CLEMSON

FOOD, NUTRITION, AND PACKAGING SCIENCES

CLEMSON

FOOD, NUTRITION, AND PACKAGING SCIENCES

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

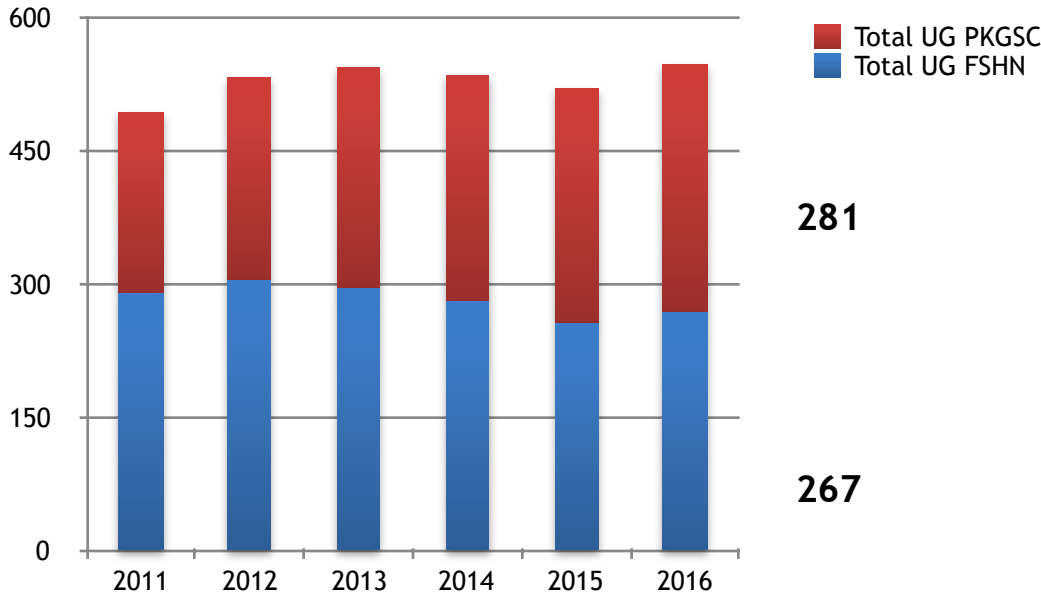
- Department of Food, Nutrition, and Packaging Sciences (FNPS)
- 24 Faculty includes
  - seven lecturers, one administrator/faculty
  - 17 TT faculty members
  - Teaching = 14.5
  - Research = 5.5
  - Extension = 4.0

