# Table of Contents

- Meeting Agenda 2
- UM Planning Committee 9
- Steering Committee 9
- Key Information 9
- Overview of Activities of Steering Committee 2011-2014 10
- Memorandum of Agreement 2008 12
- Roadmap: How Can We Best Shape the Future for the US/Thai Consortium? 18
- Invited Speaker Biographical Information 20
- Scientific Abstracts 43
- School Posters/Affiliation 96
- Conference Attendees 97
US/Thai Pharmacy Education Consortium
20th Anniversary Conference
May 28-30, 2014
University of Maryland School of Pharmacy
Baltimore, Maryland, USA

“Educational Innovations, International Program Certification, Research, and Faculty Development”

Wednesday, May 28

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:00-4:00 p.m.</td>
<td>Workgroup Meetings</td>
</tr>
<tr>
<td></td>
<td>• Education Workgroup</td>
</tr>
<tr>
<td></td>
<td>Location: Room N106</td>
</tr>
<tr>
<td></td>
<td>• Residency Workgroup</td>
</tr>
<tr>
<td></td>
<td>Location: Room N306</td>
</tr>
<tr>
<td></td>
<td>• Exchanges Workgroup</td>
</tr>
<tr>
<td></td>
<td>Location: Room N310</td>
</tr>
<tr>
<td></td>
<td>• Workforce Development Workgroup</td>
</tr>
<tr>
<td></td>
<td>Location: Room N314</td>
</tr>
<tr>
<td>4:00-6:00 p.m.</td>
<td>Registration</td>
</tr>
<tr>
<td></td>
<td>Location: Ellen H. Yankellow Grand Atrium</td>
</tr>
<tr>
<td>4:30-6:00 p.m.</td>
<td>Steering Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>Location: Room S103</td>
</tr>
<tr>
<td>6:00-7:30 p.m.</td>
<td>Welcome Reception</td>
</tr>
<tr>
<td></td>
<td>Location: Ellen H. Yankellow Grand Atrium</td>
</tr>
<tr>
<td></td>
<td>Dress: Casual</td>
</tr>
<tr>
<td>Time</td>
<td>Activity</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>7:30-8:00 a.m.</td>
<td>Registration</td>
</tr>
<tr>
<td></td>
<td><strong>Location:</strong> Ellen H. Yankellow Grand Atrium</td>
</tr>
<tr>
<td>8:00-9:00 a.m.</td>
<td><strong>General Assembly and Opening Ceremony</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Moderator:</strong> Edward Moreton, PhD (University of Maryland, Baltimore)</td>
</tr>
<tr>
<td></td>
<td><strong>Location:</strong> Room N103</td>
</tr>
<tr>
<td></td>
<td>• <strong>Welcome:</strong> Edward Moreton, PhD (University of Maryland, Baltimore)</td>
</tr>
<tr>
<td></td>
<td>• <strong>Greetings from the School of Pharmacy:</strong> Dean Natalie D. Eddington, PhD, FCP, FAAPS</td>
</tr>
<tr>
<td></td>
<td>• <strong>Greetings from University of Maryland, Baltimore:</strong> Bruce Jarrell, MD, FACS</td>
</tr>
<tr>
<td></td>
<td>• <strong>Greetings from PECT:</strong> Wongwiwat Tassaneeyakul, PhD (Khon Kaen University)</td>
</tr>
<tr>
<td></td>
<td>• <strong>Welcome from the Steering Committee:</strong> Surakit Nathisuwan, PharmD (Mahidol University) and Melody Ryan, PharmD, MPH (University of Kentucky)</td>
</tr>
<tr>
<td>9:00-9:15 a.m.</td>
<td><strong>Group Photograph</strong></td>
</tr>
<tr>
<td>9:00-9:45 a.m.</td>
<td><strong>Refreshment Break</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Location:</strong> Ellen H. Yankellow Grand Atrium</td>
</tr>
<tr>
<td>9:45-11:45 a.m.</td>
<td><strong>Plenary Session I – Update on Activities</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Moderator:</strong> Suphat Subongkot, PharmD (Khon Kaen University)</td>
</tr>
<tr>
<td></td>
<td><strong>Location:</strong> Room N103</td>
</tr>
<tr>
<td></td>
<td>• <strong>Snapshot of the State of Health Care in Thailand</strong></td>
</tr>
<tr>
<td></td>
<td>Pavich Tongroach, PhD (Commission on Higher Education Ministry of Education, Thailand)</td>
</tr>
<tr>
<td></td>
<td>• <strong>Report on School Activities</strong></td>
</tr>
<tr>
<td></td>
<td>Earlene Lipowski, PhD (University of Florida)</td>
</tr>
<tr>
<td></td>
<td>• <strong>Story of Successful Collaboration</strong></td>
</tr>
<tr>
<td></td>
<td>Ilene Zuckerman, PharmD, PhD (IMPAQ International) Vithaya Kulsomboon, PhD (Chulalongkorn University)</td>
</tr>
<tr>
<td></td>
<td>• <strong>Thai-US Consortium for the Development of Pharmacy Education in Thailand: Beginning and Current Impact on the Thai Pharmacy Profession</strong></td>
</tr>
<tr>
<td></td>
<td>Sumon Sakolchai, PhD (Khon Kaen University)</td>
</tr>
<tr>
<td></td>
<td>• <strong>Future Training Needs in Thailand: An Introduction</strong></td>
</tr>
<tr>
<td></td>
<td>Surakit Nathisuwan, PharmD (Mahidol University)</td>
</tr>
<tr>
<td>Time</td>
<td>Event</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>11:45-1:00 p.m.</td>
<td>Lunch and Scientific and School Poster Session 1</td>
</tr>
<tr>
<td></td>
<td><strong>Location:</strong> John H. Balch Family Gallery</td>
</tr>
<tr>
<td></td>
<td>• Posters #101-133</td>
</tr>
<tr>
<td></td>
<td>• Posters #201-214</td>
</tr>
<tr>
<td>1:00-2:30 p.m.</td>
<td>Workgroup Breakout Session</td>
</tr>
<tr>
<td></td>
<td><strong>Workgroup:</strong> Exchanges Workgroup</td>
</tr>
<tr>
<td></td>
<td><strong>Moderators:</strong> Connie Kraus, PharmD (University of Wisconsin), and Thitima Pengsuparp, PhD (Chulalongkorn University)</td>
</tr>
<tr>
<td></td>
<td><strong>Location:</strong> Room N310</td>
</tr>
<tr>
<td></td>
<td>• Fulbright Health Science Opportunities in East Asia</td>
</tr>
<tr>
<td></td>
<td>Veronica Onorevole (East Asia and the Pacific Fulbright Scholar Program)</td>
</tr>
<tr>
<td></td>
<td>• Thai Scholarship Opportunities for Visiting Scholars</td>
</tr>
<tr>
<td></td>
<td>Thitima Pengsuparp, PhD (Chulalongkorn University)</td>
</tr>
<tr>
<td></td>
<td>Supatra Porasuphatana, PhD (Khon Kaen University)</td>
</tr>
<tr>
<td>1:00-2:30 p.m.</td>
<td>Workgroup Breakout Session</td>
</tr>
<tr>
<td></td>
<td><strong>Workgroup:</strong> Residencies Workgroup</td>
</tr>
<tr>
<td></td>
<td><strong>Moderator:</strong> Michael Katz, PharmD (University of Arizona)</td>
</tr>
<tr>
<td></td>
<td><strong>Location:</strong> Room N306</td>
</tr>
<tr>
<td></td>
<td>• Current Status of Residency Programs in Thailand</td>
</tr>
<tr>
<td></td>
<td>Suphat Subongkot, PharmD (Khon Kaen University)</td>
</tr>
<tr>
<td></td>
<td>• Accreditation of Residencies Outside the US</td>
</tr>
<tr>
<td></td>
<td>Janet Teeters, RPh, MS (American Society of Health-System Pharmacists)</td>
</tr>
<tr>
<td></td>
<td>• Experiences of Two Current Thai Residents in the US</td>
</tr>
<tr>
<td></td>
<td>Mantiiwee Nimworapan, PharmD (University of Arizona)</td>
</tr>
<tr>
<td></td>
<td>Ittiporn Chuatisorn, PharmD (University of Maryland Medical Center)</td>
</tr>
<tr>
<td></td>
<td>• Questions and Discussion About Future Direction for Residency Training</td>
</tr>
<tr>
<td></td>
<td>All speakers</td>
</tr>
<tr>
<td>1:30-2:30 p.m.</td>
<td>Workgroup Breakout Session</td>
</tr>
<tr>
<td></td>
<td><strong>Workgroup:</strong> Workforce Development Workgroup</td>
</tr>
<tr>
<td></td>
<td><strong>Location:</strong> Room N314</td>
</tr>
<tr>
<td>1:30-2:30 p.m.</td>
<td>Workgroup Breakout Session</td>
</tr>
<tr>
<td></td>
<td><strong>Workgroup:</strong> Education Workgroup</td>
</tr>
<tr>
<td></td>
<td><strong>Moderator:</strong> Jeanine Mount, PhD (Northeastern University)</td>
</tr>
<tr>
<td></td>
<td><strong>Location:</strong> Room N106</td>
</tr>
<tr>
<td></td>
<td>• Comparison of Curricula and Teaching Methods Observed in Thailand and the US</td>
</tr>
<tr>
<td></td>
<td>Anjana Fuangchan, PhD (Naresuan University)</td>
</tr>
<tr>
<td></td>
<td>• Open Discussion on Teaching-Oriented Exchanges and Best Practices for Exchanges</td>
</tr>
<tr>
<td>Time</td>
<td>Event</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2:30-3:00 p.m.</td>
<td>Refreshment Break</td>
</tr>
<tr>
<td>3:00-4:30 p.m.</td>
<td>Plenary Session II – Educational Simulations and Interprofessional Education</td>
</tr>
<tr>
<td></td>
<td><strong>Location:</strong> Room N103</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>4:30-5:30 p.m.</td>
<td>Business Meeting</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>4:30-5:30 p.m.</td>
<td>Tour of Educational Simulation Facilities at University of Maryland, Baltimore</td>
</tr>
<tr>
<td>6:00 p.m.</td>
<td>Board Shuttle from Hotel Lobbies to Aquarium</td>
</tr>
<tr>
<td>6:30-11:00 p.m.</td>
<td>Welcome Dinner at National Aquarium in Baltimore</td>
</tr>
</tbody>
</table>
### Friday, May 30

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 8:00-8:30 a.m. | **Registration**  
  **Location:** Ellen H. Yankellow Grand Atrium                           |
| 8:30-9:30 a.m. | **Plenary Session III – International Professional Program Certification**  
  **Moderator:** Phayom Sookanekun, PhD (Mahasarakham University)  
  **Location:** Room N103  
  **Objectives:**  
  - Describe Pharmacy Education Council of Thailand standards  
  - Outline goals for ACPE International Services Program  
  - Review process for certification  
  **Presentations:**  
  - **Enhancement of Quality: ACPE’s International Certification Program**  
    Robert Beardsley, PhD (University of Maryland, Baltimore)  
  - **Accreditation System in Thailand and Challenges Toward Harmonization of Pharmacy Education in ASEAN Countries**  
    Chuthamanee Suthisisang, PhD (Mahidol University) |
| 9:30-9:45 a.m. | **Refreshment Break**  
  **Location:** Ellen H. Yankellow Grand Atrium                           |
| 9:45-10:45 a.m. | **Plenary Session IV – Developing a Career Path for Clinical Faculty**  
  **Moderator:** Sirada Maphanta, PharmD, MS, BCPS (Naresuan University)  
  **Location:** Room N103  
  **Objectives:**  
  - Describe success and challenges of clinical faculty development and career path of Thai pharmacy schools  
  - Describe competency needed for clinical faculty (practice, teaching, and scholarship)  
  - Share experiences with clinical faculty mentoring and development  
  **Presentations:**  
  - **Overview of Clinical Faculty Development and Career Path of Thai Pharmacy Schools**  
    Sirada Maphanta, PharmD, MS, BCPS (Naresuan University)  
  - **Nurturing Successful Clinical Faculty**  
    Alan Lau, PharmD (University of Illinois at Chicago)  
    - Clinical practice
| 10:45-11:45 a.m. | Plenary Session V – Research  
Moderator: Lane Wallace, PhD (The Ohio State University)  
Location: Room N103 |
|-----------------|-------------------------------------------------------------------|
| **Objectives:** | • Share examples of collaborative projects involving consortium members  
• Describe emerging areas of pharmaceutical sciences and of therapeutics regimens research |
| **Presentations:** | • **Collaboration and Opportunities for Research in Social and Administrative Pharmacy**  
Rungpetch Sakulbumrungsil, PhD (Chulalongkorn University)  
• **Health Services Research: An Opportunity for International Collaboration**  
Ilene Zuckerman, PharmD, PhD (IMPAQ International)  
• **Clinical Research in Thailand as an Output of US-Thai Consortium**  
Sutthiporn Pattharachayakul, PharmD (Prince of Songkla University)  
• **Pharmacoeconomics: Opportunities and Challenges**  
Fadia Shaya, PhD, MPH (University of Maryland, Baltimore)  
• **Panel Discussion**  
All Speakers |
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:45-1:15 p.m.</td>
<td>Lunch and Scientific and School Poster Session 2</td>
<td>John H. Balch Family Gallery</td>
<td>Posters #134-170, Posters #215-228</td>
</tr>
<tr>
<td>1:15-2:45 p.m.</td>
<td>Workgroup Reports</td>
<td>Room N103</td>
<td></td>
</tr>
<tr>
<td>2:45-3:00 p.m.</td>
<td>Refreshment Break</td>
<td>Ellen H. Yankellow Grand Atrium</td>
<td></td>
</tr>
<tr>
<td>3:00-4:30 p.m.</td>
<td>Concluding Session – Future Directions of US-Thai Consortium</td>
<td>Room N103</td>
<td>Review of Roadmap from 2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Surakit Nathisuwan, PharmD (Mahidol University)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Melody Ryan, PharmD, MPH (University of Kentucky)</td>
</tr>
<tr>
<td>4:30-5:00 p.m.</td>
<td>Concluding Ceremony</td>
<td>Room N103</td>
<td>Remarks on the 20th Anniversary of the US-Thai Consortium for the</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Development of Pharmacy Education</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pavich Tongroach, PhD (Commission on Higher Education in Thailand;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ministry of Education, Thailand)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sindhchai Keokitichai, PhD (Dean, Burapha University)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Concluding Remarks from the Pharmacy Education Council of Thailand</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Wongwiwat Tassaneeyakul, PhD (Khon Kaen University)</td>
</tr>
</tbody>
</table>
University of Maryland, Baltimore Planning Committee

Uraiwan Akanit                Wannisa Dongtai                Edward Moreton
Malissa Carroll              Dana Joyce                  Pemmarin Potisarach
Rebecca Ceraul               Christopher Klimas         Dhakrit Rungkitwattanakul
Pam Crowe                    Areerut Leelathanalerk     Harmony Senko
Jeremy Doggett               Ruth McLean-Foster

Steering Committee

Michael Katz                Surakit Nathisuwan               Melody Ryan
University of Arizona        Mahidol University             University of Kentucky
Alan Lau                    Wirat Niwatananun               Bernard Sorofman
University of Illinois –    Chiang Mai University         University of Iowa
Chicago
Earlene Lipowski             Surachat Ngorsuraches         Pornsak Siamornsak
University of Florida        Prince of Songkla University   Silpakorn University
Sirada Maphanta              Gary Oderda                   Suphat Subongkot
Naresuan University          University of Utah              Khon Kaen University
Edward Moreton              Thitima Pengsuparp            Lane Wallace
University of Maryland,     Chulalongkorn University       The Ohio State University
Baltimore

Key Information

- All conference activities will take place in Pharmacy Hall except the welcome dinner Thursday evening, which will be at Baltimore’s National Aquarium.
- Bring your laptop computer! The full program (with slides if provided beforehand) will be available on the School of Pharmacy US/Thai Consortium website at www.pharmacy.umaryland.edu/globalhealth/usthaiconsortium/. A guest password will be provided for WiFi access during the conference.
- Speakers are asked to give their presentation to the session moderator on a USB/flash drive at least 15 minutes prior to the session start time.
- Posters must be prepared for display on 3-foot (0.91440m) (H) by 4-foot (1.22m) (W) boards.
- Poster presenters are asked to attach their posters on the boards which will be numbered according to the number of their abstract. The number of each abstract will be placed on each board by the organizer. All material needed for attaching posters will be provided by the organizer.
Overview of Activities of Steering Committee 2011-2014

Following the 2011 success of using a Steering Committee to continue the work of the Consortium between meetings, a group was formed in 2012. Steering Committee members were added to assure a balance of US and Thai and basic sciences and clinical sciences faculty members. Surakit Nathisuwan from Mahidol University and Melody Ryan from the University of Kentucky were named co-chairs of the Committee.

