Small total sample size (N=25), especially for the green donor cohort (n=5).
 - Student responses only collected from single institution (QU).

DISCUSSION

- Based on survey results, students want more practice with fresh tissue during didactic year. Green donors are a promising technology to fill that gap.
- The next steps to this project would include:
 - Locating a bigger population size to collect survey responses.
 - Strategizing ways a green donor can be best implemented in a PathA program. An interesting avenue to explore would be autopsy-specific practice.
 - Ascertaining how other health schools at QU perceived their experience with the green donors.
 - Analyzing how feasible it is for other PathA programs to procure a green donor.

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