- 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

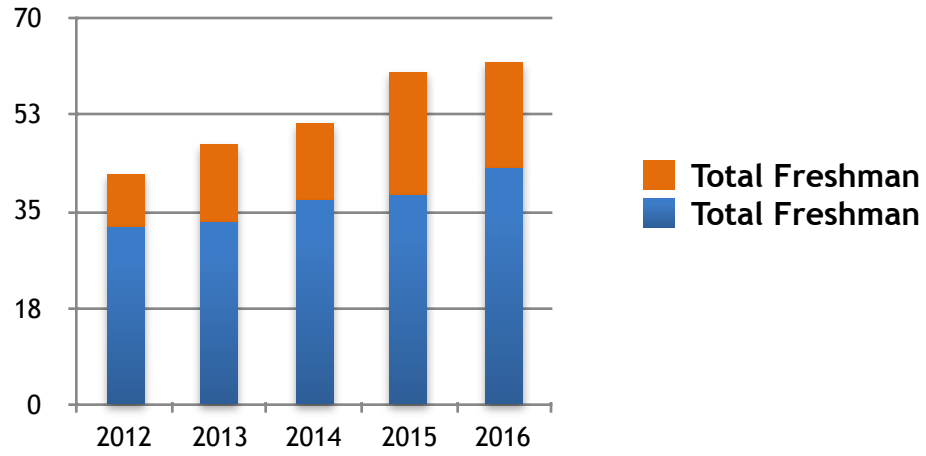
FNPS Undergraduate Programs

- 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



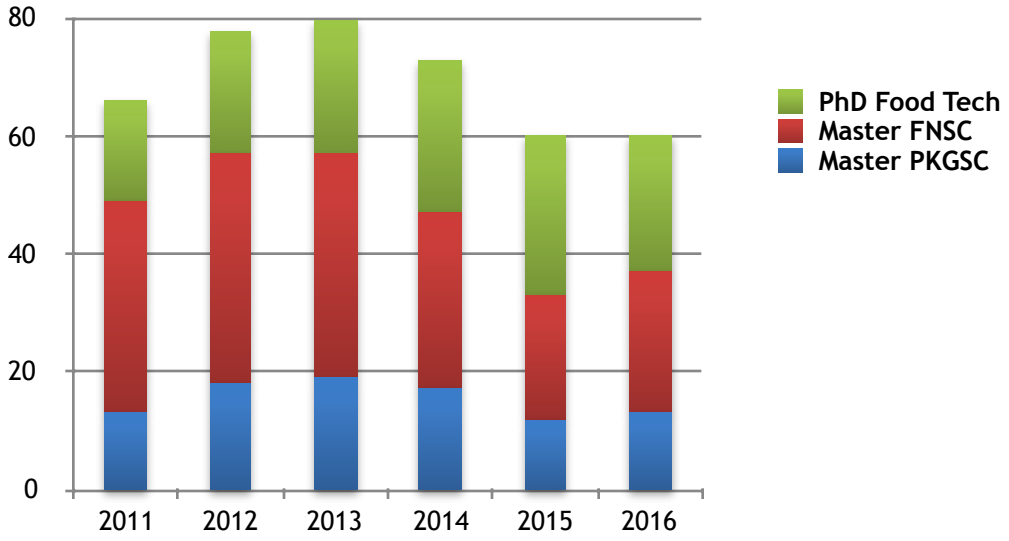
Packaging Science 5yr Enrollment

		New Students Enrolled Packaging Science	Avg SAT	Avg ACT
2012	Freshman	32	1197	28
	Transfer	10		
2013	Freshman	33	1174	28
	Transfer	14		
2014	Freshman	37	1263	28
	Transfer	14		
2015	Freshman	38	1246	28
	Transfer	22		
2016	Freshman	43	1199	28
	Transfer	19		



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

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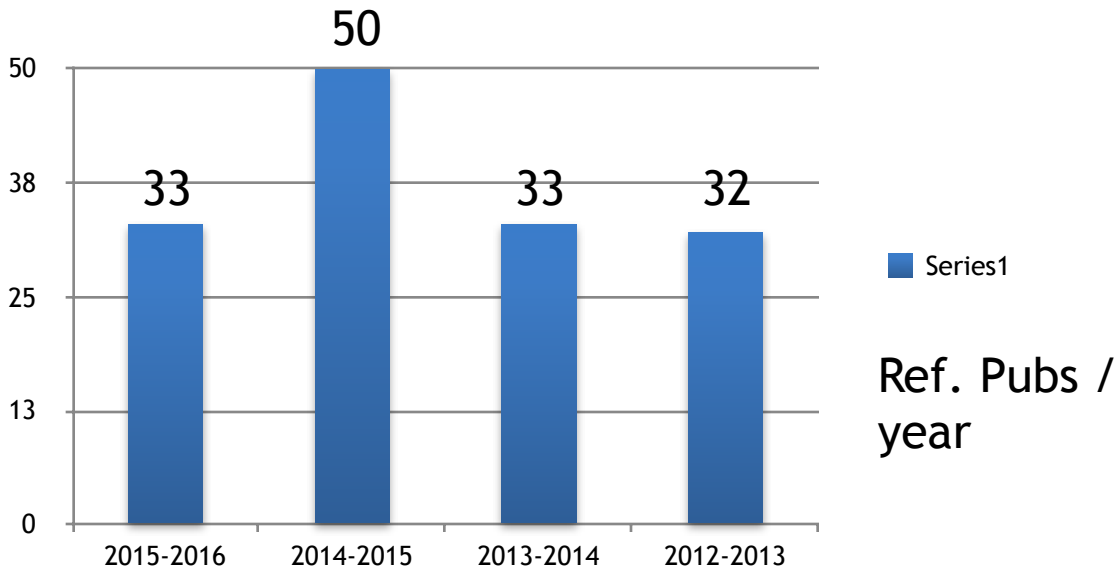


Open Positions

- 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 Packaging 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

Sonoco Package Testing and Materials Evaluation Laboratory

ista CERTIFIED LABORATORY

Electrolux

WIX FILTERS

BUSH'S BEST

FUJIFILM

NOVA Chemicals

Cryovac® Flavour Mark™ Retort Laboratory

Sealed Air
CRYOVAC
Food Packaging Systems

STOCK
STOCK America Inc.

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

CLEMSON UNIVERSITY

Sonoco Institute of Packaging Design & Graphics


Design Lab


Digital Printing

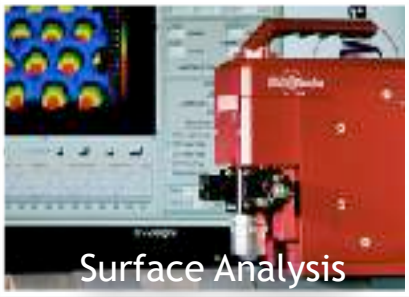

Prototype Production


Consumer Response

from
idea to invention


Digital Platemaking


Platform Press


Surface Analysis

Ink Formulation

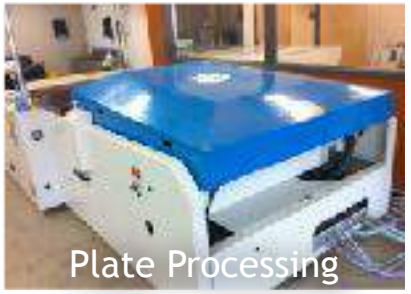


Plate Processing

THE SONOCO INSTITUTE

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

30 YEAR ANNIVERSARY

2015 PACKAGING JAMBOREE

PAST | PRESENT | FUTURE

- 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

Examples of FNPS Undergraduate Teams 2015 SE Section IoPP 48 HR Re-pack Award (Third place)

https://www.youtube.com/watch?v=gdh-wwlp9h4

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

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.

http://newsstand.clemson.edu/mediarelations/esko-gives-gift-in-kind-valued-at-nearly-27-million-to-clemsons-sonoco-institute/

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)
  - http://newsstand.clemson.edu/mediarelations/clemson-packaging-science-student-wins-package-of-the-year-award/?utm_source=feed

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 Dunnavant**
  - Packaging World Outstanding Senior
  - Co-op w/ BMW Manufacturing & interned w/ AECOM Inc., Grenville, 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
  - http://newsstand.clemson.edu/mediarelations/clemson-announces-fall-2016-packaging-science-award-winners/?utm_source=feed