At the conclusion of the 2011 Consortium Meeting, participants were encouraged to sign up for working groups of interest. There were a total of 19 proposed workgroups including: curriculum planning between countries and within countries; combined PharmD/PhD program; translational research collaboration; short (0.5-1 year) research programs in the US; establish equitable promotion criteria for clinical and basic science faculty; foster research collaboration; teaching certificate program; create short-term visiting scholar model program in the US; create extended-time visiting faculty scholars model program in Thailand; create self-help program for residencies; facilitate Fulbright scholars (including Fulbright seniors program); residency accreditation process for Thailand; sharing e-learning opportunities; research fellowship for Thai PharmD faculty; financing international experiences for students; create model collaborative research projects; identify capabilities, willingness and needs for collaboration at all levels; establish models for residency funding; and skills development for pharmacists. The Steering Committee felt that this number of workgroups would be inefficient and consolidated the number to five, incorporating most of the original workgroup topics into the charges of the smaller number of workgroups. The following workgroups were formed and two chairs were named for each workgroup, one from Thailand and one from the US. The charges to each workgroup were approved by the Steering Committee and presented to the co-chairs.

<table>
<thead>
<tr>
<th>Workgroup</th>
<th>Co-chairs</th>
<th>Charges</th>
</tr>
</thead>
</table>
| Education              | Sawaeng Watcharathanakij (Ubon Ratchathani University) Earlene Lipowski (University of Florida) | 1. Explore shared e-learning opportunities between US and Thai institutions  
2. Determine extent of curriculum mapping in Thailand; compare curricula between Thai schools; compare Thai curricula to US accreditation standards  
3. Determine steps needed to develop a combined PharmD/PhD program in Thailand |
| Research Collaboration | Paul Jungnickel (Auburn University) Surachat Ngorsuraches (Prince of Songkla University) | 1. Develop a method for translational research collaboration (sharing basic and clinical sciences) between US and Thai institutions  
2. Develop a methodology to standardize short (0.5-1 year) research programs in the US  
3. Determine ways to foster research collaboration  
4. Create model collaborative research projects |
| Residencies            | Suphat Subongkot (Khon Kaen University) Michael Katz (University of Arizona) | 1. Create self-help program for residencies  
2. Explore necessary steps to develop a residency accreditation process for Thailand  
3. Establish models for residency funding  
4. Develop a model for international residencies for Thai candidates in the US |
| Workforce Development | Gary Oderda (University of Utah)  
Sirada Maphanta  
(Naresuan University) | 1. Determine what skill development is needed for Thai pharmacists  
2. Explore methods of establishing a teaching certificate program  
3. Determine steps needed to establish research fellowships for Thai PharmD faculty  
4. Suggest model equitable promotion criteria for clinical and basic science faculty |
| Exchanges | Thitima Watanavijtkul  
(Chulalongkorn University)  
Connie Kraus (University of Wisconsin) | 1. Develop a model for short-term visiting scholar programs in the US  
2. Develop a model for extended-time visiting faculty scholars program in Thailand  
3. Determine ways to facilitate Fulbright scholars (include Fulbright seniors program)  
4. Explore ways to finance international experiences for students |

The workgroups have been populated with faculty from both the US and Thailand and have begun initial meetings. Their work is expected to continue during the Consortium meeting. Additionally, the Exchanges and Residencies Workgroups have developed breakout programs for the 2014 meeting.

At the 2011 meeting, the deans of all member schools established criteria for US schools wishing to join the Consortium. The Steering Committee operationalized these criteria and two schools, Auburn University Harrison School of Pharmacy and West Virginia University School of Pharmacy, were welcomed into the Consortium.

To commemorate the 20th anniversary of the Consortium, the Steering Committee undertook developing a comprehensive listing of the achievements of the Consortium. A survey was developed and distributed to member schools. The data collection is nearly complete and an interim report will be presented at the 2014 meeting.

The majority of the efforts of the Steering Committee went into planning the 2014 Consortium Meeting. The University of Maryland Baltimore was chosen as the host institution. A diverse and robust set of topics was chosen for the program with speakers from Consortium member institutions and American and international associations. The Committee looks forward to the 2014 meeting as a time to work toward our common goals and renew relationships.

Submitted by  
Melody Ryan and Surakit Nathisuwan  
Steering Committee Co-chairs
MEMORANDUM OF AGREEMENT
U.S. – Thai Consortium for the Development of Pharmacy Education in Thailand

By and Between a Consortium of U.S. Schools and Colleges of Pharmacy and the Pharmacy Education Consortium of Thailand

In continuance of the goals and objectives of the 1993-2006 MOA between the parties and to create and encourage proactive outcomes by and between them, the Pharmacy Education Consortium of Thailand (PECT), on behalf of the Thai Faculties of Pharmacy / Pharmaceutical Sciences, and the U.S. Consortium of Schools and Colleges of Pharmacy (U.S. Consortium), extend and renew their cooperation and collaboration on various activities and programs as mutually agreed upon in this document.

During the January 6 – 9, 2007, Bangkok meeting of the U.S. – Thai Consortium for the Development of Pharmacy Education in Thailand, the following collaborations between the two Parties were proposed, discussed, and accepted as terms mutually agreed upon to maintain the continuity of and to build further collaborations:

1. General terms and conditions
   1.1. The general terms of this Agreement will be "To share the strongest assets of both parties for the greatest benefits to the participating universities and countries."
   1.2. Scope and responsibilities. This agreement covers educational opportunities; faculty, student and scholar exchanges; and research; and is based on equal responsibility on the part of both U.S. and Thai Parties for its success.
   1.3. Equal opportunity. All exchanges under this Agreement will comply with the national and institutional policies of equity, religion, beliefs, politics, employment, education, faith and ethics.

2. Exchanges
   2.1. Post-doctoral students/scholars, fellows and visiting scholars. Scholars will have the opportunity to visit each other's countries for research and/or educational experiences, as well as short- and long-term training, for up to one year. The extent, nature and duration of the visit will be mutually agreed upon.
   2.2. Graduate students. Both Parties agree to accept graduate students and staff to pursue further study / research for the M.S. and/or Ph.D. degree and/or other training programs. Acceptance will be in accordance with normal admission procedures of both Parties. This includes opportunities for non-degree experiences.
   2.3. Undergraduate and professional students. Exchanges of pharmacy students from participating universities to explore and gain professional and / or research experiences are encouraged.
   2.4. Residents and equivalent. Both Parties agree to strengthen programs organized in both countries for mutual experiential pharmacy

July 16, 2008
practices. It is suggested that a task force be established, separately from this Agreement, to identify opportunities to help fulfill this provision.

2.5. Practitioners and preceptors. Both Parties agree to explore and investigate mechanisms to develop practitioners and preceptors.

3. Resources
3.1. Tuition / fees / costs. Opportunities will be sought to reduce out-of-pocket costs to the participants for exchange and/or training programs.

3.2. Sources of research funding and allocation. Opportunities for research funding will be pursued from public and private sources as may be mutually agreed upon.

4. Additional Collaborations
4.1. Sharing of experiences. Experience sharing is beneficial to strengthen higher education, academic services, and research. Therefore, both Parties agree to exchange program management and other experiences related to pharmaceutical sciences, pharmacy practice and any other topics of mutual interest.

4.2. Further possible joint investment / management / cooperation. Additional relevant issues of mutual benefit may be discussed and settled in the future.

5. Assessment
5.1. Review of programs. There will be a review process of outputs / outcomes. It is proposed that this be performed by both Parties biannually. The results of the review should be reported at the biannual meeting.

6. Extension and termination
6.1. Extending or terminating the Memorandum of Agreement between U.S. and Thai institutions.

6.1.1. Duration of this Memorandum of Agreement. These joint collaborations between PECT and the U.S. Consortium will be in effect from the date of signing until A.D. 2022.

6.1.2. Termination of the Agreement. Terminations of this Agreement or any particular joint collaboration between PECT and U.S. Consortium members must be done hereunder by written notification of the other Party at least six months in advance.

6.1.3. Extension of the U.S. – Thai Consortium Memorandum of Agreement. It is proposed that this Memorandum of Agreement be renewed by the participants after assessment and evaluation, for an additional 15 year period, to 2037, and such renewal shall be effective upon the execution of the parties to a new Agreement of extension/renewal of this Agreement.

July 16, 2008
SIGNED ON July 16, 2008.

By, Between and On the Behalf of the Corresponding Colleges / Faculties / Schools / Universities:

**U.S. Consortium**

- College of Pharmacy
  University of Arizona - Tucson
- University of Florida - Gainesville
- College of Pharmacy
  University of Illinois – Chicago
- College of Pharmacy
  University of Iowa
- College of Pharmacy
  University of Kentucky
- School of Pharmacy
  University of Maryland – Baltimore
- College of Pharmacy
  University of Minnesota
- College of Pharmacy
  University of North Carolina – Chapel Hill
- College of Pharmacy
  The Ohio State University
- School of Pharmacy and Pharmaceutical Sciences
  Purdue University

**PECT**

- Poom Panuyut
  Chulalongkorn University
- Dr. J. A. Belg
  Chiang Mai University
- N. T. But
  Khon Kaen University
- Dely K. Kanyarnds
  Mahasarakam University
- Lek S.
  Mahidol University
- M. Prapumthavorn
  Naresuan University
- N. Krongpairoj
  Prince of Songkla University
- T. J. Krupaj
  Rangsit University
- N. T. Thanyaporn
  Sripatum University

July 16, 2008
L. C. O.
College of Pharmacy
University of Texas – Austin

Ubon Ratchathani University

John W. Manning
College of Pharmacy
University of Utah

Ardinda Arsina
Wakellak University

Michael D. Nelson
College of Pharmacy
University of Washington

July 16, 2008

American Association of Colleges of Pharmacy
Representatives of the following institutions signed this document on July 16, 2008, in Madison, Wisconsin. Authorized signatures from the respective institutions were placed on the preceding pages of this MOA at a later date.

**U.S. Consortium Members**

Eileen Dipersio  
College of Pharmacy  
University of Florida

See enclosed additional UofI signatures.

College of Pharmacy  
University of Illinois - Chicago  

College of Pharmacy  
University of Iowa  

College of Pharmacy  
University of Texas - Austin  

College of Pharmacy  
University of Utah  

College of Pharmacy  
University of Washington  

School of Pharmacy  
University of Wisconsin - Madison

July 16, 2008
MEMORANDUM OF AGREEMENT
U.S. – THAI CONSORTIUM FOR THE DEVELOPMENT OF PHARMACY EDUCATION IN THAILAND

FOR THE BOARD OF TRUSTEES OF
THE UNIVERSITY OF ILLINOIS

Walter K. Knorr
Comptroller
Date: 8/27/09

Michele M. Thompson
Secretary
Date: 8/27/09
Road Map: How Can We Best Shape the Future for the US-Thai Consortium?

Faculty Development:

1. **Develop** residencies or other postgraduate training experiences for Thai clinical faculty who are not licensed to practice pharmacy in the U.S.
2. **Expand** residency programs and develop research fellowships in Thailand for PharmD graduates.
3. **Establish** short-term training experiences in US for Thai clinical preceptors and establish clerkship opportunities in the U.S. for Thai pharmacy students interested in becoming Thai faculty members.
4. **Provide** incentives to attract Thai PharmD’s to pursue a career in academia.
5. **Establish** equitable promotion criteria for clinical and basic science faculty.
   a. There is a perception that academic promotion of clinical faculty members in Thailand may be based on standards that do not reflect their academic contributions.
6. **Develop** policies enabling returning faculty adequate protection from teaching and administrative responsibilities to establish scholarly activity.
7. **Develop** an incentive plan to foster teaching, research, practice and service (e.g., administrative) endeavors in Thai schools.
8. **Establish** an organization similar to AACP and make it an open membership organization to foster faculty organization.
   a. Open membership is a resolution currently before the AACP.

Curriculum Development:

9. **Foster** curricular development to meet new standards for the entry level PharmD in Thailand.
10. **Evaluate** the accreditation process for Thai pharmacy education.
    a. Should ACPE standards be employed?
11. **Develop** and **strengthen** formal relationships between the schools and university and regional hospitals in Thailand.
    a. **Offer** adjunct faculty appointments to hospital pharmacists who serve as preceptors for students doing clerkships in the hospital.
    b. **Offer** preceptors (hospital and community) access to school electronic libraries and data bases as an incentive to participate as a preceptor.
12. **Determine** if the six-year curriculum should prepare all students for pharmaceutical care rather than splitting resources between pharmaceutical sciences and pharmaceutical care.
13. **Establish** full-fledged skills laboratories and model pharmacies in the schools to incorporate dispensing, patient assessment, communications, etc. in the laboratory.
    a. Apparently, in some schools the students get their dispensing skills by working in a community pharmacy and may not have adequate faculty-directed training in dispensing laboratory before entering practice.
14. **Develop** multidisciplinary courses with Nursing, Dentistry, Medicine, and Allied Health Sciences especially during clerkships.
    a. This is something we have talked about in US for over 30 years but have not been able to do. Thailand can learn from our mistakes.
15. The consortium should **take** advantage of joint PharmD/MPH programs to **foster** bi-directional Thai/US exchanges.
   a. PharmD/MPH programs are being established at an increasing rate and often offer specialization in Global Health. US PharmD students are becoming more and more interested in Global Health and joint PharmD/MPH programs offering capstone research projects overseas.
   b. What role can we play in the newly formed AACP Global Pharmacy Education SIG?

**Research:**

16. **Foster** collaborative projects and funding between US and Thai schools.
   a. Would multi-school projects similar to project grants combining resources make them more attractive and increase potential for success?

17. **Establish** school and/or university-based research centers, centers of excellence, and bioparks in Thailand.

18. **Offer** workshops regarding US FDA regulatory processes to colleagues in academia and in Thai regulatory agencies to foster clinical trials and drug development

19. **Pursue** research resources offered by federal agencies.
   a. For example, training courses, *in vivo* research models employing non-mammalian animals that can be established more easily and economically in Thailand where facilities and funding may be limited (e.g., C. Elegans, Drosophila, Aplasia, Zebra Fish, etc.) See [http://www.neuroscienceblueprint.nih.gov](http://www.neuroscienceblueprint.nih.gov) and similar sites in the NIH Blueprint.

**Use of Resources:**

20. **Develop** policies enabling sharing of eLearning resources (i.e., make US courses available via secure internet links at little or no cost).
   a. Soon many US schools will have their entire curriculum available via distance education links.

21. Effectively **utilize** offices of Vice Chairs for Education and Research to fulfill the mission of the consortium.

22. **Share** the Thai/US consortium expertise with other countries attempting to improve pharmacy education and practice.

23. **Establish** firm relationships between US and/or Thai communities, foundations, industries and professional organizations to garner support for the consortium.

24. **Identify** means by which US schools can offer tuition and fees reductions (in-state vs out-of-state) or waivers.

25. **Address** the issue of counterfeit drugs, especially those for chronic diseases.

**Other:**

26. Effectively **employ** web resources for more effective communication among US and Thai colleagues.

27. **Establish** an alumni association of Thai/US graduates.
Speaker Information

Robert S. Beardsley, RPh, PhD
Professor and Vice Chair for Administration
Department of Pharmaceutical Health Services Research
University of Maryland School of Pharmacy

Dr. Beardsley is a professor and vice chair for administration in the Department of Pharmaceutical Health Services Research at the University of Maryland School of Pharmacy. He received his BS in pharmacy from Oregon State University in 1972, and both MS and PhD degrees in pharmacy administration from the University of Minnesota in 1974 and 1977, respectively. He completed a residency at the U.S. Public Health Service Hospital in New Orleans and served as a staff pharmacist there as well.

Dr. Beardsley currently serves on the Board of Directors of the Accreditation Council for Pharmacy Education and is the Council’s current president. He also served as chair of the Council of Deans for the American Association of Colleges of Pharmacy (AACP) and served on AACP’s Board of Directors for three years. In July 2011, he received the Robert Chalmers Distinguished Educator Award from AACP. In June 2012, he received the Distinguished Alumnus Award from the Oregon State University College of Pharmacy. Dr. Beardsley has been selected as Outstanding Teacher of the Year by three School of Pharmacy graduating classes. His research has focused on human behavior theory, public health, and educational innovation. He has conducted numerous workshops on curricular development, assessment, leadership, and communication at schools and colleges of pharmacy in the United States as well as in several countries.

Ittiporn Chuatrisorn, MS, PharmD
Post Graduate Year 1 Resident
University of Maryland Medical Center

Dr. Chuatrisorn, a native of Bangkok, Thailand, obtained her bachelor's degree in pharmaceutical science from Chulalongkorn University, Thailand and then completed her Master of Clinical Pharmacy at the University of Sydney and University of South Australia. Upon completion of her master's degree, Dr. Chuatrisorn worked for three years as a clinical pharmacist at Bangkok Hospital Medical Center and one year as a lecturer at the Chulalongkorn University, Thailand. She moved to Chicago to earn her Doctor of Pharmacy from the University of Illinois at Chicago. Dr. Chuatrisorn received board certification as a pharmacotherapy specialist in 2012. She is currently a PGY-1 pharmacy practice resident at the University of Maryland Medical Center (UMMC) and will continue her training as a PGY-2 health system and practice administration resident at UMMC.
Heather Brennan Congdon, PharmD, BCPS, CDE, FNAP
Associate Professor, Department of Pharmacy Practice and Science
Assistant Dean for Shady Grove
University of Maryland School of Pharmacy

Dr. Congdon is the assistant dean for Shady Grove and an associate professor of pharmacy practice and science at the University of Maryland School of Pharmacy. She earned her PharmD degree from the University of Pittsburgh in 2001. She then completed a pharmacy practice residency with emphasis in community care at the University of Maryland.

