Clemson Packaging Science
• University Reorganization (new/seven colleges)
  – College of Agriculture, Forestry and Life Sciences (CAFLS)
    • Dept. of Food, Nutrition, and Packaging Sciences (FNPS)
  – College of Architecture, Arts and Humanities
  – College of Behavioral, Social and Health Sciences
  – College of Business
  – College of Education (including the Eugene T. Moore School of Education)
  – College of Engineering, Computing and Applied Sciences
  – College of Science
Safe, Nutritious, Good-tasting, Sustainably-Packaged Food
• Department of Food, Nutrition, and Packaging Sciences (FNPS)
  – 24 faculty with 552 students combined
  – **B.S. degrees** in Food Science & **Packaging Sciences**
  – Graduate degrees (over 60 graduate students)
    • **M.S.** in Food, Nutrition, Culinary Sciences,
    • **M.S.** in Packaging Science
    • **Ph.D.** in Food Technology (interdisciplinary)
    • Individually designed programs depending on student’s background
• Department of Food, Nutrition, and Packaging Sciences (FNPS)
• 24 Faculty includes
  – seven lecturers, one administrator/faculty
  – 17 TT faculty members
  – Teaching = 14.5
  – Research = 5.5
  – Extension = 4.0
• **Undergraduate degree program**
  – B.S. in Packaging Science
    • Hands-on experience through lab work, industry projects and internships/co-ops
    • Active learning through technology
    • Individual attention

• **Two thesis-based graduate degrees**
  – M.S. Packaging Science
  – Ph.D. Food Technology (interdisciplinary)
  – Individually designed programs depending on student’s background
• B.S. and M.S. degrees in Packaging Science
  – Focused around four emphasis areas:
    • Distribution & Transportation Technology
    • Material Science
    • Food & Healthcare
    • Package Design & Graphics
• In each of these four areas, we conduct teaching, research, and service
• It is common for research to span more than one of these areas
FNPS Undergraduate Programs

• B.S. in Food Science and Human Nutrition
  – Two concentrations:
  – Food Technology (Culinary emphasis)
  – Human Nutrition

• B.S. in Packaging Science
  – Four Emphasis areas:
    • Distribution & Transportation
    • Materials
    • Food & Healthcare
    • Package Design & Graphics
## Packaging Science 5yr Enrollment

<table>
<thead>
<tr>
<th>Year</th>
<th>New Students Enrolled Packaging Science</th>
<th>Avg SAT</th>
<th>Avg ACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>Freshman 32</td>
<td>1197</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Transfer 10</td>
<td></td>
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<tr>
<td>2013</td>
<td>Freshman 33</td>
<td>1174</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Transfer 14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>Freshman 37</td>
<td>1263</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Transfer 14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>Freshman 38</td>
<td>1246</td>
<td>28</td>
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<tr>
<td></td>
<td>Transfer 22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>Freshman 43</td>
<td>1199</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Transfer 19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Graph:**
- **Total Freshman**
- **Total Freshman**

### Yearly Enrollment Trends

- 2012: 53
- 2013: 55
- 2014: 53
- 2015: 56
- 2016: 55
FNPS Graduate Programs

- M.S. Food, Nutrition, and Culinary Sciences
  - Thesis and
  - Non-thesis
- M.S. Packaging Sciences
- Ph.D. Food Technology
• Undergraduates Total = 598
  – FSHN = 315
  – PKSC = 283

• Student/Teaching FTE Ratio = 41 to 1
  – Student / TT Faculty Ratio = 35 to 1

• Ref. Publications / Research FTE = 6 to 1
  – Refereed Publications / TT Faculty = 1.9 to 1
• Ref. Publications / Research FTE = 6 to 1
  -- Refereed Publications / TT Faculty = 1.9 to 1

![Bar chart showing Ref. Pubs/year for years 2015-2016 to 2012-2013.

