

# INTERNATIONAL FINE PARTICLES RESEARCH INSTITUTE

## Leveraging a Research Budget Through IFPRI

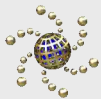


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Willie Hendrickson, President

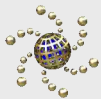
# Why Is Particle Science and Technology Important?

- Ubiquitous throughout all industrial manufacturing
- Small changes in particle related processes and properties can have huge effects on productivity and profitability
- Particle technology is never the focus in development until it is too late



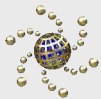
# Examples of Particle Technology Challenges

- Powder flow from hoppers
- Powder segregation during handling
- Inconsistent slurry properties
- Particle size variations on raw materials
- Variations in drying



# Where Do You Find Expertise, Suggestions or Answers?

- Corporate Engineering
- Academic Literature
- Consultants
- Internet
  
- IFPRI



# IFPRI History

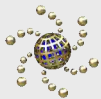
Started in 1979 by:

- 5 professors

- Pfeffer
- Leschonski
- Inoia
- Scarlett
- Tiller

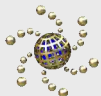
- 12 international companies

- |                           |   |               |  |
|---------------------------|---|---------------|--|
| – DuPont                  | – | Unilever      |  |
| – Standard Oil Of Indiana | – | Eastman Kodak |  |
| – Bethlehem Steel         | – | US Steel      |  |
| – Exxon                   | – | P&G           |  |
| – British Nuclear Fuels   | – | 3M            |  |
| – Alcoa                   | – | ICI           |  |



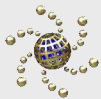
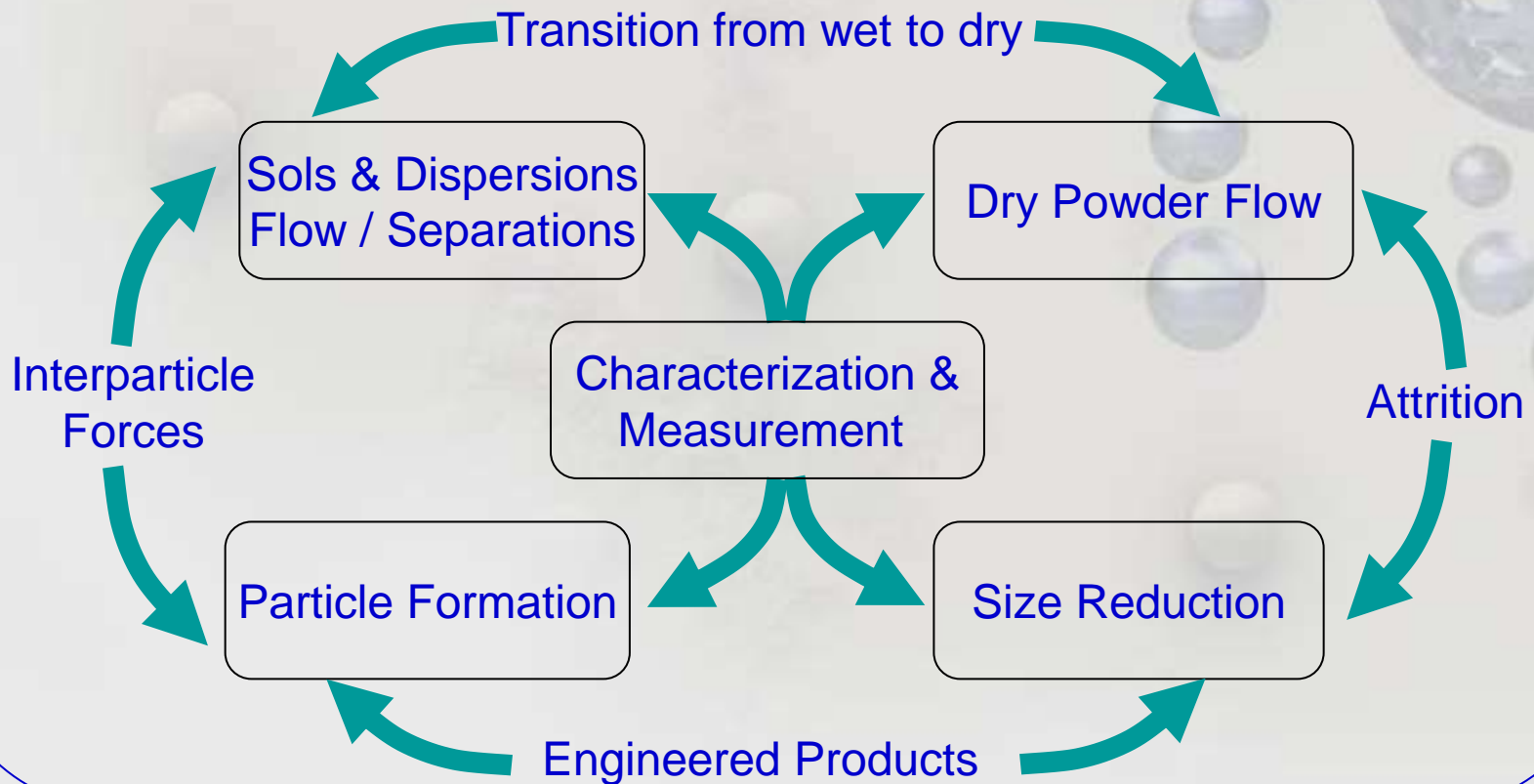
# Original Observations and Mission of IFPRI