Between 2003 and May 2007, Dr. Congdon was a faculty member at West Virginia University (WVU) School of Pharmacy, Eastern Division Campus. At WVU, she was instrumental in setting up various programs for the school, including an ambulatory care practice site, specializing in anticoagulation and diabetes management. She also became very involved with interprofessional training of health care students in rural areas of West Virginia.

Dr. Congdon rejoined the University of Maryland in May 2007. As assistant dean, she is responsible for the oversight of the School of Pharmacy’s distance pharmacy campus located in Rockville, Md. In addition, Dr. Congdon serves as a co-director of the University of Maryland, Baltimore’s Center for Interprofessional Education, and is chair of the Committee on Collaboration, Interprofessional and Interdisciplinary Education Strategies at the Universities at Shady Grove, a committee that has developed various didactic, clinical, and community service interprofessional activities. Dr. Congdon sees patients at Mercy Health Clinic, providing medication therapy management and diabetes education to underserved, uninsured patients as part of an interprofessional team. In this role, she has been part of HRSA’s Patient Safety and Clinical Pharmacy Services Collaborative (PSPC) for the past four years. This HSRA PSPC team has won various awards including the Life Saving Patient Safety Award and the Performance Award. Further, this strong collaboration also won the American Diabetes Association’s Promising Practice Award in 2011.

Natalie D. Eddington, PhD, FAAPS, FCP
Dean and Professor
University of Maryland School of Pharmacy
Executive Director of University Regional Partnerships
University of Maryland, Baltimore

Dr. Eddington became dean of the University of Maryland School of Pharmacy in August 2007. Dr. Eddington, an alumna of the School, was
formerly chair of its Department of Pharmaceutical Sciences.

Dr. Eddington graduated summa cum laude with a BS in pharmacy in 1982 from Howard University. She earned her PhD from the University of Maryland School of Pharmacy in 1989 and, after working as assistant director of new drug development at Pfizer Inc., joined the faculty in 1991. She was appointed director of the School of Pharmacy’s Pharmacokinetics/Biopharmaceutics Laboratory in 1999, and became chair of the Department of Pharmaceutical Sciences in 2003. As chair, she guided the launch of the Center for Nanomedicine and Cellular Delivery, which brings together a collection of scientists to find new and better ways of providing pharmaceutical treatment. It is the School of Pharmacy’s first Organized Research Center.

Dr. Eddington is a nationally known expert in drug delivery and pharmacokinetics, the movement of drugs in the body. Her research focuses on cancer therapy and treatments for disorders of the central nervous system. Her work has been supported by funding from the National Cancer Institute, the National Institute of Mental Health, the National Institute on Drug Abuse, the U.S. Food and Drug Administration, and the pharmaceutical industry.

In 2014, she was named executive director of University Regional Partnerships at the University of Maryland, Baltimore (UMB), a position she assumes while maintaining her leadership of the School of Pharmacy. In this role, Dr. Eddington assist’s UMB’s senior vice presidents, working collaboratively with the deans, on issues related to the expansion of the University’s academic and research programs in Montgomery and Prince George’s counties.

Anjana Fuangchan, PharmD, PhD
Lecturer of Pharmacy Practice
Faculty of Pharmaceutical Sciences, Naresuan University, Thailand

Dr. Fuangchan is a lecturer in the Department of Pharmacy Practice at Faculty of Pharmaceutical Sciences, Naresuan University, where she has been since 1999. From 2012 to 2013, she served a deputy chief of the Department of Pharmacy Practice.

She obtained her PharmD degree in 1998 and a PhD in 2010, both from Naresuan University. During her PhD studies, she had a 10-month research and clinical practice experience at the University of Maryland School of Pharmacy. She is currently a visiting scholar at Auburn University to advance her comprehension of the development of PharmD programs and problem-based learning.

Dr. Fuangchan is a course coordinator for Advanced Pharmacotherapy IV and teaches pharmacotherapy in diabetes mellitus. She has been working as
a preceptor for the PharmD elective rotation of Harrison School of Pharmacy at Auburn University since 2012. Her practice interest and expertise is in the area of ambulatory care. In addition to her teaching duty, she has also routinely practiced as a clinical pharmacist in a multidisciplinary diabetes care team at Naresuan University Hospital. In 2014, she earned the Outstanding Faculty Award in Community Service from Faculty of Pharmaceutical Sciences, Naresuan University.

Dr. Fuanchan’s research interests include diabetes care, chronic disease management, medication adherence, clinical trial, and Thai herbal and traditional medicine.

Bruce Jarrell, MD, FACS
Chief Academic and Research Officer and Senior Vice President
Dean of the Graduate School
University of Maryland, Baltimore

As the University of Maryland, Baltimore’s (UMB) chief academic and research officer (CARO) since April 2012, Dr. Jarrell is the focal point for all academic matters at the University. In his CARO role, Dr. Jarrell is responsible for facilitating the research mission of the University by working closely with UMB administrators, the deans, the research leadership of the schools, and other individuals.

Dr. Jarrell is dean of the Graduate School and also provides leadership for and direction to the Health Sciences and Human Services Library, Campus Life Services, and Academic Services.

He also functions as the University's provost in matters related to University of Maryland: MPowering the State, UMB’s innovative and structured collaboration with the University of Maryland, College Park, and in building and maintaining academic interactions with all University System of Maryland institutions.

Recruited by the University of Maryland School of Medicine to chair the Department of Surgery, Dr. Jarrell came to UMB in 1997. Under his leadership, the Department of Surgery expanded its surgical programs and developed innovative research studies and clinical trials, and was ranked 11th nationally in total research funding from the National Institutes of Health. In 2003, Dr. Jarrell moved to the Dean's Office of the School of Medicine, where he served as the executive vice dean, directing the School's education and research enterprises. He also served as the Institutional Official for Human Research Protection and Animal Research Protection. He has remained actively involved in research and medical student education throughout his career.

Dr. Jarrell received his undergraduate degree in chemical engineering from
the University of Delaware in 1969 and his medical degree from Jefferson Medical College in 1973. He completed a surgical residency and transplantation fellowship at the Medical College of Virginia and practiced general and vascular surgery in Dover, Del., for two years. In 1980, he joined the faculty at Thomas Jefferson University in Philadelphia, where he performed kidney and liver transplantation and hepatobiliary surgery for 10 years. Dr. Jarrell was recruited to the University of Arizona in 1990 to chair its Department of Surgery, before coming to UMB in 1997.

Dr. Jarrell has written a number of books, including the popular textbook *NMS Surgery* and the new *NMS Surgery Casebook*. In 1999, 2000, 2001, and 2003, he received the student council faculty teaching award from students at the University of Maryland School of Medicine. In 2002, Jarrell received the "Golden Apple" award for best clinical faculty member.

**Michael Katz, PharmD**
Professor, Department of Pharmacy Practice & Science  
Director, College of Pharmacy International Affairs  
University of Arizona College of Pharmacy

Dr. Katz is a professor at the University of Arizona College of Pharmacy in the Department of Pharmacy Practice & Science. He practices at the University of Arizona Medical Center with the Department of Internal Medicine. His practice interests include general internal medicine, endocrinology, HIV/AIDS, infectious diseases, and evidence-based practice.

Dr. Katz teaches pharmacy and medical students in both the classroom and experiential settings. He was selected in 2001 as a Dean’s Teaching Scholar by the Arizona Health Sciences Center and has received numerous teaching awards.

He is a past-chair of the American Society of Health-System Pharmacists Commission on Therapeutics. Dr. Katz has numerous publications, including *Pharmacotherapy Principles and Practice Study Guide: A Case-Based Care Plan Approach*.

He has been involved in international education and practice for more than 12 years and serves as the College of Pharmacy’s Director of International Affairs. In 2010, he received the University of Arizona’s prestigious Excellence in International Education Award. He has consulted and lectured extensively in Japan and other countries regarding pharmacy education and clinical pharmacy practice, and he serves on the Board of Directors of the U.S.-Thai Pharmacy Consortium. Dr. Katz directs the largest program of its kind to train clinical pharmacy faculty members from Saudi Arabia.
Sindhchai Keokitichai, BSc in Pharm, MPhil, PhD
Dean and Associate Professor, Faculty of Pharmaceutical Sciences Burapha University

Dr. Keokitichai is dean of the Faculty of Pharmaceutical Sciences of Burapha University where he also serves as a member of the Burapha University Academic Council. He previously served as dean of the Faculty of Pharmacy, and vice-president for planning and development, and provost at Silpakorn University. Prior to that, he was head of the Department of Biochemistry of the Faculty of Pharmaceutical Sciences at Chulalongkorn University. Dr. Keokitichai he has been presidential chair of the Pharmacy Education Consortium of Thailand and president of the Pharmaceutical Association of Thailand under Royal Patronage. He is currently serving as a committee member of the Pharmacy Council of Thailand.

Dr. Keokitichai received his Bachelor of Science degree from the Faculty of Pharmaceutical Sciences at Mahidol University and his masters and doctoral degrees from Chelsea College at the University of London.

Connie Kraus, PharmD
Vice-chair, Pharmacy Practice Division
Director, Office of Global Health
University of Wisconsin-Madison School of Pharmacy

Dr. Kraus joined the faculty of the University of Wisconsin (UW)-Madison School of Pharmacy in 1993. She is a faculty member in the Pharmacy Practice Division and began her service as vice chair in July 2013. Dr. Kraus became director of the School of Pharmacy’s Office of Global Health in 2008 and has facilitated the development of international educational and research opportunities. She is a board certified ambulatory care pharmacist and has practiced in family medicine since 1993. Prior to joining the UW School of Pharmacy faculty, she worked as a clinical pharmacist at UW Hospital and Clinics as both an inpatient and ambulatory pediatric pharmacist.

Vithaya Kulsomboon, MS, PhD
Associate Professor, Social and Administrative Pharmacy
Director, Social Research Institute
Faculty of Pharmaceutical Sciences
Chulalongkorn University

Dr. Kulsomboon graduated with a PhD in pharmacy administration from the University of Maryland School of Pharmacy in 2000. He earned a Bachelor’s degree in pharmacy and a Master’s degree in primary health care management from the Asian Institute for Health Development at Mahidol
Dr. Kulsomboon publishes in the areas of pharmaceutical policy, pharmacoeconomics, pharmacoepidemiology, and health consumer protection. He is currently a council member of the National Economic and Social Advisory Committee, is the vice president of the Pharmacy Council of Thailand, and is the director of the College of Pharmaceutical and Health Consumer Protection.

Since 2005, he has served as director of the Health Consumer Protection Program, under the cooperation of the Thai Health Foundation and Chulalongkorn University. In addition, he is the president of the International Society for Pharmacoeconomics and Outcome Research’s Thailand Chapter.

Alan Lau, PharmD
Professor, Department of Pharmacy Practice
Director, International Clinical Pharmacy Education
University of Illinois at Chicago College of Pharmacy

Dr. Lau received a Bachelor’s of Pharmacy and a Doctor of Pharmacy degree from the State University of New York in Buffalo and completed a clinical care pharmacy residency at the University of Illinois at Chicago. He pioneered the development of clinical pharmacy services for renal failure patients on dialysis. He has obtained many research grants for clinical and laboratory research in renal pharmacotherapeutics and clinical pharmacology, with a recent focus on mineral and bone disorder in chronic kidney disease.

Dr. Lau was one of the founding members of the Nephrology Practice and Research Network of the American College of Clinical Pharmacy (ACCP). In addition, he has served on the Board of Directors and as chair of the Renal Scientific Section of the American Society for Clinical Pharmacology and Therapeutics. Dr. Lau was elected vice-chair of the Nephrology/Urology Expert Committee of United States Pharmacopeia (USP) in 2007. In 2010, he was named a Distinguished Practitioner in the National Academies of Practice in Pharmacy. In 2011, Dr. Lau was appointed by ACCP as its Professional Development Associate for International Programs.

With a passion for advancing global pharmacy education and practice, Dr. Lau has been invited to give lectures and organize many programs on pharmacotherapy and clinical pharmacy service and education development in various countries, including Japan, South Korea, China, Hong Kong, Taiwan, Thailand, Malaysia, Singapore, Vietnam, Philippines, Indonesia, Saudi Arabia, and Malta.
Earlene Lipowski, PhD
Professor, Department of Pharmaceutical Outcomes and Policy
University of Florida College of Pharmacy

Dr. Lipowski received a degree in pharmacy from the University of Wisconsin-Madison and practiced pharmacy for 10 years. She returned to the University of Wisconsin and earned masters and doctoral degrees and then joined the faculty at the University of Florida, where she is a professor of pharmaceutical outcomes and policy. Dr. Lipowski teaches courses for professional and graduate students about the United States’ health care system, the pharmaceutical industry, and public policy. Dr. Lipowski has been a regular participant at meetings of the US-Thai Consortium since 2002. She has had the pleasure of visiting Thailand on several occasions and claims the honor of having visited and taught at Faculty of Pharmacy in 10 Thai universities, many of them more than once. She is quite fond of things Thai, particularly textiles and Thai food. It was suggested by one of her hosts that she must have been Thai in a former life.

Sirada Maphanta, PharmD, MS, BCPS
Assistant Professor, Department of Pharmacy Practice
Faculty of Pharmaceutical Sciences
Naresuan University

Dr. Maphanta received a Doctor of Pharmacy degree from the University of Wisconsin-Madison. After six years of pharmacy school and two residency trainings positions, she joined the Department of Pharmacy Practice at Naresuan University as a faculty member. Dr. Maphanta served as department chair from 2008 to 2012, while also serving as assistant dean of hospital pharmacy service at Naresuan University Hospital’s Faculty of Medicine. Dr. Maphanta has also served as a member of the Executive Board of the College of Pharmacotherapy of Thailand. Since 2012, she has been a visiting faculty member in the Office of Global Health at the University of Wisconsin-Madison School of Pharmacy. Her research and practice interests are health system pharmacy administration and critical care pharmacy.

J. Edward Moreton, RPh, PhD
Professor of Pharmaceutical Sciences
University of Maryland School of Pharmacy

Dr. Moreton earned a BS in pharmacy in 1966 and a PhD in pharmacology in 1971 from the University of Mississippi School of Pharmacy. From 1971-1973, he was a National Institute of Mental Health postdoctoral fellow in psychiatry research at the University of Minnesota School of Medicine and was a National Institute on Drug Abuse research associate in pharmacology.
Dr. Moreton teaches pharmacology to pharmacy, dental, and graduate students in a wide range of topics including neuropharmacology, behavioral, autonomic, cardiovascular and renal pharmacology, principles of drug action, general toxicology, and drug abuse and dependence. He has been the recipient of the AACP Teacher of the Year Award and twice received the Graduating Class Teacher of the Year Award from the University of Maryland School of Pharmacy.

Dr. Moreton’s research background includes investigation of drug abuse and dependence employing behavioral and neuropharmacological animal models and investigation of potential neuroprotective drugs employing the rat and C. elegans models.

Dr. Moreton has served as coordinator for the US/Thai Consortium for the Development of Pharmacy Education in Thailand since its inception in 1994. In this capacity, he assists with the recruitment and matriculation of Thai pharmacy faculty in the PhD and PharmD programs at the University of Maryland. He also coordinates short-term exchanges of Maryland and Thai faculty and students and has served as a visiting professor at several Thai schools of pharmacy. Dr. Moreton was recognized by H.R.H Princess Maha Chakri Sirindhorn for his contributions to pharmacy education in Thailand and received an Honorary Doctorate from Ubon Ratchathani University.

Jeanine Mount, PhD, RPh
Associate Dean and Professor
Northeastern University

Dr. Mount is a graduate of Purdue University where she completed her BS in Pharmacy and MS and PhD degrees in Sociology with specialty in organizational analysis. She joined Northeastern University in 2013 as a professor of practice in the Department of Pharmacy Practice in the School of Pharmacy and as associate dean for undergraduate education in the Bouvé College of Health Sciences.

Prior to joining Northeastern, Dr. Mount was on the faculty of the University of Wisconsin-Madison School of Pharmacy in the School’s Division of Social and Administrative Sciences (beginning in 1985) and served as an associate
dean (beginning in 2004).

Her research addresses organizational change in health care and health profession education, focusing on factors that affect quality and effectiveness of outcomes. Her teaching focuses on quality and improvement in health care delivery, emphasizing social, ethical, and legal aspects of care.

Dr. Mount has worked for almost 20 years with students and faculty colleagues from several Faculties of Pharmacy in Thailand and looks forward to future collaborations.

**Surakit Nathisuwan, PharmD**  
Vice President, International Relations  
Mahidol University

Dr. Nathisuwan received a Bachelor of Science in pharmacy from the Faculty of Pharmacy, Mahidol University in 1994 and a Doctor of Pharmacy degree from the University of Florida in 1999. He later completed a pharmacy practice residency at the Florida Hospital in Orlando and then did a residency in pharmacotherapy at the University of Texas Health Science Center at San Antonio. He became a board certified pharmacotherapy specialist in 2001. His main area of interest is cardiovascular pharmacotherapy. Dr. Nathisuwan served as the assistant dean for academic affairs at the Faculty of Pharmacy, Mahidol University from 2006 to 2008 and as deputy dean for international relations from 2008 to 2011. He is the University’s vice president for international relations.

