

Research Week Abstract Instructions and Template
Posters and Presentations

Research Abstract Instructions

Write a concise summary of the key points of your research. This abstract needs to represent your research well as it could be used as part of the judging criteria during the event. Your abstract should contain a strong literature review or introduction to your research topic, hypothesis or research questions, methods, results, and conclusions. You should also include possible implications of your research and future work you see connected with your findings. Your abstract should be a single paragraph double-spaced. Your abstract should be *between 200 and 300 words*. The second paragraph should address how your research is informed by a Christian worldview. **In 250-500 words**, describe how your Christian worldview has informed your research design and communication of your results.

When submitting your abstract, please use the template (abstract sample) provided below.

Abstract

Title – High Strength, Stiffness, and Toughness Polypropylene Composite for a Football Helmet Shell

Program of Study – Engineering

Presentation Type – **Choose one of the following:** Three Minute Thesis.

Subtype – **Choose one of the following for poster or oral presentation types:**

Theoretical Abstract

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Abstract: This thesis will examine the use and benefit of a thermoplastic composite material as an American football helmet shell. Currently, football helmet shells are made of either polycarbonate (PC) or acrylonitrile-butadiene-polystyrene (ABS), thermoplastic polymers which contain high impact strength and stiffness. While these materials have historically done well to protect athletes from skull fracture, they have not been demonstrated to prevent concussions. By studying nature, our research group has previously found biological protective features, such as rams' horns, turtle shells, and woodpecker beaks, to have a specific material or geometrical design that allows effective stress wave dissipation, thereby preventing neurological damage upon impact. From these studies, we have determined a high strength, stiffness, and toughness thermoplastic composite outer helmet shell will be ideal in order to reduce concussions. A

composite material having these properties will be effective in dispersing stress waves across the entire helmet, thereby reducing impact localization. The tensile pressure in the brain will also be decreased due to this force delocalization and stress wave dissipation; concussion reduction will be a byproduct. Analysis of commercial and novel thermoplastic composites has demonstrated polypropylene reinforced with carbon fiber (40% by weight) will be the most effective high strength, stiffness, and toughness thermoplastic composite for reducing concussions in an American football helmet.

Christian worldview integration: The design of the entire football helmet system follows a bio-inspired design paradigm. This bio-inspiration draws its influence from biological structures, such as ram horns, turtle shells, and woodpecker beaks, designed by God. Utilizing God's design methodology is a way to honor God's infallible and infinite wisdom. Also, if successful in reducing brain damage, we can use this helmet as a testimony to lead others to Christ by clearly demonstrating biological design, a process which is not possible without a creator, God. This research directly fulfills a Christian worldview because of its mission to serve others. By improving existing football protective technology, athletes will be benefited greatly. Since concussions and chronic traumatic encephalopathy are both prevalent issues in football and have serious short and long term health effects, technology enhancement will increase football players' quality and longevity of life.