- 2015-2016: 33
- 2014-2015: 50
- 2013-2014: 33
- 2012-2013: 32

Legend:
- Series1

Ref. Pubs / year]
Open Positions

• PKSC TT Faculty Open Position -
  – Search Committee formed, Dr. Cooksey Chair
  – Drs. Kimmel, Batt, Hurley, and Barron
  – Position Description written - Automotive Packaging/Supply Chain and Logistics Assistant Professor

• PKSC Lecturer
  – Mr. Aaron Synder will be leaving August 2017
  – Plan for same PKSC Search committee to recruit
Packaging Science Program Mission

- Advance the field of packaging globally by
  - producing knowledgeable, industry-ready graduates,
  - conducting innovative, and multidisciplinary applied research that contributes to economic development, and
  - providing responsive, high-quality service to our industry.
Multidisciplinary Research

- We have collaborated in research with numerous other departments within our college (CAFLS) and all 4 other colleges
  - Architecture & Design
  - Chemical Engineering
  - Computer Science
  - CU-ICAR
  - Food Science & Nutrition
  - Experimental Statistics
  - Graphics Communications
  - Materials Science
  - Mechanical Engineering
  - Rhetorics & Communications
  - External companies and consultants
Packaging Science Program Strategy

- **Capped & Restricted Program** - Managed program growth - our strength is our interdisciplinary hands-on laboratory experience, and uncontrolled growth is a threat in a resource neutral environment.
- Capitalize on the following growing trends (teaching, research, and industry service)
- **Sustainability**
  - Materials, down-gauging & bio-based polymers
  - Life Cycle Assessments (LCA’s)
  - Food Waste
- **Smart / Intelligent / Active Packaging**
- **E-Commerce Implications**
- **Consumer Response / Behaviors**
- **Antimicrobial Packaging - Food Safety / Packaging Nexus**
Educational Philosophy

• Broad-based interdisciplinary, industry oriented
  – Sciences and packaging
• Career skills integrated into courses
• Hands-on, experiential laboratory experiences
  – Total lab space >50,000 sq. ft. (incl. Smith Bldg.)*
  – 60/40 classroom/lab ratio
  – Required industry co-op (15-24 week)
  – Many industry-sponsored projects
• Opportunities for undergraduate research
• Holistic design approach
  – Materials + functional + prototyping + graphic + industrial + consumer
• Capstone Course (industry-sponsored projects)
Creative Inquiry (CI)

- CI gives undergraduates research opportunities working with faculty over several semesters, currently:
  - Design projects
  - Health care packaging
  - Converting technologies
  - Sustainable Packaging

- CI provides critical thinking opportunities
- ~30 CI teams in FNPS, 250-300 students each semester
- Definitely helps set our graduates apart from other universities
FACULTY
• Dr. Kay Cooksey, Professor, Cryovac Chair
  – Food Science, Packaging Science
  – Antimicrobial packaging, shelf life modeling, bio-based polymers, smart packaging, migration & scalping

• Dr. Bob Kimmel, Assoc. Professor, Director, Packaging Science Program & Center for Flexible Packaging
  – Materials Engineering
  – Polymer physics, plastic packaging design, packaging system design

• Dr. Duncan Darby, Assoc. Professor, Assoc. Director, Center for Flexible Packaging
  – Chemical Engineering
  – Converting, flexible film advances, flexible package design, heat sealing technology, printed electronics
• Dr. Greg Batt, Asst. Professor
  – Mechanical Engineering, Packaging Science
  – Protective packaging system transportation modeling, transportation environment measurement, analysis, and simulation

• Dr. Andrew Hurley, Asst. Professor, Sonoco Institute
  – Rhetorics & Communication, Packaging Science
  – Packaging design and marketing, CUshop®

• Dr. Heather Batt, Senior Lecturer
  – Food Technology, Anthropology, Nutraceuticals

• Bob Moore, Senior Lecturer
  – Packaging systems, bottles, dispensers, closures

• Erin Snyder, Lecturer
  – Packaging Science, Packaging design
• Dr. Scott Whiteside, Assoc. Professor, Extension
  – Food Technology, Agricultural Economics
  – Food packaging, food processing, retortable pouches
• Dr. E. Jeffery Rhodehamel, Professor, Chair
  – Food Safety, Food Packaging, Antimicrobial Packaging
• Dr. Anthony Pometto, Professor
  – Bacteriology, Biopolymers, Packaging Machinery
• Dr. Chip Tonkin, Director, Sonoco Institute
  – Computer science, graphics, printing technologies
Packaging Materials Research