**Ruth E. Nemire, PharmD, EdD**  
Associate Executive Vice President  
American Association of Colleges of Pharmacy

Dr. Nemire joined the American Association of Colleges of Pharmacy (AACP) in January 2013 as its associate executive vice president. Dr. Nemire is a graduate of Ohio Northern University and the University of Toledo Colleges of Pharmacy. She completed formal fellowship training in neurology with an emphasis in epilepsy at the University of Miami College of Medicine in Florida. Dr. Nemire completed a doctorate in education with a major in higher education leadership at the Nova Southeastern University Fischler School of Education.

Her academic and research endeavors include leadership positions across the United States in both pharmacy and medical schools. Prior to joining AACP, she served as the executive founding dean for Fairleigh Dickinson University in Madison, NJ. She helped establish the Touro College of Pharmacy in New York in 2007 as the associate dean for professional
education and community engagement and as a professor of pharmacy and health outcomes. Dr. Nemire is known for her expertise in pharmacy education and research, epilepsy, service-learning, and using new technologies in education. Her teaching and research interests are reflective of her education and training in the areas of neurology, epilepsy, education, and technology. She is the author of numerous book chapters and articles in these same areas. Dr. Nemire is co-editor of *Pharmacy Student Survival Guide* (McGraw-Hill, 2009). Her record of community service includes participating in immunization clinics in Harlem, disaster relief both nationally and international, and leadership in medical missions. Dr. Nemire belongs to numerous professional organizations, including the American Epilepsy Society and the American College of Clinical Pharmacy.

**Mantiwee Nimworapan, PharmD**  
Post Graduate Year One Pharmacy Practice Resident  
**University of Arizona Medical Center**

Dr. Nimworapan received her BPharm, MPharm from Chiang Mai University, Thailand and her PharmD from the University of Maryland School of Pharmacy. She has practiced clinical pharmacy at Chiang Mai University for five years as a faculty member. She is currently participating in the PGY1 residency in pharmacy practice at the University of Arizona Medical Center, University Campus where she will continue her PGY2 residency in internal medicine. After finishing residency training, Dr. Nimworapan will return to the Faculty of Pharmacy at Chiang Mai University to resume her faculty responsibilities. Her areas of interest include internal medicine, cardiology, endocrinology, and teaching.

**Gary Oderda, PharmD, MPH**  
Professor and Director, Pharmacotherapy Outcomes Research Center  
**University of Utah**  
Director, Utah Medicaid Drug Regimen Review Center

Dr. Oderda was born and raised in northern California. His college education was completed at the University of California system including the Santa Barbara, Berkeley, and San Francisco campuses. He received his PharmD from the University of California at San Francisco in 1972 and completed an internship and residency in clinical pharmacy at the University of California Hospital in 1973. He received a Masters of Public Health in 1982 from the Johns Hopkins University School of Hygiene and Public Health.

His first professional position was at the University of Maryland School of Pharmacy where he served as director of the Maryland Poison Center and as a faculty member. He joined the faculty in 1973 as an instructor and had been promoted to professor by the time he left the University in 1991. While at the University of Maryland, he also served as acting assistant dean.
from 1989 to 1991. While a senior policy fellow at the School's Center for Drugs and Public Policy, he worked on a project to develop drug use criteria for use in Medicaid programs in the United States. In addition, he worked with the School's Student Committee on Drug Abuse Education on programs related to drug abuse.

In 1991, Dr. Oderda moved to the University of Utah where he served as professor and chair of the Department of Pharmacy Practice from 1991 to 1998. In addition to his responsibilities for administration of the department, teaching, and service, he was active in research involving the epidemiology of poisoning and drug use review.

On Jan. 1, 1999, Dr. Oderda began a sabbatical from the University of Utah and started as a visiting professor in the Department of Health Care Management at Novartis Pharmaceuticals Corporation in East Hanover, NJ. He was active in a variety of outcomes research and disease management projects. He returned to the University of Utah on Jan. 1, 2000, where he served as a professor and interim chair of the Department of Pharmacy Practice and conducted outcomes research. He currently serves as a director of the University of Utah Pharmacotherapy Outcomes Research Center.

Dr. Oderda developed a clerkship in Thailand for PharmD students from the University of Utah. The ninth group of students completed the clerkship in March 2014. The overall objectives of the clerkship are for students to learn about tropical medicine and health care in the developing world. The success of this clerkship has been accomplished by partnering with faculty at Chiang Mai University and Naresuan University. In addition to these clerkship activities, Dr. Oderda has worked on research collaborations in outcomes research and pharmacoeconomics with colleagues in Thailand and Malaysia.

Veronica Onorevole  
Regional Lead  
Fulbright U.S. Scholar Program

Ms. Onorevole has served as the regional lead of the Fulbright U.S. Scholar programs for East Asia and the Pacific region since June 2013. Prior to her work with the Fulbright program, Ms. Onorevole served for six years as the senior manager of education and research programs at the American Society of International Law in Washington, DC. She earned her Master's Degree from American University's School of International Service, where she specialized in East Asia foreign policy, and a Bachelor's Degree in economics and Japanese language studies from Rutgers University. Among other relevant activities, Ms. Onorevole worked as a research assistant with the Political Affairs Division of the Embassy of Japan in Washington, DC and participated in the Japan Exchange of Teachers Programme as an assistant.
language teacher in Fukushima, Japan. Ms. Onorevole is active with the Japan-America Society of Washington DC and was most recently recognized in 2013 as a specialist of Japanese studies by the Japan Foundation.

**Sutthiporn Pattharachayakul**  
Assistant Professor, Department of Clinical Pharmacy  
Prince of Songkla University

Dr. Pattharachayakul received her Bachelor's degree in pharmaceutical science with second class honors from Prince of Songkla University (PSU) in Thailand. After graduation, she worked at Tachana Hospital, a community hospital in Southern Thailand for three years. She then went to the United States and received a PharmD degree from the University of Illinois at Chicago (UIC) in 1998. She next completed pharmacy practice and infectious disease pharmacotherapy residencies and fellowships at UIC. Presently, Dr. Pattharachayakul is an assistant professor in the Department of Clinical Pharmacy at PSU. In addition, she participated in infectious diseases consultation service and on a neurosurgery patient care team to provide pharmaceutical care to the patients at Sonklanagarind Hospital. Dr. Pattharachayakul is actively involved in infectious disease clinical research and teaches PharmD students. Additionally, she is a preceptor in clinical clerkship rotation for PharmD students and pharmacy residents.

**Thitima Pengsuparp, PhD**  
Director of the International PhD Program in Pharmaceutical Care  
Faculty of Pharmaceutical Sciences, Chulalongkorn University

Dr. Pengsuparp obtained her pharmacy degree with Gold Medal First Class Honor from Faculty of Pharmaceutical Sciences, Chulalongkorn University in 1987, and a PhD in pharmacognosy from the University of Illinois at Chicago (UIC) in 1996. During her PhD studies, she worked as a teaching assistant at UIC and won the University's Van Doren Scholars Award in 1995.

Following completion of her bachelor degree, Dr. Pengsuparp was appointed as a lecturer in the Department of Biochemistry at the Faculty of Pharmaceutical Sciences, Chulalongkorn University. Since then, she has been a part of the Faculty's academic committees. She implemented various new teaching methods to stimulate students’ learning. In 2009, she received the Best Teacher Award from Chulalongkorn University. Dr. Pengsuparp has worked in the University's Department of Pharmacy Practice since 2010. She is trained in the concepts of curriculum preparation and evaluation, especially pharmacotherapy courses, and participated in the Experiential Education and Teaching Certificate Program in the Division of Pharmacy Practice at the University of Wisconsin-Madison School of Pharmacy from July to December 2009.
After returning to Thailand, she served as associate dean for academic affairs in Faculty of Pharmaceutical Sciences, Chulalongkorn University from 2010 to 2013. In this position, she was responsible for facilitating and implementing the new PharmD competency-based curriculum. In 2010, she was appointed to her current position of director of the International PhD Program in Pharmaceutical Care in the Department of Pharmacy Practice, Faculty of Pharmaceutical Sciences, Chulalongkorn University.

Supatra Porasuphatana, PhD
Assistant Professor, Division of Pharmacognosy and Toxicology
Assistant Dean for International Programs
Faculty of Pharmaceutical Sciences, Khon Kaen University

Dr. Porasuphatana earned her Bachelor of Pharmacy from Khon Kaen University, Thailand in 1991. Following her graduation in Master of Sciences (Pharmacology) from Mahidol University in 1994, she was awarded the Royal Thai Government Scholarship to pursue PhD from University of Maryland, Baltimore from 1996 – 2001. During her PhD and post-doctoral trainings under the supervision of Professor Dr. Gerald M. Rosen, Dr. Porasuphatana conducted research with substantial outcomes from which numerous publications were generated and cited. After returning to Thailand, Dr. Porasuphatana started working to conduct and collaborate in the fields of free radical and antioxidant to expand her research skills to support graduate students and other researchers. She has been teaching in Toxicology and related subjects for pharmacy students and graduate students from Faculty of Pharmaceutical Sciences and Faculty of Medicine, Khon Kaen University.

In 2003, she received a scholarship from ASIA-UNINET to conduct research as a visiting scientist at the Institute of Nutrition, University of Veterinary Medicine, Vienna, Austria. In 2004, she received a research grant from the Thailand Research Fund (TRF) as well as an additional research funding from the Cerebos Award in 2005 on the study of effects of an antioxidant in patients with diabetes mellitus. Results were published and presented in various conferences. She was also nominated as a recipient for Faculty Staff of the Year by the Faculty of Pharmaceutical Sciences in 2006.

Dr. Porasuphatana is a member of the Pharmacological and Therapeutic Society of Thailand and the Society of Toxicology. She is currently an Assistant Professor at Faculty of Pharmaceutical Sciences, Khon Kaen University and has been serving as an Assistant Dean for International Program since 2011.
Melody Ryan, PharmD, MPH, BCPS, CGP, FCCP, FAPhA  
Associate Professor, Department of Pharmacy Practice and Science  
Director of International Professional Student Education  
University of Kentucky College of Pharmacy

Dr. Ryan received her PharmD and Masters of Public Health degrees from the University of Kentucky. She completed a pharmacy practice residency at Duke University and a neurosciences fellowship at the University of Kentucky (UK). She holds appointments as associate professor in the Department of Pharmacy Practice and Science at the UK College of Pharmacy and in the Department of Neurology at the UK College of Medicine. Her practice site is the neurology clinic at the Veteran’s Affairs Medical Center in Lexington. She is the director of International Professional Student Education at the UK College of Pharmacy.

Dr. Ryan earned her certification in geriatric pharmacy in November 1998, and she attained board certified pharmacotherapy specialist status in 2000. She is a fellow of the American College of Clinical Pharmacy and the American Pharmacists Association (APhA). She also serves on the Medicare Model Guidelines Expert Panel for the United States Pharmacopeia. She is president of the American Pharmacists Association – Academy of Pharmaceutical Research and Science. She is a member of APhA’s Board of Trustees and the board of the College of the Psychiatric and Neurologic Pharmacists Foundation.

Sumon Sakolchai, PhD  
Professor Emeritus, Khon Kaen University

Dr. Sakolchai earned a Bachelor of Science in pharmacy from Chulalongkorn University and a Master of Science in pharmacology from Mahidol University. He went on to earn PhD in medicinal chemistry at Perdue University.

Dr. Sakolchai has assumed many leading roles as an administrator at various levels in educational institutes of Thailand. At Khon Kaen University, his major roles included associate director of the university hospital (800-bed teaching hospital), and assistant dean of the Faculty of Medicine. At the age of 34, he was appointed as dean of the Faculty of Pharmaceutical Sciences, a role he served in for almost 11 years. He was then named vice president for international relations, a role he held for almost five years. He then served as president of Khon Kaen University from 2003 to 2011. One of his highlighted achievements was being appointed by His Majesty the King as member of the National Legislative Assembly, which is an equivalent body of the United States Congress. Dr. Sakolchai serves on university council committees at five universities in Thailand.

During his career, Dr. Sakolchai has made significant contributions to the Faculty of Pharmaceutical Sciences at Khon Kaen University and has helped found two new schools of pharmacy in Thailand. He has actively contributed to pharmacy education and the pharmacy profession as a committee member.
and chairman of the Pharmacy Education Consortium of Thailand and has initiated many projects to develop and strengthen clinical pharmacy education and practice for hospitals of the Ministry of Public Health. Dr. Sakolchai’s commitment and contribution to the pharmacy profession are demonstrated by his roles in various organizations, including the Pharmacy Council of Thailand and the Asian Association of Schools of Pharmacy. He is also one of the founder members of this US-Thai Consortium for Pharmacy Education and played a significant role in the consortium during its first decade.

Rungpetch Sakulbumrungsil, PhD
Assistant Professor and Dean
Faculty of Pharmaceutical Sciences, Chulalongkorn University

Dr. Sakulbumrungsil earned her Bachelor’s degree in Pharmaceutical Sciences from Chulalongkorn University in 1984 and worked as a hospital pharmacist at Bumrungrad Hospital for three years before entering the graduate program in pharmaceutical socioeconomics at the University of Iowa. After receiving a PhD in 1993, she started teaching at Chulalongkorn University. Since joining the faculty, she has held several administrative positions including head of the pharmacy administration unit, chair of the graduate program in social and administrative pharmacy, head of continuing education unit, associate dean for research affairs, and is currently dean of the Faculty of Pharmaceutical Sciences, Chulalongkorn University.

Fadia Shaya, PhD, MPH
Professor and Vice Chair for Academic Affairs
Associate Director, Center on Drugs and Public Policy
Department of Pharmaceutical Health Services Research
Director of Research, Center for Innovative Pharmacy Solutions
University of Maryland School of Pharmacy

Dr. Shaya obtained her PhD in Health Policy, Finance and Management from the Johns Hopkins University Bloomberg School of Public Health (with a minor in Health Economics), her doctoral health economics degree from the Sorbonne University Paris-IX Dauphine, and her Master’s in Public Health and BSc in Pharmaceutical Sciences from the American University of Beirut.

Dr. Shaya is a professor in pharmaceutical health services research at the University of Maryland School of Pharmacy and is on faculty in the Department of Epidemiology and Public Health at the University of Maryland School of Medicine. She is also director of research at the School of Pharmacy’s Center for Innovative Pharmacy Solutions and an associate director at its Center on Drugs and Public Policy. Prior to joining the School of Pharmacy, Dr. Shaya worked in health care consulting in Washington DC, the Johns Hopkins Bayview Medical Center, the Johns Hopkins Bloomberg School of Public Health, and in
health policy at the Health Planning Commission in Paris, France and at the American University of Beirut, Lebanon.

Her research focuses on the implementation of new Medicare policies, patient-centered approach to care and research, comparative effectiveness, and the development of methods to inform optimal clinical and coverage decisions.

Dr. Shaya has advanced training and expertise in formulary development and management, as well as medication therapy management programs. She has built research capacity to support all stages of drug development and policy, from pre-clinical trials to post-marketing surveillance. She has experience in developing clinical, economic, policy, and decision analysis, along with budget impact models. She works with Medicare and Medicaid programs and commercial plans to guide drug formulary management and coverage decisions. Her extramural research is supported by federal, state, commercial, and foundation grants and contracts.

A member of the Pharmacy and Therapeutics Committee at CareFirst BlueCross BlueShield, she also serves on the Editorial Advisory Boards of the Journal of Medical Economics, the Journal of Managed Care Pharmacy, Expert Review in Pharmacoeconomics and Outcomes Research, and P&T. She is a reviewer for and has published in peer-reviewed journals, including Circulation, The Lancet, The Lancet Diabetes, The Lancet Infectious Disease, Health Affairs and Archives of Internal Medicine. She has reviewed more than 400 papers for publication in these journals and has published more than 200 articles herself. She regularly presents at national and international scientific and policy meetings, with more than 250 presentations and posters to date. She has also been an invited speaker at Harvard Medical School, the Post-Approval Summit, the Johns Hopkins University Bloomberg School of Public Health, the Institute of Medicine, and various other federal, academic or industry venues.

Dr. Shaya has served as chair of the State of Maryland’s Governor’s Advisory Council on Hepatitis C and Diseases of the Liver, heads the MVP (Maryland Cardiovascular Health) Program, and has served as the co-PI of a large grant from the National Heart, Lung, and Blood Institute (NHLBI) to develop and implement a research partnership program between academia and a community-based health system in the Health Enterprise Zone in West Baltimore.

She serves on the Advisory Council for Clinical Pharmacology and Pharmaceutical Sciences at the Food and Drug Administration, the Board of the Delmarva Foundation for Medical Care, the Quality Health Foundation, the Health Services and Value Research Review study section, and special emphasis panels for the Agency for Healthcare Research and Quality. Her translational medicine work is based on public-private partnerships and community
engagement initiatives aimed at reducing the burden of chronic disease.

Dr. Shaya teaches in various clinical and graduate policy courses and advises and mentors pharmacy, medical, graduate and postdoctoral students and junior faculty. Her mentees and students have a 100 percent career placement rate and have taken positions in government, academia, consulting, non-profit organizations, and the health care industry. She serves as advisor for the School’s student chapter of the Academy of Managed Care Pharmacy and has led her team to several national wins in the annual pharmacy and therapeutics formulary competition.

She is a member of the School of Pharmacy’s Executive Council, the Faculty Senate, the Faculty Senate Advisory Committee, and the Council of University System Faculty (CUSF) at the University of Maryland. She has led the design of the new curriculum, serving as chair of the Curriculum and Assessment Committees at the School. She has also chaired various search committees at the University and other organizations she serves.