- Lack of fundamental particle science understanding
- Lack of forum for intercompany discussion
- Poor connectivity between universities and industry
- Provide venue for particle technology discussion
- Develop strategic plan for particle science
- R&D focus on industry concerns



# IFPRI Technical Program

Dynamic - responds to Member Company needs  
Managed within 5 Subject Areas which have strong interactions and weak boundaries



# IFPRI 2015-2016 Programs (Part I)

Type	Technical Area	Project Description	Research Associate	Institute	Renewal Date	End Date
Full Proposals	Characterization	Effect of Electrostatics on Particle Packing	M. Quintilla	U. Seville	2016	2019
	Formation	Creating Tunable Agglomerates via 3D Printing	K. Hapgood	Monash U.	2017	2020
		Powder Structure Control	R. Kohlus	U. Hohenheim	2014	2017
		Relating Compaction Performance and Behavior to Process Conditions	A. Zavaliangos	Drexel U.	2015	2018
		Molecular Self Assembly	U. Weisner	Cornell U	2018	2021
		Spray Drying at High Temperatures	A. Bayly	U. Leeds	2016	2019
	Wet Systems	Long-Term Stability of Colloidal Gels	W. Poon	U. Edinburgh	2017	2020
	Size Reduction	Development of Grindability Tests	J. Ooi	U. Edinburgh	2015	2018
	Dry Systems	Die Filling of Aerated Powders	C. Wu	U. Surrey	2016	2020
		Quantitative Prediction of Segregation at Process Scale	C. McCarthy	U. Pittsburg	2017	2020
		Dry Powder Rheology	K. Daniels	NCSU	2018	2021
		Flowability Assessment of Weakly Consolidated Powders	C.Hare and A. Hassenpour	U. Surrey	2017	2020
	Reviews	Wet Systems	Deliquoring of Solvent Wet Cakes	H. Anlauf	KIT	NA
Formation		Sticking of Powders to Equipment Surfaces	S. Beaudoin	Purdue U.	NA	2016
Size Reduction		Surface and Structural Transformations in Milling	M. Descamps	U. Lille	NA	2016



# IFPRI Industrial Membership

- FINE CHEMICAL

- Syngenta
- Corbion
- Novozymes

- PHARMACEUTICAL

- Merck
- Eli Lilly
- AbbVie
- Roche

- CONSUMER GOODS

- Procter & Gamble
- Unilever

- ASSOCIATE MEMBERS

- PSE
- Hosokawa (Europe)
- AVEKA, Inc.
- Freeman Technologies
- Paul O. Abbe
- Horiba

- GENERAL CHEMICALS

- DuPont
- DSM

- STEEL

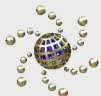
- Nippon Steel

- SPEC. CHEMICALS

- Corning
- Johnson Matthey
- UOP
- Almatris
- Evonik
- Duracell

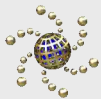
- POTENTIAL NEW MEMBERS

- Sandvik
- Imerys
- Mondelez
- Air Products
- Chemours
- Pfizer
- Restek



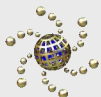
# IFPRI Deliverables

- Annual general meeting
- Winter business meeting
- 10-12 annual research reports
- Over 600 commissioned reports and reviews
- 2-3 reviews annually
- Workshops
- Roundtables
- Intensive technical interaction