• **Advanced Materials**
  – *Multi-component polymers (Darby, Kimmel)*
  – *Multi-layer pkg. materials (Darby, Kimmel)*
  – *Converting technologies, sealing (Darby)*
  – *Traditional biopolymers (chitosan, gelatin, grain proteins) (Cooksey)*
  – *Nanoclay-modified biopolymers (Whiteside)*
  – *Properties and applications of “sustainable” polymers (Cooksey, Darby, Batt)*
  – *Active packaging (Cooksey)*
    • Antimicrobial
    • Controlled release (flavors, aromas, antioxidants)
Packaging Materials Research

• Key Faculty
  – Dr. Duncan Darby, Dr. Robert Kimmel, Dr. Charles Tonkin

• Current Research Activities
  – Flexible packaging technologies
  – Package sealing systems
  – Sustainable packaging
  – Printed electronics
Food Packaging Research

• Food packaging systems
  – Food packaging design (Cooksey, Darby, Whiteside, Kimmel, Hurley)
  – Shelf Life - modeling and understanding material selection and product quality (Cooksey)
  – Food safety (Cooksey, Whiteside)
    • Thermal processing of flexible packages
    • Thermal and radiation sterilization technologies
    • Antimicrobial packaging
  – Aroma and flavor permeation/migration (Cooksey, Darby)
  – Food-package material interactions (Cooksey, Darby, Kimmel)
Food Packaging Research

• Key Faculty
  – Dr. Kay Cooksey, Dr. Paul Dawson, Dr. Ron Thomas, Dr. Scott Whiteside

• Current Research Activities
  – Antimicrobial packaging systems
  – Active / smart / modified atmosphere packaging
  – Retort packaging
Transport Packaing Research

- Transportation systems
  - Shock and vibration theory (Batt)
  - Distribution, product damage prevention (Batt)
  - Packaging materials’ properties and performance (Batt)
  - “Sustainable” cushioning materials (Batt, Darby)
  - Air transport distribution technologies (Batt)
  - Packaging systems development and management (Batt, Kimmel)
Transport Packaging Research

• Key Faculty
  – Dr. Gregory Batt

• Current Research Activities
  – Dynamic modeling of nonlinear, viscoelastic expanded polymer cushioning materials
  – Characterization of forces in the distribution environment
  – Experimental characterization of the shock and vibration response of cushion materials
Packaging Design Research

• Package design
  – Designing with sustainable materials (Hurley, Cooksey, Darby, Kimmel)
  – Source reduction for improved sustainability (Hurley, Cooksey, Darby, Kimmel)
  – Environmental impact of packaging (Kimmel, Cooksey)
  – Integration of functional, graphic and industrial design (Hurley)
  – Package design methodology (Hurley)
  – Consumer experience/interaction (Hurley, Tonkin, Darby)
  – Printed electronics (Tonkin, Darby)
Packaging Design Research

• Key Faculty
  – Dr. Andrew Hurley

• Current Research Activities
  – Eye-tracking and other bio-response studies
  – Consumer interactions with packaging
  – Distribution-marking studies
DuPont Packaging Lab

Film Extrusion and Laminating

- Cast Film Line
- 3-layer Blown Film Line
- Coater-Laminator
- Solventless Laminator
DuPont Packaging Lab

Pouch Making and Bottle Blowing

Leak Tester

Hot Tack Tester

Pouch Maker

5-layer EBM

VFFS
Sonoco Package Testing and Materials Evaluation Laboratory

Electrolux

WIX® Filters

FUJIFILM

BUSH’S BEST

NOVA Chemicals®
Cryovac® Flavour Mark™ Retort Laboratory
Permeation Testing Laboratory

Testing of Flat Materials or Packages Under Specified Temperature and Humidity Conditions

Mocon Units
- 3 Modules for Water Vapor Transmission
- 3 Modules for Low Oxygen Transmission
- 1 Module for High Oxygen Transmission
- Package Environmental Chamber

Illinois Instruments Unit
- 1 Module for Oxygen Transmission
Sonoco Institute of Packaging Design & Graphics
Design Lab

Digital Printing

Prototype Production

Consumer Response

Digital Platemaking

Platform Press

Surface Analysis

Ink Formulation

Plate Processing

from idea to invention
Other Labs

• Food packaging microbiology lab
  – Equipment to grow microbes and test active packaging solutions