She is also very involved in her local community, volunteering on the boards of various community organizations such as Sinai Hospital, Our Daily Bread, and at fund raising events for various health and education causes. She is also active with the World Trade Center Institute programs sponsored by the U.S. Department of State. She is fluent in English, French, Arabic, and Spanish.

Phayom Sookaneknun, PharmD, PhD
Assistant Professor
Associate Dean for Special Affairs and International Relations
Mahasarakham University

Dr. Sookaneknun is a lecturer in the clinical group at the Faculty of Pharmacy, Mahasarakham University (MSU), Thailand. She is associate dean for international relations and special affairs and is head of Primary Care Practice Research Unit. She received her BS in Pharmacy from Chulalongkorn University in 1995 and her PharmD degree from Mahasarakham University in 2001. She received a PhD in from Chiang Mai University in 2005 and completed a research fellowship at Robert Gordon University in Scotland.

Dr. Sookaneknun also serves as MSU’s Pharmacy manager. She is chair of subcommittee for community pharmacy clerkship training for the Pharmacy Education Consortium Thailand (PECT) from 2013 to 2015. She is serving a three-year term on the committee of the Community Pharmacy Association (Thailand) and has served as a member of the committee of the Community Pharmacy Foundation since 2009. She led the Community Pharmacy Network for Health Promotion from 2011 to 2013. She received the Best Researcher Award in 2013 from MSU’s Faculty of Pharmacy.
Dr. Sookaneknun’s research focuses on community pharmacy practice in collaboration with the National Health Security Office and health related organizations and policy research for smoke-free workplace environments.

**Bernard Sorofman, PhD**  
Division Head and Professor  
University of Iowa

Dr. Sorofman received a Bachelor of Arts in anthropology from the University of Nevada and a Bachelor of Science in pharmacy from the University of Oklahoma. He then completed a PhD in social and administrative pharmacy at the University of Minnesota. Dr. Sorofman’s research centers on health behavior theory in the context of treatment-oriented health care practices (actions) by patients. His studies are directed at the lay-oriented health care system. His second complementary research interest is on the system of pharmacy in society as it relates to access and impact on care. The content of Dr. Sorofman’s research typically covers one or more of the following areas: self-care, pharmacy, gerontology, rural health care, medication adherence, and interdisciplinary teams.

**Suphat Subongkot, MS, PharmD, BCPS, BCOP**  
Assistant Professor and Chair, Clinical Pharmacy Division  
Faculty of Pharmaceutical Sciences, Khon Kaen University  
President, College of Pharmacotherapy of Thailand

Dr. Subongkot is currently an assistant professor and chair of the Clinical Pharmacy Division at Faculty of Pharmaceutical Sciences, Khon Kaen University. His responsibilities include didactic teaching in an advanced pharmacotherapy course for undergraduate, master, and doctorate of clinical pharmacy students and providing oncology clinical pharmacy and clinical pharmacology service at Srinagarind Hospital KKU. He is also host of a board certification in pharmacotherapy training program and serves as a residency/fellowship coordinator under the College of Pharmacotherapeutics.

His past experiences involve clinical coordination with the medical team and oncology services at Rush University Medical Center in Chicago, teaching the experiential and didactic portion of the curriculum at the University of Illinois Chicago College of Pharmacy, precepting pharmacy students and residents, and conducting clinical research at Rush University Medical Center. He is the recipient of a National Institutes of HealthK-30 grant to participate in a clinical research training program for clinicians at Rush University Medical School from 2001 to 2003.

In 2006, Dr. Subongkot founded the Asia Pacific Oncology Pharmacy Society in Thailand and the first Asia Pacific Oncology Pharmacy Congress which is one of
the premier events held biannually to support oncology pharmacy education among SEA regions. Recently, he was appointed president of the College of Pharmacotherapy of Thailand, an official residency program accrediting body in Thailand.

His main interest is targeted therapy for cancer treatment, especially the role of cyclo-oxygenase II and herbal drugs in treatment and prevention, pharmacogenomics, and cancer drug development. He is also interested in many palliative care issues emphasizing cachexia, nausea/vomiting, and nutrition in oncology patients. His ongoing research involves the use of olanzapine to improve emesis control, the effect of melatonin on breast cancer supportive care, effect on melatonin in alleviating radiation-related toxicities, and ginger in treatment-related cancer cachexia.

Chuthamanee Suthisisang, MS, PhD
Associate Professor and Dean
Faculty of Pharmacy, Mahidol University

Dr. Suthisisang was appointed dean of the Faculty of Pharmacy at Mahidol University in Bangkok in 2008. She is also the president of the Thai Association for the Study of Pain and director of the Center for Continuing Pharmaceutical Education in Thailand, Committee of Pharmacy Council and Pharmacy Education Accreditation Committee of Pharmacy Council. Dr. Suthisisang received her Bachelor’s in pharmacy and Master’s and Doctoral degrees in pharmacology from Mahidol University. She also held visiting professorships at various international institutions such as the Mario Negri Institute of Pharmacological Sciences in Milan, Italy and the Chinese University of Hong Kong. She has published more than 30 papers, including research on pharmacologic treatment of migraine and osteoarthritis of the knee. Dr. Suthisisang sits on the National Drug Committee and was previously a member of the National Narcotic Board. She continues her interest in pharmacy education via positions as a member of the Board of Directors of Asian Association of Schools of Pharmacy and the International Advisory Group for the International Services Program of the Accreditation Council for Pharmacy Education. She is a past president of the Pharmacy Education Consortium of Thailand.

Wongwiwat Tassaneeyakul, PhD
Associate Professor, Pharmacology and Toxicology
Dean, Faculty of Pharmaceutical Sciences, Khon Kaen University

Dr. Tassaneeyakul received his Bachelor of Pharmacy and Master of Science in Pharmacology from Chiang Mai University. He completed a postgraduate specialization course in environmental control in chemical and pharmaceutical industries at the State University of Ghent in Belgium. His Doctor of Philosophy in clinical pharmacology was awarded from the Flinders University of South
Dean Tassaneeyakul has served in a variety of leadership roles including chair of the Graduate Program for the Master of Science in Toxicology at Khon Kaen University, member of the Executive Committee of the Toxicology Society of Thailand, co-secretary of the Committee for Development of the Drug Quality Surveillance System in the National Health Security System, and member of the Executive Committee of the Pharmacological and Therapeutic Society of Thailand. He has published in the areas of pharmacokinetics and pharmacogenomics.

Stacy Taylor, PharmD, MHA, BCPS
Clinical Assistant Professor, Department of Pharmacy Practice and Science
University of Kentucky College of Pharmacy

Dr. Taylor is a clinical assistant professor at the University of Kentucky (UK) College of Pharmacy. Her training and credentials include a Doctor of Pharmacy degree from the University of Kentucky in 1999, residencies in pharmacy practice and internal medicine-pediatrics at Shands at the University of Florida from 1999 to 2001, board certification as a pharmacotherapy specialist in 2002, and a Master’s of Health Administration from Texas A&M Health Science Center School of Rural Public Health in 2008. Prior to returning to teach at the University of Kentucky, Dr. Taylor spent 10 years working in health-system pharmacy in a variety of roles in both private and academic medical centers. Her clinical roles included cardiology, critical care, and emergency medicine and administrative roles included pharmacy clinical manager, and director of pharmacy. Her teaching interests center on health-system pharmacy topics in the classroom and in the patient care laboratory. Dr. Taylor serves as the UK College of Pharmacy’s liaison for interprofessional education and has collaborated interprofessionally to design, implement, and assess novel interprofessional educational activities.

Janet L. Teeters, RPh, MS
Director of the Accreditation Services Division
American Society of Health-System Pharmacists

Ms. Teeters is director of the Accreditation Services Division at the American Society of Health-System Pharmacists (ASHP), which accredits pharmacy residency programs and pharmacy technician training programs. Currently about 1,700 pharmacy residency programs and over 250 technicians training programs are accredited or have applied to be accredited by ASHP. Ms. Teeters has been with ASHP since 2002. She received her pharmacy degree from the University of Wisconsin and completed the two year combined Master’s degree and ASHP-accredited residency in hospital pharmacy at the University of Minnesota Hospital and Clinics.
Previous to ASHP, Ms. Teeters was the director of pharmacy at Lutheran General Hospital, a 600 bed teaching hospital in Park Ridge, Ill. She was also the director of the pharmacy program for Advocate Health Care, an integrated health system in the Chicago area, which at the time included nine hospitals. Ms. Teeters served as the residency program director for the pharmacy practice residency program at Lutheran General Hospital for 13 years. She is a past president of the Illinois Council of Health-System Pharmacists. She has also worked in management positions at New England Medical Center in Boston, Ma., and the Veterans Administration System in Philadelphia, Pa.

**Pavich Tongroach, BPharm, MSc, PhD**  
Commission on Higher Education in Thailand; Ministry of Education, Thailand

Dr. Tongroach graduated with a BPharm from Chulalongkorn University in 1969, and then received a MSc in neurobiology and a PhD in neuropharmacology from the School of Pharmacy, University of London in 1977 before continuing with postdoctoral research at the Faculty of Medicine, Tokyo University in 1980.

He was dean of the Faculty of Pharmaceutical Sciences, Chulalongkorn University, from 1990 to 1993 before serving as the founding president of Mahasarakham University from 1995 to 2003. In 2004, he was appointed secretary general of the Commission on Higher Education, which oversaw the entire university system of the country.

Dr. Tongroach also served as the founding president of two other universities, Nakornphanom University and Princess of Narathiwat University, and was acting president of King Mongkut Institute of Technology at Ladkrabang. He has also held positions such as chair of the Dean of Pharmacy Council, president of the Council of University Presidents of Thailand, chair of the ASEAN University Network, and secretary general of the University Mobilization in the Asia-Pacific. Dr. Tongroach also served two terms as the president of the Pharmacy Council, the governing board of pharmacy profession in Thailand. During his final term, he issued the new professional standard that required a six-year PharmD as the entry level degree. While serving as the dean of Pharmacy and chair of the Dean Council, together with other deans, extensive internationalization of Thai pharmacy education was initiated, which included establishment of the US-Thai Consortium on Pharmacy Education, the Japan-Thailand Core University Exchange System in Pharmaceutical Science, and the UK-Thai Consortium.

Dr. Tongroach is still active as chair of the council of two Nakornphanom University and Kalasin Rajabhat University, chair of the National Research Council of Thailand (Chemistry and Pharmacy), and vice minister for education.
Ilene Zuckerman, PharmD, PhD
Principal Research Scientist and Managing Director
IMPAQ International, LLC

Dr. Zuckerman is a principal research scientist and managing director at IMPAQ International, a public policy research firm whose mission is to provide exemplary research and consulting services to its domestic and international clients in the areas of impact evaluation, applied research, policy analysis, and technical assistance. Dr. Zuckerman has more than 30 years of experience and more than 100 publications in geriatrics, medication use and quality measures, medication adherence, pharmacoepidemiologic research, quantitative analysis, and drug policy and program evaluation.

Prior to joining IMPAQ, she served on the faculty of the University of Maryland School of Pharmacy from 1983 to 2013, where she was chair of the Department of Pharmaceutical Health Services Research for five years and associate dean for research and graduate education for two years. Dr. Zuckerman is proud to have had the opportunity to collaborate with faculty and students at Chulalongkorn University through the US-Thai Consortium, and as a Senior Fulbright Scholar.
101. Analysis of multiclass antimicrobial residues in feed water by liquid chromatography and ion trap mass spectrometry

Chusak Arsoongnearna\textsuperscript{a}, Ongart Boonbanlu\textsuperscript{a}, Sunan Kittijaruwattana\textsuperscript{a}, Leena Suntornsuk\textsuperscript{b,c}

\textsuperscript{a}Bureau of Quality Control of Livestock Products, Department of Livestock Development, Bangkok 10400 Thailand
\textsuperscript{b}Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Mahidol University, Bangkok 10400 Thailand
\textsuperscript{c}Center of Excellence for Innovation in Drug Design and Discovery, Faculty of Pharmacy, Mahidol University, Bangkok 10400 Thailand

Background: This project was the collaboration between Mahidol University and Veterinary Drugs Assay Division (VDA), Department of Livestock Development, Thailand to ensure food safety measurement. According to EU Commission Regulation residues of antimicrobials are not allowed in any food products due to their toxicity. Thus, there is an urgent need for a confirmatory method with higher sensitivity for simultaneous analysis these residues.

Objective: This work aimed to develop a liquid chromatography-mass spectrometric method (LC-MS) for the quantitation of nitrofurans (e.g. nitrofurazone (NFZ), nitrofurantoin (NFT), furazolidone (FZD) and furaltadone (FTD)), nitroimidazoles (e.g. metronidazole (MNZ), ronidazole (RNZ) and dimetridazole (DMZ)) and chloramphenicol (CAP) in animal feed water.

Methods: Optimization of solid phase extraction (SPE) procedures (e.g. sorbent and eluting solvent), HPLC conditions (e.g. mobile phase composition and gradient elution) and MS parameters were performed. The method was validated and applied to analyze the drug residues in forty feed water samples collected from animal farms in Thailand.

Results and Discussion: HPLC analysis was performed on a Prodigy ODS-3 column, 2.0 × 150 mm, 5 µm at a flow rate of 0.2 mL/min, column temperature of 40°C, and an injection volume of 10 µL. After an off-line SPE by the Oasis HLB cartridges (with an enrichment factor of 400), the eight antimicrobials were separated in 18 min using a gradient elution of acetonitrile in acidified water (pH 5.0). MS detection was by an ion trap MS coupled with electrospray ionization (ESI) in tandem MS mode (MS/MS) using the nebulizer gas at 35 psi, drying gas at 9 L/min and drying temperature of 325°C. Method linearity was good ($r^2 = 0.979$ - 0.999) with acceptable precision (%RSDs = 3.4 to 26.6%) and accuracy (%recovery = 88.4 to 110.1%). Very low limits of detection (LOD) and quantitation (LOQ) were achieved in ranges of 0.002 to 0.06 µg/L and 0.005 to 0.25 µg/L, respectively. The established method was successfully employed to analyze 40 feed samples collected by the VDA.

Conclusion: A HPLC-MS method has been established for residue analysis of eight multiclass antimicrobial drugs at sub-ppb levels in feed water. In addition to its high efficiency, the method is simple, fast and cost-effective, which can be applied to routine analysis in regulatory departments, where sample throughput and sensitivity are priority.

*This work has been previously published in the Journal of Chromatography B 2014 (945-946): 31-38.
102. Click Chemistry, 1,2,3-Triazoles as Selective and Potent $\alpha_7$ Nicotinic Acetylcholine Receptor Agonists*

Kuntarat Arunrungvichian$^{1,2}$; Akos Nemecz$^2$; Valery V. Fokin$^3$; Palmer Taylor$^2$; Opa Vajragupta$^1$

$^1$Center of Excellence for Innovation in Drug Design and Discovery, Faculty of Pharmacy, Mahidol University, 447 Sri-Ayudhya Road, Bangkok 10400, Thailand
$^2$Department of Pharmacology, Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92093-0657, USA
$^3$Department of Chemistry, The Scripps Research Institute, 10500 North Torrey Pines Road, La Jolla, CA 92037, USA

**Background:** The $\alpha_7$ nicotinic acetylcholine receptor (nAChR) is a member of pentameric ligand-gated ion channel (LGIC) receptors and a novel candidate target for treatment of Alzheimer’s disease, schizophrenia, other CNS disorders, along with peripheral pain and inflammation. Previous *in vitro* screening of 1,2,3-triazole derivatives has identified lead compounds (TTIn-1) possessing $\alpha_7$-nAChR agonistic properties. 

**Objective:** To enhance the selectivity and potency profiles of lead compound by structure based drug design.

**Methods:** Approximately 50 molecules were designed based on the binding poses of $\alpha_7$-nAChR agonists obtained from x-ray crystal structures and previous *in vitro* screening results. Homologous proteins of nAChR extracellular domain from *Aplysia californica* (Ac) and *Lymnaea stagnalis* (Ls) acetylcholine binding proteins (AChBPs) are expressed and purified as templates for drug design, binding affinity assays, and x-ray crystallography. Lead optimization of 1,2,3-triazole products started with an azide building block modification to obtain a suitable cationic center followed by a variation of alkyne building blocks to fit a hydrophobic region in the binding pocket of $\alpha_7$-nAChRs. All modified compounds were synthesized by copper-catalyzed azide-alkyne cycloaddition (CuAAC) or click chemistry. The pharmacological properties were evaluated by binding affinity and functional assays using the AChBPs and fluorescent cell-based detection in LGIC expressed cell lines.

**Results and Discussion:** Both selectivity and potency profiles of the modified compounds were superior to the lead molecule. IND1, a six-membered monocyclic ring with a 2 methylene linker, is the most potent and selective $\alpha_7$-nAChR agonist in this series. Its potency is the same as PNU-282987 and 3-fold greater than the lead compound with high selectivity for $\alpha_7$-nAChR over the $\alpha_4\beta_2$-nAChR and 5HT$_{3A}$ receptors. Three compounds (IND8, QND2, and QND8) from a quinuclidine azide building block are the most potent compounds. Their potencies are equal to PHA-543613 increased 20-fold compared with lead compound, where the selectivity is maintained.

*This work was presented at the 8th Annual Drug Discovery for Neurodegeneration Conference: An Intensive Course on Translating Research into Drugs, Miami, February 2-4, 2014.

