The Center for Process Analytical Chemistry (CPAC) is a self-sustaining organization, with a successful consortium of sponsors recruited from all sectors of industry. The present CPAC program can be summarized by two main components:

- new measurement approaches including the miniaturization of traditional instrumentation and the development of new sensors and non-traditional instruments,
- mechanisms for interaction, collaboration, and communication of Center activities, research programs, and information related to process analytical technology (PAT) among sponsors, other universities and academic departments, government agencies, and the general measurement and control community. CPAC has an established track record in fostering academic/industrial/national laboratory interactions, which aim at bridging the gap between basic research and full-scale process/product development.

Within CPAC, the following sponsor focus groups serve as a forum for discussion and guidance concerning the industrial relevance of CPAC research projects.

**Industrial:**
- Materials & Chemical Processes
- Oil & Petrochemicals
- Food & Consumer Products
- Pharmaceuticals & Biotechnology

### CPAC Initiatives and Platform Projects

- **Bio-Process Monitoring:** The optimization of bio-reactors is of importance due to the value of industrial bio-technology, as well as the increasing interest in bio-fuels and bio-sustainability. CPAC is involved with several research projects to develop measurement tools that will complement existing monitoring methods and allow for studies to optimize bio-reactors and related process control.
- **Micro-Reactors and Instrumentation:** Several CPAC Research Projects are emphasizing micro-analytical and micro-sensor development.
- **New Sampling/Sensor Initiative (NeSSI™) for Process Optimization Studies:** a miniature, modular sample system. This is an ad-hoc group of end-users and equipment manufacturers who are looking to modularize and miniaturize process analyzer sample system components to simplify and standardize sample system design. The goals for NeSSI™ are to facilitate the acceptance and implementation of miniaturized sample systems that has resulted in an ISA S75 standard and to promote the concept of "smart" analytical systems by closely integrating flow, pressure and temperature with analytical sensors.
- **Chemometrics for On-Line Process Analysis (COFA):** has been successfully completed via NeSSI™ Generation II.

### Personnel

**Faculty Director:** Rob Synovec  
**Executive Director:** Mel Koch  
**Adm. Manager:** Nan Holmes

**UW, Chemistry**
- Anatol Brodsky  
- Lloyd Burgess  
- Daniel Chiu  
- Norm Dovichi  
- Scott Gilbert  
- Robert Synovec

**UW, Applied Physics Laboratory (APL)**
- Brian Marquardt

**UW, Electrical Engineering**
- Alex Mamishev  
- Brian Otis  
- Babak Parviz  
- Tim Strovas

**UW, Forest Resources**
- Richard Gustafson  
- Renata Bura  
- Ray Chrisman

**UW, Medical Genetics**
- Clement Furlong  
- Scott Soelberg

**U. of St. Thomas**
- Anthony Borgedring

**U. of Minnesota**
- Kent Mann

**U. of California - Davis**
- Michael McCarthy  
- Jeffrey de Ropp  
- Jeffrey Walton

### Visiting Scholars

**UW PIs:** 20  
**Off Site PIs:** 6  
**Docs:** 2

**Staff:** 2

### Industrial Advisory Board

CPAC presently has 28 Sponsors (12 Full Sponsor organizations) and 16 Associate (Vendor/Instrumentation) Sponsors to aid in the transfer/commercialization of CPAC technology.

**IAB Chair:** Paul Vahey, Boeing  
**Past Chair:** Jeff Gunnell, ExxonMobil  
**Chair Elect:** Carl Rechsteiner, Chevron

### Research Projects

**Sensors:**
- Advanced Sensors for Process Analysis, Burgess/Synovec
- Vapochromic and Identification of Important Analytes, Mann/Marquardt
- Modular Sensing Architecture for Low-Cost Wireless Monitoring, Parviz/Otis

**Spectroscopy / Imaging:**
- NEW Energy Impact of CPAC Technologies, Mamishev
- Evaluating Raman Spectroscopy to Improve Process Monitoring and Materials Characterization, Marquardt / Bura / Gustafson / Chrisman
- Investigating the Use of LIBS as an Effective Process Analysis Tool, Marquardt
- Improving the Sensitivity of Nuclear Magnetic Resonance for Process Analysis, McCarthy / Garcia / Walton / Collins / Han

**Chromatography:**
- NEW Process Monitoring with Microdialysis Extraction and Gas Chromatography, Borgedring / Synovec
- Process Gas Chromatography and Chemometrics, Synovec / Rohrback / Ramos

**Process Optimization and Control:**
- The Use of Microreactors and NeSSI™ for Characterizing Chemistry and Developing Effective Chemical Processes, Marquardt / Schwartz / Gustafson

**Bio-Analytical:**
- Droplet-Based Analytical Devices, Chiu
- Microreactor-Based Assays, Dovichi

**Bio-Energy:**
- Development of Sensors for Hydrolysis of Cellulosic Biomass to Sugars, Bura / Gustafson / Marquardt
- Application of Novel Membranes for Separation and Concentration in Lignocellulosic Biorefineries, Gustafson / Bura / Marquardt / Chrisman

### Recent Highlights

**Process Analytical Technology (PAT) and Quality by Design (QbD):** CPAC has been involved with the PAT and QbD programs at FDA, including participating in training programs for selected reviewers and inspectors.

**Summer Institute Program:** The 2010 Annual CPAC Summer Institute, ‘Challenges and Opportunities in the Development of Enabling Technologies’, provided a multi-disciplinary forum open to both sponsor and non-sponsor participants. The importance of interdisciplinary communication is key to discussion of topics addressing the development and potential of micro-instrumentation for impacting high throughput experimentation and process intensification.

**CPAC Satellite Workshop in Rome, Italy:** focuses on multi-disciplinary and multi-industry developments of Micro-reactors and Micro-Analytical which impact future high throughput research and novel approaches to production, particularly in the pharmaceutical and biotechnology industries.