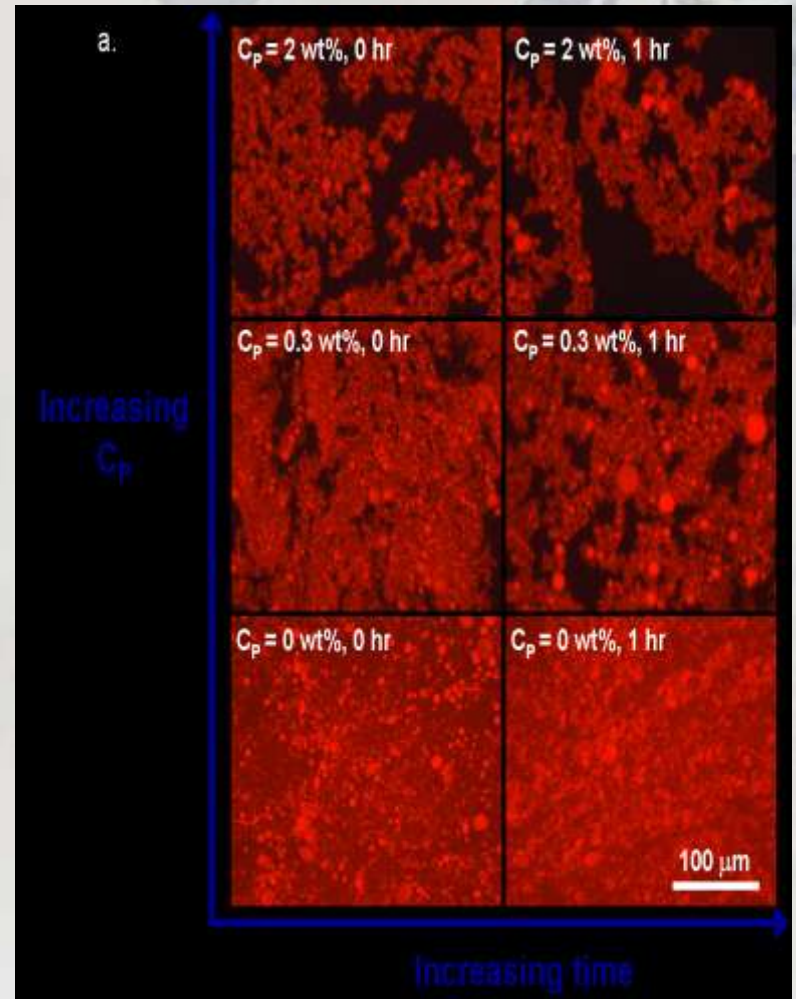
# Annual General Meeting

- Five Day Meeting
  - 2014 University of Edinburgh
  - 2015 Cornell University
  - 2016 University of Surrey

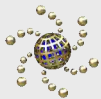


# Annual General Meeting

- Particle technology reviews
- Project overviews
- Project brief writing
- Bob Pfeffer seminar series
- Student poster session
- Proposal and brief voting
- Business meeting



E. Furst University of Delaware



# 38<sup>th</sup> Annual General Meeting

June 12-16, 2016

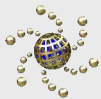
Horsley Conference Center  
Surrey, United Kingdom

Host: Professor C.-Y. Wu



## IFPRI

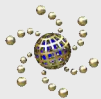
International Fine Particle  
Research Institute



IFPRI

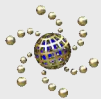
# Deliverable Example

- Focused workshop on particle formation
- 2 day technical overviews, breakout sessions, consensus building
- Program proposals



# Workshop Outcome

- Defined two areas of interest
  - Standard particle
  - Best practices
- Wrote project brief on standard particle
- Received 3 proposals
- Voted on funding Karen Hapgood at Monash on 3D printing



# Predicting Crystallization Behavior Workshop

June 19<sup>th</sup> – 20<sup>th</sup>, 2015  
Ithaca, NY, USA



IFPRI

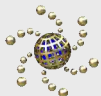
Workshop Chairs: Dr. Neil George and Professor James Litster

***Plenary speakers:***

Prof. Dr. Gerard Coquerel, Univ. Rouen  
Prof. Dr. Michael Doherty, Univ. Santa Barbara  
Dr. Rob Geertman, DSM  
Dr. Daniel Green, DuPont  
Dr. Paul Meenan, Pfizer  
Prof. Dr. Sarah Price, UC London  
Prof. Dr. Joop ter Horst, Univ. Strathclyde  
Prof. Dr. Elias Vlieg, Univ. Nijmegen

***Invited participants:***

Dr. Keith Chadwick, Univ. Purdue  
Dr. Denis Gebauer, Univ. Konstanz  
Prof. Dr. Kevin Roberts, Leeds Univ.  
Prof. Dr. Ronald Rousseau, Georgia Tech  
Dr. Thomas Vetter, Manchester Univ  
Prof. Dr. Ulrich Wiesner, Cornell Univ.  
Prof. Dr. Michael Zoworotko, Univ. Limerick

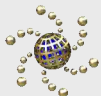


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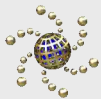
# IFPRI Shear Testing Roundtable Discussion

- IFPRI Member Roundtable January 2015
  - Intent of flowability measurements
  - What devices or methods employed
  - Number of samples measured
  - Who conducts the tests
  - What problems are encountered
  - Unmet needs
  - Is this a topic for further IFPRI sponsored R&D



# General Conclusions

- Broad research portfolio serving diversified membership
- Projects provide new relevant scientific knowledge for membership
- IFPRI academic associates are world-class authorities providing a unique global network and forum in particle technology
- Workshops and roundtables focus on intercompany discussions of best practices and development of strategic plan for particle technology
- Full profit of IFPRI membership is based on an active participation among members and contractors



# INTERNATIONAL FINE PARTICLES RESEARCH INSTITUTE

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**Email: [whendrickson@aveka.com](mailto:whendrickson@aveka.com)**

**Thank you!**