103. An Economic Burden of Central Nervous System Inflammatory Demyelinating Disorder Patients In Thailand: A Preliminary Report on Patients’ Perspective

Chalakorn Chanatittarat$^1$, Naraporn Prayoonwiwat$^2$, Sasitorn Siritho$^2$, Usa Chaikledkaew$^1$
Background: Central Nervous System Inflammatory Demyelinating Disorder (CNSIDD) is a burden disease affecting patients’ quality of life and their families, though it considers as rare disease in Thailand. However, the burden from opportunity cost and out of pocket expenses due to CNSIDD has never been explored in Thailand yet.

Objective: This study aimed to evaluate the economic burden of CNSIDD on patients’ perspective for each disease state and type and to determine the correlation of economic burden with disease severity and quality of life.

Methods: One hundred thirteen patients were recruited at MS clinic in Siriraj hospital, Bangkok during September 2011 through April 2013. Interviews were conducted with patients and/or families on cost related to hospitalization (e.g., food, traveling, etc.), facility modification, homecare cost and other alternative treatment cost. Descriptive statistical method was used to analyze the data.

Results: The average age of patients was 40 years and disease duration was 3.3 years. The annual number of outpatient visits was 5.9 times and patients spent 11.4 hours per visit. Annual total direct non-medical cost per patient was $US1,979, informal care cost was $US711 (95% CI: 420 to 1012), facility modification was $US423 (95% CI: 137 to 710), cost related to hospitalization was $US276 (95% CI: 199 to 352), while annual total indirect cost was $US2,839 (95% CI: 983 to 4,695). The overall cost was significantly correlated with quality of life score (p=0.01). The overall cost of CNSIDD patients was significantly increased with disease severity, while quality of life negatively correlated with disease severity significantly.

Discussion: The major part for overall cost was an indirect cost due to earning lost followed by an informal cost and cost related to hospitalization. The economic burden of CNSIDD on patients’ perspective was high as relative to the gross domestic product (GDP) due to earning lost and out of pocket expenses which was correlated with patient disability and disease severity.

Keywords: Cost of illness, Cost, Quality of life, Multiple sclerosis, Thailand

104. Chemical stability determination of *Cassia fistula* pod pulp extract by TLC- densitometric method

Savita Chewchinda; Pongtip Sithisarn; Wandee Gritsanapan
Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Bangkok, Thailand

Background: *Cassia fistula* Linn. (Fabaceae) is a medium-sized tree, native to Southern Asia. The ripe pod pulp has long been used as a traditional laxative drug due to anthraquinone glycosides constituent. The major anthraquinone derivative in the pulp is rhein.

Objective: The aims of our study was to develop and validated a TLC densitometric method for quantitative analysis of rhein content in the *C. fistula* pod pulp extract stored at different conditions (in...
glass vial and in aluminum foil, at room temperature and at 40°C for 3 and 6 months. Physical
c characteristics e.g. color, odor and solubility of the extracts were also determined.

**Methods:** The pulp from the ripe pods of *C. fistula* was extracted by decoction. The filtered extract was
 evaporated to dryness to yield a crude extract. Three batches of the crude extract were stored in glass
 vials and in aluminum foil bags under accelerated condition and at room temperature as described in
 ASEAN guideline on stability study of drug product. For TLC densitometric method, the separation was
carried out on an aluminum sheet of silica gel60F254 using ethylacetate/methanol/water (100:17:10,
v/v/v) as a mobile phase. The wavelength of the detector was set at 435 nm. The method was validated
by evaluation of linearity, precision, accuracy, limit of detection (LOD) and limit of quantitation (LOQ).

**Results:** The proposed TLC densitometric method showed acceptable validation parameters. The
correlation coefficient value was ≥ 0.999, confirming the linearity of the method. The R.S.D value was
lower than 2% and the average recovery of rhein was 101.21%, indicating the precision and accuracy of
the method. The content of rhein in the crude extract remained more than 95% (95.22%-100.20%) of
the initial content for all storage conditions. From the results, there was no significant change of the
extracts and the acceptance criteria were met. Regarding physical attributes, all pod pulp extracts had
brownish-black with characteristic odor and mild sweet taste. After 6 months of storage under
previously mentioned conditions, no significant changes were found.

**Discussion:** TLC densitometric method is a simple, rapid, sensitive and economical alternative method
for a routine analysis of rhein content in *C. fistula* pod pulp extract. The pulp extracts were chemically
stable after 6 months of storage at room temperature and at 40°C. This indicated a good stability of the
pod pulp extract which could potentially be developed as a herbal laxative drug.

105. HPLC analysis of rhein content in *Cassia fistula* pod pulp

**Savita Chewchinda; Pongtip Sithisarn; Wandee Gritsanapan**

**Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Bangkok 10400, Thailand**

**Background:** *Cassia fistula* Linn. belongs to Fabaceae family. In Thai traditional medicines, the ripe pod
pulp has long been used as a laxative drug. The major anthraquinone derivative in the ripe pods is rhein.
For the quality assessment of herbal preparation, HPLC is the most widely used method for both
quantitative and qualitative analysis of plant materials.

**Objective:** The aims of this study are to develop and validate HPLC method for quantitative analysis of
the rhein content in the pod pulp of *C. fistula* and to perform analysis of its HPLC fingerprints.

**Methods:** The pulp from the ripe pods was extracted with distilled water by decoction. The filtered
extract was evaporated to dryness on a water bath to yield a crude decoction extract.
Instrument and Chromatographic condition: HPLC method was performed on a Shimadzu SCL-10A HPLC
system, equipped with a model LC-10AD pump, UV-vis detector SPD-10A. A Hypersil® BDS C-18 column
(4.6 x 150 mm, 5 μm size) with a C-18 guard column was used. The isocratic mobile phase was 0.5%
aqueous acetic acid solution and methanol (40:60). The total running time was 30 min and a flow rate
was 1.0 mL/min. The UV detector monitored at 435 nm while the injection volume was 20 μL. The
method was validated by evaluation of linearity, precision, accuracy, limit of detection (LOD) and limit of
quantitation (LOQ) according to the International Conference on Harmonization guideline, ICH, 1996.
Results: The proposed HPLC method showed acceptable validation parameters. The correlation coefficient value was $\geq 0.999$, confirming the linearity of the method. The R.S.D value was lower than 2% and the average recovery of rhein was 99.12%, indicating the precision and accuracy of the method. Average yield of the crude extract was 64.21% wet weight while extract ratio was 1.6:1. The content of rhein in the crude decoction extract was 0.0926±0.0073 %w/w while in the fresh pod pulp was 0.0594±0.0047 %w/w. HPLC chromatograms of the extract showed similar pattern with a major peak of rhein at retention time of 13.6 minute.

Discussion: The HPLC method for quantitative analysis of rhein content in *C. fistula* pod pulp is reliable and accurate with validated repeatability, reproducibility and recovery testing. The proposed HPLC quantitative analysis would be useful for quality assessment and standardization of *C. fistula* pod pulp raw materials and products containing its extracts.

---

106. Evaluation of rhein chemical stability in *Cassia fistula* pod pulp extract by HPLC

Savita Chewchinda; Pongtip Sithisarn; Wandee Gritsanapan  
*Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Bangkok 10400, Thailand.*

**Background:** *Cassia fistula* Linn. (Fabaceae) is an ornamental plant widely grown in tropical and subtropical area. The ripe pod pulp has long been used as a traditional laxative drug due to anthraquinone glycosides content. Rhein is the major anthraquinone in the pod pulp.

**Objective:** This study was aimed to evaluate chemical stability of *C. fistula* pod pulp extracts which kept under the storage condition as described in ASEAN guideline on stability of drug product.

**Methods:** The ripe pod pulp of *C. fistula* was extracted by decoction method. HPLC method was developed and validated for quantitative analysis of rhein content in these extract. Three batches of crude extract were stored for 6 months under accelerated (at 40°C) and real time storage conditions.

**Results:** The proposed HPLC method showed acceptable validation parameters and the content of rhein in the decoction extract was remained more than 95% (96.88% - 99.62%) of the initial amount for all storage conditions. From the results, there was no significant change of the extracts and the acceptance criteria were met.

**Discussion:** The extract from *C. fistula* pod pulp had good stability and suitable to be further developed as an alternative laxative product.

---

107. Stability study on antioxidant activity of standardized *Cassia fistula* pod pulp extract

Savita Chewchinda$^1$; Adelheid H. Brantner$^2$; Wandee Gritsanapan$^1$  
$^1$*Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Thailand*  
$^2$*Institute of Pharmaceutical sciences, University of Graz, Austria*

**Background:** *Cassia fistula* Linn. (Fabaceae) is a medium-sized, deciduous tree widely grown in tropical and subtropical areas as an ornamental plant. It is native to southern Asia and can be found in every part of Thailand. In Ayurvedic medicinal system, *C. fistula* has been used against various disorders such
as haematemesis, pruritus, diabetes and other ailments. Various biological activities of *C. fistula* pods such as antibacterial, antifungal, antioxidant, antileishmanial, and hypolipidemic properties were reported.

**Objective**: The aim of this study is to determine antioxidant activity of standardized *C. fistula* pod pulp extract at various storage conditions of stability study.

**Methods**: The pulp from the ripe pods of *C. fistula* was extracted by decoction method. The crude extract was stored in glass vials and in aluminum foil bag under the condition described in ASEAN guideline on stability study of drug product. For antioxidant activity assay, the extract was determined using DPPH scavenging assay and ferric reducing antioxidant power (FRAP) method. Total phenolic content of the stored extracts was also investigated.

**Results**: The extract exhibited antioxidant activity with EC₅₀ of 6.86 ± 0.56 to 9.38 ± 0.19 mg/mL by DPPH scavenging assay and 19.59 ± 0.16 to 21.24 ± 2.04 g gallic acid equivalent/100 g extract using FRAP method. Total phenolic content ranged from 2.50 ± 0.40 to 2.89 ± 0.50 g gallic acid equivalent/100 g extract.

**Discussion**: These results would be useful for the development of standardized *C. fistula* extract as pharmaceutical products.

---

**108. Comparison of HPLC and TLC densitometric methods for the quantification of rhein in *Cassia fistula* pod pulp extract**

*Savita Chewchinda; Pongtip Sithisarn; Wandee Gritsanapan*

*Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Bangkok 10400, Thailand*

**Background**: *Cassia fistula* Linn. (Fabaceae) is commonly known as “Khun” and “Ratchapruetk” in Thai. *C. fistula* pod pulp is used in traditional medicine as a purgative/laxative drug. The major anthraquinone derivative in the pod pulp is rhein. Although HPLC is the most widely used method for quality assessment of herbal preparations, it requires high operational cost and skilled operator.

**Objective**: The purpose of this study is to compare the quantitative results obtained by validated HPLC and TLC densitometric methods in the analysis of rhein content in the extracts of *C. fistula* pod pulp.

**Methods**: HPLC Method: A validated HPLC analysis was performed on a Shimadzu Technologies modular model Class VP system. The analysis was carried out using a BDS Hypersil C18 column (150×4.6 mm, i.d. 5 μm) with a BDS Hypersil C18 guard column. The isocratic mobile phase was 0.5% aqueous acetic acid solution and methanol (40:60). The total running time was 30 min and the flow rate was 1.0 mL/min. The UV detector monitored at 435 nm while the injection volume was 20 μL.

TLC Densitometric Method: TLC was performed on an aluminum sheet of silica gel60 F₂₅₄ (20 cm x 10 cm). Sample and standard solutions were applied on the plate as 7 mm band with a Linomat V automatic sample spotter (Camag, Switzerland). The mobile phase consisted of ethyl acetate-methanol-water (100:17:10, v/v/v). The plate was developed to a distance of 8 cm in a Camag twin trough chamber. The densitometric scanning was performed by using a TLC Scanner 3 with winCATS software. The wavelength of the detector was set at 435 nm. The sample was applied at 10 μL/spot.
**Results:** The contents of rhein in the six samples of *C. fistula* pod pulp extracts analyzed by both methods were compared. The paired t-test showed no statistically significant difference (P > 0.05) between the mean contents of rhein performed by HPLC method and TLC densitometric method.

**Discussion:** The proposed TLC densitometric method could be used as an alternative method for the quantitative analysis of rhein content in *C. fistula* pod pulp extract. This method showed several advantages such as simplicity, fast data acquisition, and high efficacy.

109. A Bayesian Multiple Treatment Comparison of Duloxetine, Pregabalin, Gabapentin, Amitriptyline, and Their Combinations for Painful Diabetic Peripheral Neuropathy Based on Pain Reduction Reported in Clinical Trials

Chanadda Chinthammit, BSPharm, MS¹; Daniel C. Malone, RPh, PhD²

¹The University of Arizona College of Pharmacy, Tucson, AZ
²Center for Health Outcomes and PharmacoEconomic Research, Tucson, AZ

**Background:** Painful Diabetic Peripheral Neuropathy (PDPN) is a developed long-term complication of diabetes mellitus, which is estimated to occur be 7.8 % of the United States population and 12-14% in people over 40 years. According to American Academy of Neurology, numerous medications, including anti-depressants, antiepileptic, and opioids have been suggested as treatment for PDPN.

**Objectives:** The goal of this study was to compare the performance of treatment of painful diabetic peripheral neuropathy (PDPN) — duloxetine, pregabalin, gabapentin, amitriptyline, and their combinations based upon pain reduction reported in clinical trials, and inform a revised treatment algorithm.

**Methods:** Published studies of PDPN treatment through May 2012 were identified from MEDLINE(PubMed) database and extended manual search was conducted based on citations from identified studies. Inclusion criteria was restricted to randomized controlled trials lasting at least 5 weeks and at most 12 weeks and studies examining 30% pain reduction or equivalent. Direct and indirect pairwise odds ratios (OR) were obtained. The study used Bayesian Analysis Using Gibbs Sampling in Windows (WinBUGS) version 1.4.3. and Monte Carlo Simulations to conduct a multiple treatment comparison. Results are reported in OR with 95% credible intervals (CI) and the median of ranking.

**Results:** There were a total of 10 studies with 23 treatment arms, representing 2,885 subjects enrolled, that were included in the analysis. The results from fix effects model indicated that duloxetine, pregabalin, gabapentin, and co-administration of duloxetine and gabapentin were significantly better than amitriptyline (OR= 3.22[95%CI, 1.54-7.17], OR = 2.53[95%CI, 1.11-5.94], OR = 4.00[95%CI, 1.33-11.69], OR = 2.86[95%CI, 1.09-7.48], respectively). The results from random effects model suggested that only duloxetine and pregabalin were significantly better than placebo (OR = 2.61[95%CI, 1.37-4.95] and OR = 0.97[95%CI, 1.01-3.62], respectively). There was no significant difference between amitriptyline and placebo in either fixed or random effects models. With regard to the median ranking, gabapentin was ranked first, followed by duloxetine, co-administration of duloxetine and gabapentin, pregabalin, placebo, and amitriptyline from the fix effects model.
Conclusion: Treatment of PDPN with amitriptyline does not appear to be significantly different from placebo. Duloxetine and pregabalin appear to be better than both amitriptyline and placebo.

110. Modulation of drug release kinetics from shellac-based matrix tablets

Noppadol Chongcherdsak¹; Direk Aekhammarat²; Chutima Limmatvapirat³; Sontaya Limmatvapirat⁴,⁵
¹Faculty of Pharmacy, Siam University, Bangkok 10160, Thailand
²Faculty of Medical Science, Nakhon Ratchasima College, Nakhon Ratchasima, 30000, Thailand
³Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Silpakorn University, Nakhon Pathom 73000, Thailand
⁴Department of Pharmaceutical Technology, Faculty of Pharmacy, Silpakorn University, Nakhon Pathom 73000, Thailand
⁵Pharmaceutical Biopolymer Group (PBiG), Faculty of Pharmacy, Silpakorn University, Nakhon Pathom 73000, Thailand

The aim of this research was to evaluate the factors and their consequences on mechanism of drug release through fitting with various kinetic models. The matrix tablets containing different amount of shellac (SHL) were prepared by direct compression method and theophylline was selected as a model drug. The tablets were annealed at various temperatures. Kinetics of drug release was investigated in 0.1 N HCl (pH 1.2) and phosphate buffer pH 6.8 by fitting curve with zero order kinetic model, first order kinetic model, Higuchi model and power law equation model, respectively. The result demonstrated that the kinetics of drug release in 0.1 N HCl (pH 1.2) and phosphate buffer pH 6.8 were both fitted with Higuchi model and power law equation model, respectively. The drug released in pH 6.8 more rapid than in 0.1 N HCl (pH 1.2). The value of release exponent (n) in power law equation model had a tendency to decrease when using the high content of SHL and annealed temperature. The main mechanism of drug release in 0.1 N HCl (pH 1.2) was well fitted with diffusion process while the mechanism of drug release at pH 6.8 should be the combination of diffusion and erosion.

Keywords: shellac, annealing temperature, kinetics of drug release

111. Medicare Outreach Program: Engaging Pharmacy Students Through Service Learning

Salisa C. Westrick, PhD
Harrison School of Pharmacy, Auburn University

Background: In the United States, prescription drug coverage (Medicare Part D) for Medicare beneficiaries is provided by private plans. These Part D plans vary greatly in terms of their premiums, patient cost sharing, and medication coverage. The plan selection process places a great reliance on computer literacy and can be challenging to many Medicare beneficiaries. The Medicare outreach project is a collaborative project between Harrison School of Pharmacy and Alabama State Health Insurance and Assistance Program and was launched in October – November 2013. A total of 17 enrollment events in 10 counties in Alabama were offered to provide assistance for Medicare beneficiaries in Part D plan selection.