• Food packaging lab
  – Equipment to test food / package interactions

• Analytical lab
  – IR, thermal analysis, COF, microscope, Gelbo, haze, contact angle, hot tack, sealability, etc.
Student Activities / Accomplishments
• Three day, student-run packaging conference
• Invited schools with packaging programs/degrees
• Clemson hosted the 30th annual Jamboree
  – 200 registered (144 students) from five schools
  – Clemson, MSU, UW-Stout, Virginia Tech, and RIT
  – Networking, speakers, tours, and activities
Examples of FNPS Undergraduate Teams
Flexible Packaging Association 2015 Awards

• **First Place Team:**
  • “Froot Loops Cereal Packaging”
  • https://www.youtube.com/watch?v=1AoTtQljrKM&feature=youtu.be

• **Second Place team:**
  • “Off the Grid Trail Mix”
  • https://www.youtube.com/watch?v=7ANkcM2D8ks&feature=youtu.be
Examples of FNPS Undergraduate Teams
2015 SE Section IoPP 48 HR Re-pack Award

We are Very Pleased to Announce the Top 10 Teams* of
This Year’s 48 Hour RePack Student Design Competition:

- STRICTLY BUSINESS FLOUR - Creative Circus
- PUSH - Georgia State University
- NATURE’S MEDLEY - California Polytechnic University
- BAND-ITS - Rutgers
- NEATO BURRITO - Clemson University
- BAKETRESS - Portfolio Center
- RISE BAKING COMPANY - Wichita State University
- KEEP ME TOGETHER - Georgia Tech
- EARNEST BLUE FARMS - Creative Circus
- BAND+AID - University of Bridgeport

*Random Order

The Top 3 Winners Will Be Revealed @
April 16th!
Examples of FNPS Undergraduate Teams
2015 SE Section IoPP 48 HR Re-pack Award
(Third place)

http://www.thedieline.com/blog/2015/4/9/concepts-we-wish-were-real

https://www.youtube.com/watch?v=gdhwwlp9h4
Examples of FNPS Undergraduate Teams
Association of Independent Corrugated Converters (AICC)
(First place)

Corrugated as Art -
Students design anything of their choosing out of corrugated

First Place Winners -
Clemson University, Team “Pack Attack”: “Minecraft”
Brandon Francois,
Emily Elliot,
Linden Holder,
Arif Javed,
Edward Couvillion
Esko Gift to Sonoco Institute

Esko has given to Clemson University’s Sonoco Institute of Packaging Design and Graphics gift-in-kind equipment, maintenance, and software valued at nearly $27 million over a five-year period.

2016 PackExpo Chicago

- Clemson Packaging Science Department & Sonoco Institute
  - 53 students attended
2016 PackExpo Chicago
2016 Student Awards

• Ms. Mengmeng Zhao
  – PKSC Graduate Student and Ph.D. Candidate
  – 2016 Student Package of the Year Award
  – Association for Dressings and Sauces (ADS)
Spring 2016 Outstanding Seniors

• **Ms. Sarah Zemitis**
  – Packaging World Outstanding Senior
  – Emphasis Area with a 3.96 GPA
  – Two Internships, Proctor & Gamble
  – Upstream Packaging - Carton supplier / consumer studies
  – Plans to go to graduate school in Materials Science & Engineering and study polymeric materials

• **Ms. Kelsey Byrd**
  – Dr. Robert Testin Outstanding Packaging Science Senior
  – Design Package Design and Graphics with a 3.96 GPA
  – Co-op with Package Insight and Spanx’s creative Dept. in Atlanta
  – Enjoys packaging design competitions (48-Hour Repack)
  – After graduation plans to pursue a career in Brand Management and Design
Fall 2016 Outstanding Seniors

• Mr. Paul Dunnivant
  – Packaging World Outstanding Senior
  – Co-op w/ BMW Manufacturing & interned w/ AECOM Inc., Greenville, SC
  – Paperboard Packaging Alliance Scholarship

• Mr. Wayne Stevenson
  – Robert Testin Outstanding Senior
  – 4.0 GPA, PKSC Major with Minor in Business Administration
  – Co-op with Package Insight, LLC concentrating on consumer biometric research projects