Objectives: This program was evaluated in terms of participants’ and students’ outcomes. The specific objectives were to 1) identify participants’ characteristics, preferences and enrollment decisions, and
potential out-of-pocket cost savings and 2) describe pharmacy students’ experiences after volunteering at enrollment events.

**Methods:** For enrollment event participants, data were collected using interviewer-administered questionnaire. Potential annual cost-saving was the cost difference between switching to the least expensive plan and continuing with the 2013 plan. For students’ reflections, students who interacted with Medicare beneficiaries wrote a paragraph to reflect on their experience. Reflections were coded independently by two coders using ATLAS.TI and merged for comparison. A final coding scheme was determined through discussion and consensus.

**Results:** Of 146 participants, the majority of participants were female (64.3%). The average age was 66.9 (SD = 8.5) and had 5.6 prescription drugs for chronic conditions (SD = 3.8). The majority (59.1%) preferred plans with the lowest overall out-of-pocket cost while some preferred no deductible plans (23.5%) and plans with lowest monthly premiums (17.4%). The potential annual savings per person was $488.50 (SD = $879.23). Of those who selected a plan, the vast majority (78.1%) selected the overall least expensive plan while 21.9% would pay $207.6 (SD = $204.7) more on average annually. As for students’ outcomes, 80 participating students provided written reflections. The majority of students felt the outreach project was a great learning experience that allowed them to apply information learned in class in the real world. They described their experience helping patients and the realization of need for programs like this in the community. The most common theme among the students was aspirations for future participation in enrollment events.

**Discussion:** The program has positive participants’ and students’ outcomes and should be sustained over time.

---

**112. Sunitinib-treated dendritic cells promoted Th1 phenotype in CD3^+CD56^− subset of CIK cells**

*Adisak Wongkajornsilp, M.D., Ph.D.¹ Khanit Sa-ngaamsuntorn, Ph.D.³ Valla Wamanuttajinda, B.Sc.¹ Kanda Kasetsinsombat, M.Sc.¹ Sunisa Duangsa-ard, M.Sc.¹ Kittipong Maneechotesuwan, M.D., Ph.D.²*

¹Department of Pharmacology and ²Department of Medicine, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand.

³Department of Biochemistry, Faculty of Pharmacy, Mahidol University, Bangkok, Thailand.

**Background:** CIK cells have been clinically used for the treatment of leukemia and solid tumors. Their anti-tumor cytotoxicity has been intensified after the co-culture with dendritic cells.

**Objectives:** Since the enhancing function of dendritic cells to the anti-tumor cytotoxicity of cytotoxic T cells had been observed and could be further augmented with sunitinib pretreatment, we asked whether the in vitro pre-treatment of dendritic cells with sunitinib could drive the anti-tumor activity of CIK cells.

**Results:** We observed a strikingly enhanced cytotoxicity of CIK cells toward HubCCA1, a cholangiocarcinoma cell line. This enhancing action could be attributed to the heightening activity from CD3^+CD56^− subset of CIK cells. This activity coincided with the polarization toward Th1 differentiation within CD3^+CD56^− subset as evidenced by the heightening expression of interferon-γ and T-bet. The Th2
differentiation were lessened as evidenced by decreasing IL-4 and GATA3 expressions; and so were the Th17 differentiation as evidenced by decreasing RORγt and STAT3 expressions.

**Discussion:** It is concluded that sunitinib-treated dendritic cells drove CD3⁺CD56⁺ subset toward Th1 phenotype and enhanced its anti-tumor cytotoxicity.

113. **The role of pharmacist in multidisciplinary diabetes care team, Naresuan University Hospital, Thailand**

Anjana Fuangchan, PharmD, PhD¹; Posavee Rattanapayoungsathaporn, BPharm²; Sarinya Sattanon, MD³

¹ Department of Pharmacy Practice, Faculty of Pharmaceutical Sciences, Naresuan University, Phitsanulok, 65000, Thailand
² Pharmacy Division, Naresuan University Hospital, Faculty of Medicine, Naresuan University, Phitsanulok, 65000, Thailand
³ Department of Medicine, Naresuan University Hospital, Faculty of Medicine, Naresuan University, Phitsanulok, Thailand

**Background:** Inter-professional collaborative work has proved benefit to patients with chronic diseases. Diabetes clinic, Naresuan University Hospital was established in 2011 to deliver a holistic care by the multidisciplinary care team, which included an endocrinologist, three pharmacists, four nurses and one dietitian. Three pharmacists were rotated to work in diabetes clinic.

**Objective:** The aim of this study was to assess the role of pharmacists in a multidisciplinary care team in diabetes clinic.

**Method:** This retrospective study collected data from pharmacist’s note. Patients’ data were also reviewed from diabetes clinic records, outpatient profiles and computerized medication records between October 2011 and September 2012.

**Results:** Pharmacist activities included medication history interview, drug related problems assessment, and consultation with physician where necessary. Patient counseling was performed following physician appointment if needed. One hundred and forty-seven patients were enrolled to the clinic with the mean age of 52.5±10.3 years. The median hemoglobin A1C (HbA1C) was significantly decreased from 8.4 (Interquartile range (IQR); 7.2, 10.2) mg/dL to 7.9 (IQR; 7.1, 9.0) mg/dL (p<0.0001) after registered to the clinic. Non-adherence (62.6%) and adverse drug reaction (42.7%) were the main drug related problems identified. Seventy two percent of patients who used insulin were reviewed for their insulin injection technique by the pharmacists. Incorrect insulin injection technique was found in 40.0% of those using insulin pen and 37.5% of insulin syringe users, which required further follow up.

**Discussion:** Pharmacist plays an important role in the multidisciplinary diabetes care team to detect and resolve drug related problems. These will help the team to provide the quality use of medicines and assist patients to achieve their blood glucose target.
114. Development of an international PharmD program

Shaun E. Gleason, PharmD; Kari L. Franson, PharmD, PhD; Jodie V. Malhotra, PharmD; Ralph J. Altiere, PhD
University of Colorado Skaggs School of Pharmacy and Pharmaceutical Sciences

**Background:** There is an increasing awareness and desire for advancing pharmacy education worldwide to better prepare graduates to provide patient-centered pharmacy care (PCPC). Recognizing this need, we developed the internationally-trained PharmD (ITPD) degree program which is an innovative hybrid PharmD degree curriculum for international pharmacists. The ITPD program, which received ACPE accreditation as an entry-level degree pathway, is modeled after our on-campus entry-level PharmD (ELPD) program and our online post-BS North American Trained PharmD (NTPD) program.

**Objective:** The ITPD program aims to educate and train internationally-based non-PharmD practicing pharmacists to be advocates for PCPC in their communities.

**Methods:** Applicants must demonstrate plans to provide local PCPC. Successful candidates will pass English proficiency tests, and pre-admission secure online, proctored foundational sciences competency exams to establish baseline knowledge from global pharmacy education variances. Admitted students complete an initial one-month on-campus session including orientation, courses in pharmacy skills and US-based patient-centered pharmacy practice, and introductory pharmacy practice experiences. Successful students then enter the online curriculum, allowing for maintaining their home country-based practices while learning integrated clinical sciences and US-practice, through online lectures, Discussions, cases and simulations. Case-based teleconferences develop PCPC skills. The University’s online ethics course will provide interprofessional education. Upon successful completion of online coursework, students return to the US for additional professional skills courses, and introductory and advanced pharmacy practice experiences. The program is designed to be completed in three years but allows for flexibility up to six years. The inaugural ITPD class begins Summer 2014.

**Results:** Success of the program will be assessed through demographic (inquiry, applicant, admission, retention and graduation), student learning compared to our other pathways and graduate data. Total inquiries to date = 74 (2009=5, 2010=1, 2011=7, 2012=11, 2013=32, 2014 (Jan-March)=18); applications to date=10. Student learning: Assessed at the school level (performance in identical or like-courses and overall school educational outcomes, across ELPD, NTPD and ITPD programs; admissions criteria compared to performance in didactic and experiential courses) and national level (Pharmacy Curriculum Outcomes Assessment exam).

**Discussion:** Our ACPE-accredited innovative hybrid ITPD curriculum addresses the increasing demand and the global awareness for and complexity of educating pharmacists for PCPC.

115. Addressing local pharmacy educational needs through use of the FIP Global Competency Framework (GbCF) in an ACPE-accredited internationally-trained PharmD (ITPD) degree program.

Shaun E. Gleason, PharmD, MGS; Jodie V. Malhotra, PharmD; Kari L. Franson, PharmD, PhD.
University of Colorado Skaggs School of Pharmacy and Pharmaceutical Sciences; Aurora, Colorado, USA.
Background: Pharmacy education and professional needs of each country vary. To address individual country pharmacy education needs, while providing global consistency of practice expectations, FIP has put forth the GbCF. Concurrently, we developed an ACPE-accredited ITPD degree program for international pharmacists to be educated in providing patient-centered pharmacy care (PCPC). Admission to the ITPD program requires demonstration of plans to advance pharmacy practice toward PCPC in the applicants’ home countries. The learning plans are to be based on local pharmacy practice needs.

Objective: To address students’ individual and local educational and practice needs through implementation of the GbCF in our ITPD curriculum.

Methods: The ITPD curriculum includes a longitudinal Professional Development Portfolio course. In this course, students will identify their individual and local educational needs at the start of the curriculum from one or more behavior(s) for each competency of the GbCF. These GbCF competencies will be included in their online (E-Value™) professional portfolio, in addition to the ITPD program-specific required competencies. Students will document their achievement of each chosen GbCF competency through identification of didactic and experiential activities, with accompanying written reflection on how each activity allowed them to achieve the competency and how this will improve their ability to locally provide PCPC. Students will be assessed on their achievement of each GbCF competency through rubric-guided and individualized review of each submitted activity and reflection. Portfolios will be reviewed after completion of approximately half of the didactic courses have been completed, just prior to advanced pharmacy practice experiences, and prior to graduation, when all must have been achieved. A post-graduation survey sent to each graduate will assess the impact of their education and GbCF competency achievement on their local practice.

Results: Results are pending the implementation of the ITPD program in summer 2014.

Discussion: Implementing the GbCF into coursework of our ACPE-accredited ITPD program will allow the addressing of local educational needs of our international pharmacist students, while also meeting our accreditation and program goals.

116. Novel preparation technique for floating drug delivery based on sublimation technique

Kampanart Huanbutta1,2, Sontaya Limmatvapirat2,3, Srisagul Sungthongjeen4, Pornsak Srimornsak2,3
1 Faculty of Pharmaceutical Science, Burapha University, Chonburi 20131, Thailand
2 Pharmaceutical Biopolymer Group (PBiG), Faculty of Pharmacy, Silpakorn University, Nakhon Pathom 73000, Thailand
3 Department of Pharmaceutical Technology, Faculty of Pharmacy, Silpakorn University, Nakhon Pathom 73000, Thailand
4 Department of Pharmaceutical Technology, Faculty of Pharmaceutical Sciences, Naresuan University, Phitsanulok 65000, Thailand

The present study aims to develop floating drug delivery system which can prolong gastric residence time and increase bioavailability of the active drug. The core tablets containing a model drug, hydrochlorothiazide, were prepared by wet granulation method. Various levels (i.e., 0-50% w/w) of ammonium carbonate (AMC) were incorporated in the core tablets. The tablets were then coated with different amounts of the polyacrylate polymers (i.e., Eudragit® RL100, Eudragit® RS100, and the mixture
of Eudragit® RL100 and Eudragit® RS100 at 1:1 ratio). The coated tablets were kept at room temperature or cured at 70°C for 12 hours. The floating and drug release behaviors of the tablets were performed in simulated gastric fluid USP without pepsin (SGF) at 37°C. The results showed that high amount of AMC induced the floating of the tablets. The coated tablets containing 40 and 50% AMC floated longer than 8 hours with a time-to-float of about 3 minutes. The sublimation of AMC from the core tablets decreased the density of system, causing floating of the tablets. The tablets coated with Eudragit® RL100 floated at a faster rate than those of Eudragit® RS100. Even the coating level of polymer did not influence the time to float and floating time of coated tablets containing the same amount of AMC, the drug release from the tablets coated with higher level of coating the polymer showed the slower drug release. The results suggested that the gas formation and sublimation technique using AMC is promising for the development of floating drug delivery system.

117. Modification of tricomponent and dicomponent poly(ε-caprolactone)-co-poly(ethylene glycol) with methotrexate and folic acid

Ousanee Issarachot1,2; Jiraphong Suksiriworapong1,2; Kittisak Sripa3; Varaporn Buraphacheep Junyaprasert1,2
1Department of Pharmacy, Faculty of Pharmacy, Mahidol University, Bangkok 10400, Thailand
2Center of Excellence in Innovative Drug Delivery and Nanomedicine, Faculty of Pharmacy, Mahidol University, Bangkok 10400, Thailand
3Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Mahidol University, Bangkok 10400, Thailand

Regarding polymer-drug conjugation, the reaction and drug characteristics are of important since they reflect the possibility of conjugation. In addition, the different composition and the relative length of copolymer block may affect molecular and thermal characteristics of copolymer. Therefore, this study aimed to investigate an appropriate condition including solvent systems and catalysts used for conjugating methotrexate (MTX) and folic acid (FOL) molecules onto poly(ε-caprolactone)-co-poly(ethylene glycol) and to evaluate the molecular and thermal characteristics of MTX- and FOL-conjugated copolymers. Initially, tri- and dicomponent azido-functionalized copolymers were synthesized. Tricomponent copolymers consisted of caproyl, azido-substituted caproyl and ethylene glycol repeating units whereas dicomponent ones contained solely the last two repeating units. In parallel, the terminal alkyne derivatives of MTX and FOL were synthesized by coupling reaction using DCC and DMAP with an addition of NHS for FOL coupling. By click reaction, MTX and FOL were successfully conjugated with tri- and dicomponent copolymers, respectively, without polymer chain degradation. The grafting efficiencies of MTX and FOL were higher than 77% and 68% by using CuI/DBU and CuSO4.5H2O/sodium ascorbate, respectively. According to the differential scanning calorimetry thermograms, MTX did not change the semi-crystalline property of copolymers except for high % molar grafting whereas the presence of FOL affected thermal properties of copolymer except at 5 molar grafting. The resultant copolymers could be further employed as polymer-drug conjugate delivery system for cancer therapy.

Keywords: PEGylated poly(ε-caprolactone), polymer-drug conjugation, click reaction, methotrexate; folic acid
118. Herbal formulation adjuvant with antidiabetic drugs for treatment of type II diabetic patients at Bantakhun Hospital, Thailand

Jansing T; Pummangura C; Mesomboon R; Thongmanee B; Singsombat S; Thaitavorn K; Pisan A; Saripat P

1Faculty of Pharmacy, Siam University, Bangkok, Thailand
2Bantakhun Hospital, Surat Thani, Thailand

Diabetes is a chronic disease that must be treated consistently. Initial treatment includes control of diets, exercise, and medication. Many patients who cannot control their blood sugar levels turn to alternative medicine, such as herbal therapy. This study is a descriptive research and the data were collected from patient medical records. This study aimed to assess the efficacy of herbal remedies to control the level of fasting blood sugar (FBS) in patients with type 2 diabetes at Bantakhun hospital, Thailand. Inclusion criteria of the study were age over 18 years old, the FBS levels in the range of 126-300 mg/dl, and receiving 600 mg of herbal remedy (capsule consisting of 26 ingredients). The study was divided into two periods, before and after receiving the herbal remedy. Nineteen patients were included in this study. Most patients were 40-60 years old, and had FBS levels in the range of 126-199 mg/dl. Patients use a combination of metformin and glibenclamide (47.36%). After the herbal remedy was used in combination with diabetes drugs, the FBS levels were decreased significantly (25.57, 95% CI 3.70-47.45, p=0.024). When various factors were analyzed, women, 40-60 years of age and above 60 years demonstrated a significantly decreased in the FBS levels. The herbal remedy in combination with insulin, insulin and metformin, and metformin produce a significant decrease in the FBS levels (p=0.006, 0.028, and 0.034, respectively). In conclusion, the herbal remedy is beneficial in reducing the FBS level especially in females and patients at the age above 40. It can also be used with other diabetes drugs. However, future long term studies on efficacy and safety are required.

119. The Multifunctional Tryptoline and Tryptamine Triazole Derivatives that Enhanced the Neurite Outgrowth of Cultured P19-Derived Neurons

Jutamas Jiaranaikulwancha; Valery. V Fokinb; Sarin Tadtongc; Opa Vajraguptaa
[a] Center of Excellence for innovation in drug design and discovery, Faculty of Pharmacy, Mahidol University, 447 Sri-Ayudhya Road, Bangkok 10400, Thailand
[b] Department of Chemistry, The Scripps Research Institute, 10500 North Torrey Pines Road, La Jolla, CA 92037, USA
[c] Department of Pharmacognosy, Faculty of Pharmacy, Srinakharinwirot University, 63 Moo 7 Rangsit-Nakhonnayok Road, Ongkharak Nakhonnayok 26120, Thailand

Alzheimer’s disease (AD) is a common neurodegenerative disorder for which one of the hallmarks is the deposition of aggregated β-amyloid peptides (Aβ40,42) as plaques in brain. Oligomers of these peptides can react with biological metal in brain to generate free radicals resulting in neuronal cell death. We have previously reported tryptoline and tryptamine triazole derivatives (6h, 12c and 12h) as lead compounds acting on multiple targets, namely β-secretase (BACE1), β-amyloid peptides (Aβ), metal chelation and antioxidant. The multifunctional lead compounds inhibited BACE1, the key enzyme to generate β-amyloid peptides, and also interacted with Aβ and prevented the amyloid self-aggregation to form amyloid oligomers and plaques. In addition, metal chelation and antioxidant properties helped in reducing radical formation and scavenged the generated radicals. The multifunctional activities of compound 6h included anti-amyloid aggregation and antioxidant effects while those of compound 12c...
were β-secretase inhibitory action, antiamyloid aggregation and metal chelating. Compound 12h acted as Aβ aggregation blocker, chelator and antioxidant. As neurite dystrophy has been found in AD brain, and this significant loss of connectivity of neuron relates to cognitive decline, the multifunctional lead compounds (6h, 12c and 12h) were evaluated for neuritogenic activity using P19-derived neurons. The morphology of P19-derived neurons was observed and the length and number of neurites was measured comparing to geldanamycin, a positive control. At the noncytotoxic concentration of 1 nm, lead compounds 6h, 12c and 12h showed significant increase in neurite length and neurite number. The results suggested that the multifunctional lead compounds not only acted as neuroprotectants against neurotoxicity from Aβ on neuronal cells but also enhanced the survival and neurite outgrowth of P19-derived neurons.

120. In Vitro Cytotoxicity of Novel Cc-CATH3 Analogues against Human Cancer Cell Lines

Jiraphun Jittikoon1; Narumon Ngarmsaithong1; Jutarat Pimthon2; Opa Vajragupta2
1Department of Biochemistry, Faculty of Pharmacy, Mahidol University, Bangkok, Thailand, 447 Sri-Ayuthaya Road, Rajathevi, Bangkok, Thailand
2Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Mahidol University, Bangkok, Thailand, 447 Sri-Ayuthaya Road, Rajathevi, Bangkok, Thailand

Background: Cc-CATH3 is an antimicrobial peptide with 29 amino acid residues in length and demonstrated broad-spectrum antimicrobial activity against a variety of microorganisms including bacteria, fungi as well as some drug-resistant bacterial strains with MIC values in the range 0.3–2.5 µM, higher potency than ampicillin, kanamycin, and LL-37. However, the cytotoxic activity of Cc-CATH3 against human cancer cell line has never been reported.

Objectives: The objectives of this study are to explore the cytotoxic activity of Cc-CATH3 and its analogues against human cancer cell lines human hepatoma cells (HepG2) and human non-small cells lung cancer (NCI-H460) and to investigate the effect of amino-terminal truncation on cytotoxic effect of Cc-CATH3 peptide.

Method: A series of Cc-CATH3 analogues with progressive truncations of four amino acid residues from the N-terminal region was generated namely Cc-CATH3(5-29), Cc-CATH3(9-29) and Cc-CATH3(13-29) in order to investigate the effect of N-terminal truncation on its biological activity. The in vitro cytotoxicity of these analogues have been investigated by using the MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) cell proliferation assay in human hepatoma cells (HepG2) and human non-small cells lung cancer (NCI-H460).

Results: The results demonstrated that Cc-CATH3(1-29) and Cc-CATH3(5-29) exhibited cytotoxic activity against HepG2 and NCI-H460 cell lines. In contrast, Cc-CATH3(9-29) and Cc-CATH3(13-29) demonstrated no toxicity even at the maximum tested concentration of 50 µM. Cc-CATH3(1-29) displayed the cytotoxicity for HepG2 and NCI-H460 with the values of IC₅₀ 18.38 and 17.74 µM, while Cc-CATH3(5-29) exhibited the cytotoxicity for HepG2 and NCI-H460 with the values of IC₅₀ 6.58 and 4.4 µM, respectively.

Discussion: All Cc-CATH3 analogues were demonstrated prerequisite factors that fit to the classical characteristics of AMPs. However, only the native and the four amino acid truncation analogue, Cc-CATH3(5-29), are demonstrated the cytotoxicity. Therefore, the eight amino acid residues at the N-terminal region are important to its function. Interestingly, the four amino acid truncation analogue
illustrated higher cytotoxic against human cancer cell lines than that of the parent peptide Cc-CATH3(1-29).

**Keywords:** Cc-CATH3 analogues; cytotoxicity; antimicrobial peptide

---

### 121. Role of α- mangostin in VEGF induced neovascularization and hypoxia induced oxidative stress

*Kanjana Jittiporn*, *Wisuda Suvitayavat*, *Suwan Thirawarapan*, *Primchanien Moongkarndi*, *Ruth B. Caldwell*

*Department of Physiology, Faculty of Pharmacy, Mahidol University, BKK, Thailand*

*Department of Microbiology, Faculty of Pharmacy, Mahidol University BKK, Thailand*

*Vascular Biology Center, Georgia Regents University, GA, USA*

Retinal neovascularization is a major cause of the vision loss and is characterized by the development of abnormal leaky blood vessels. Vascular Endothelial Growth Factor (VEGF) is known to play an important role in this process. Oxidative stress has been strongly implicated in up regulation of VEGF associated with neovascularization in various tissues. Hence, compounds with the anti-oxidant actions can prevent neovascularization. α-mangostin, a component of mangosteen (*Garcinia mangostana* Linn) has been shown to have an anti-oxidant property in pathological conditions involving angiogenesis such as cancer. However, the specific effect of α-mangostin on angiogenesis has not been studied. Using bovine retinal endothelial cells (BRECs) and ex-vivo models, the present study investigated the anti-oxidant and anti-angiogenic activity of α-mangostin. Dihydroethidium (DHE) assay was used to study the effects of α-mangostin on superoxide formation in BRECs treated with hypoxia. 3D matrigel tube formation and aortic ring assay were performed to study whether α-mangostin can reduce neovascularization and western blot was performed to determine the signaling mechanisms involved. We observed that α-mangostin significantly and dose-dependently reduced superoxide formation in hypoxia-treated BRECs. α-mangostin also significantly inhibited VEGF-induced phosphorylation of VEGFR2 and suppressed neovascularization in the 3D matrigel tube formation and aortic ring assays of angiogenesis. According to our results, α-mangostin reduces oxidative stress and inhibits angiogenesis through blockade of VEGFR2 activation.

**Keywords:** Angiogenesis, α-mangostin, oxidative stress

---

### 122. Influence of chemical penetration enhancers on skin permeability of ellagic acid-loaded niosomes

*Varaporn Buraphacheep Junyaprasert; Pratyawadee Singhsa; Anchalee Jintapattanakit*

*Center of Excellence of Innovative Drug Delivery and Nanomedicine, Faculty of Pharmacy, Mahidol University, Rajathavee, Bangkok 10400, Thailand*

This study aimed to develop niosomes of ellagic acid (EA), a potent antioxidant phytochemical substance, for dermal delivery and investigate the influence of chemical penetration enhancers on the physicochemical properties of EA-loaded niosomes. The EA niosomes were prepared by reverse phase evaporation method using Span 60, Tween 60 and cholesterol as vesicle forming agents and Solulan C24 as a steric stabilizer. Polyethylene glycol 400 (PEG) was used as a solubilizer while dimethylsulfoxide (DMSO) or N-methyl-2-pyrrolidone (NMP) was used as a skin penetration enhancer.
enhancer. It was found that the mean particle sizes of EA-loaded niosomes were in the range of 312-402 nm with PI values of lower than 0.4. The niosomes were determined to be spherical multilamellar vesicles as observed by transmission electron microscope and optical microscopy. All niosomes were stable after 4 months storage at 4 °C. In vitro skin permeation through human epidermis revealed that the skin enhancers affected the penetration of EA from the niosomes at 24 h. The DMSO niosomes showed the highest EA amount in epidermis; whereas the NMP niosomes had the highest EA amount in the acceptor medium. Concomitantly, the skin distribution by confocal laser scanning microscopy showed the high fluorescence intensity of the DMSO niosomes and NMP niosomes at a penetration depth of between 30-90 µm (the epidermis layer) and 90-120 µm (the dermis layer) under the skin, respectively. From the results, it can be concluded that the DMSO niosomes are suitable for epidermis delivery of EA while the NMP niosomes can be used for dermis delivery of EA.

123. Protective effect of Teaw (Cratoxylum formosum) against amyloid-beta toxicity in Caenorhabditis elegans model of Alzheimer’s disease

Roongpetch Keowkase\textsuperscript{1}; Natthida Weerapreeyakul\textsuperscript{2}
\textsuperscript{1}Department of Biopharmacy, Faculty of Pharmacy, Srinakharinwirot University, Nakornayok, Thailand; \textsuperscript{2}Division of Pharmaceutical Chemistry, Faculty of Pharmaceutical Sciences, Khon Kaen University, Khon Kaen, Thailand

Alzheimer’s disease (AD), an age-related neurodegenerative disorder, is widely recognized as a serious public health problem. As lifespan increases, greater proportions of our population are affected by AD. The accumulation of amyloid β (Aβ) is one of the histopathological hallmarks of AD. Aβ is aggregated to form oligomers which are toxic to neurons and are critical to the onset and progression of AD. Currently, there is still no approved drug with a proven disease-modifying effect. This leads to the need for the development of effective compounds that can provide disease-modifying property. Oxidative stress is known to play an important role in AD, and there is strong evidence linking oxidative stress to Aβ. Thai dietary herbal plant Teaw (Cratoxylum formosum) is an indigenous Thai vegetable that is mostly grown in the Northeast of Thailand. Many evidences suggested that the extract from \textit{C. formosum} possess antioxidant property. Previous studies demonstrated that the extract from \textit{C. formosum} have protective effect against various conditions including acid/alcohol-induced gastric mucosal damage, and phenylhydrazine-induced oxidative stress and vascular injury. The purpose of this study is to investigate the protective effect of the leaf extract from \textit{C. formosum} against Aβ toxicity using transgenic \textit{Caenorhabditis elegans} (\textit{C. elegans}) model. In \textit{C. elegans} model, human Aβ is expressed intracellular in the body wall muscle. The expression and subsequent aggregation of Aβ in the muscle lead to progressive paralysis. We found that the extract significantly delayed Aβ-induced paralysis. The results also showed that chlorogenic acid, the main component of the extract significantly delayed Aβ-induced paralysis. Both extract and chlorogenic acid ameliorated oxidative stress by reducing the level of hydrogen peroxide (H₂O₂). Using genetic approach, we found that DAF-16/FOXO transcription and HSF-1 were required for the protective effect of the extract. These findings suggest that leaf extract from \textit{C. formosum} may have benefit effect for the treatment of AD.
124. Economic Evaluation of Colorectal Cancer Screening: A Systematic Review

Kankamon Kittrongsiri¹; Usa Chaikledkaew¹
¹Social and Administrative Pharmacy Excellence Research (SAPER) Unit, Department of Pharmacy, Faculty of Pharmacy, Mahidol University, Bangkok, Thailand

Background: Colorectal cancer (CRC) is a major public health problem worldwide. CRC screening in average-risk population aims to prevent new cases of CRC by detecting and removing pre-malignant lesions or to discover CRC at its early stage. Implementation of CRC screening program requires enormous of resources; therefore, it is important to carefully assess value for money of the program.

Objective: This study aimed to systematically review the economic evaluation studies of different CRC screening methods in order to identify the optimal screening modality.

Method: A search was carried out using PubMed and ScienceDirect databases. Full economic evaluations assessing CRC screening in average-risk population from January 2003 to July 2013 were retrieved.

Results: Sixteen publications identifying optimal screening modalities were included in the review. Of 16 included studies, the studies were performed in ten different countries used four modeling approaches. Fifty percent of included studies used cost-effectiveness analysis, whereas the others used cost-utility analysis. The method of gFOBT was the most assessed option, while FIT-biennial screening was the most reported optimal strategy. It was found that CRC screening was considered as a cost-effective or even cost-saving when compared with no screening. Although, the studies did not find the consensus conclusion on which screening method was the most effective or the modality of choice.

Discussion: Of implementing screening program in the country, the evaluation should be conducted to assess the benefits against the society acceptable costs because the transferability of results from one setting to another is limited.

Keywords: Colorectal cancer, screening, economic evaluation

125. Effect of γ-oryzanol on antioxidant genes of human prostate cancer cells

Papavadee Klongpityapong¹, Roongtawan Supabphol², Athikom Supabphol³
¹School of Pharmacy, Eastern Asia University, Tanyaburi, Pathumtani, Thailand
²Department of Physiology, Faculty of Medicine, Srinakharinwirot University, Bangkok, Thailand
³Department of Surgery, Faculty of Medicine, HRH Princess Maha Chakri Sirindhorn Medical Center (MSMC), Srinakharinwirot University, Ongkharak, Nakorn Nayok, Thailand

Objective: To assess the effect of γ-oryzanol on antioxidant genes of human prostate cancer cells.

Materials and Methods: Cytotoxic activity of gamma-oryzanol on human prostate cancer cells, DU145 and PC3, was performed by proliferation assay using 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) reagent. mRNA levels of genes involved in the intracellular antioxidant system, superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPX) and
Results: All concentrations of γ-oryzanol, 0.1 - 2.0 mg/ml, significantly inhibited cell growth in a dose- and time-dependent fashion in both prostate cancer cell lines, DU145 and PC3. The gene expression of catalase in DU145 and PC3 exposed to γ-oryzanol at 0.5 mg/ml for 14 days were down regulated, mRNA of GPX was also down regulated in PC3.

Conclusion: This study highlighted the effect of γ-oryzanol via the down-regulation of antioxidant genes, catalase and GPX, not the cytotoxic role. This might be interesting for adjuvant chemotherapy to make prostate cancer cells more sensitive to free radicals. It might be useful for the reduction of cytotoxic agent and cancer chemoprevention.

Keywords: γ-oryzanol, cytotoxicity, superoxide dismutase, catalase, glutathione peroxidase, glutathione reductase

126. Identification of Stemona by Microscopic Characterization

Sumet Kongkiatpaiboona,b; Sopida Chidchencheyc,d; Vichien Keeratinijakalc,d; Wandee Gritsanapan a

aDepartment of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Thailand
bDrug Discovery and Development Center, Thammasat University, Thailand
cNational Center for Agricultural Biotechnology, Kasetsart University, Thailand
dAgronomy Department, Faculty of Agriculture, Kasetsart University, Thailand

Background: Stemona plants are widely used for insecticides and antitussive remedy. Stemona in Thailand comprises 11 species which can be separated into 2 main groups according to their morphological characteristics and bioactive components, i.e. tuberosa group (S. tuberosa and S. phyllantha) and non-tuberosa group (S. aphylla, S. burkilli, S. collinsiae, S. cochinchinensis, S. curtisii, S. kerrii, S. pierrei, and S. ruprestis). There is confusion when the powder of Stemona is used.

Objective: This study was investigated the characters of each group of Stemona for separation of its species.

Methods: Cross-sectional histology of fresh root samples of 6 species of Stemona, i.e. S. burkillii, S. cochinchinensis, S. curtisii, S. kerrii, S. phyllantha and S. tuberosa were examined. Powdered drug characteristics were studied under a microscope using mounting reagents.

Results: Cross-sectional histology showed that tuberosa group had a non-lignified pith, while the non-tuberosa group had the smaller lignified one. Powder drug of both groups appeared as creamish-yellow color containing vessels, fibers, starch grains and parenchyma cells. Tuberosa group can be discriminated from the others by numerous of parenchyma cells.

Discussion: Cross-sectional histology and powder drug characteristics of various Stemona species growing in Thailand showed that tuberosa group had a non-lignified pith and contained numerous parenchyma cells, while non-tuberosa group had smaller lignified pith and less abundant of parenchyma cells. These microscopic characters can be used as a tool to identify Stemona groups.
127. Optimization of Extraction Method for High Content of Didehydrostemofoline from *Stemona collinsiae* Roots

*Sumet Kongkiatpaiboona,b; Wandee Gritsanapana*

*aDepartment of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Thailand  
bDrug Discovery and Development Center, Thammasat University, Thailand*

**Background:** *Stemona* plants have been traditionally used as natural pesticides and medicinal plants in South-East Asian countries. Among *Stemona* plants in Thailand, *S. collinsiae* Craib is one of the most interesting species. It contains didehydrostemofoline as a major alkaloid resulting in insecticidal activity and making it suitable for bio-pesticide. It also possesses anticholinesterase inhibitory activity that may be useful for pharmaceutical uses. Optimizing the extraction process will economize its production in practical application.

**Objective:** This study was aimed to optimize the extraction methods as well as various extracting solvents with different polarity on *S. collinsiae* roots.

**Methods:** Various extraction methods such as sonication, reflux, Soxhlet extraction, maceration and percolation, as well as various extracting solvents with different polarity, i.e. absolute methanol, absolute ethanol, acetonitrile, acetone, 30, 50, and 70% of methanol-water mixtures and 30, 50, 70, and 80% of ethanol-water mixtures, were performed on *S. collinsiae* roots and monitored with validated-HPLC analysis using didehydrostemofoline as a marker compound.

**Results:** Using a single solvent, the recovery of didehydrostemofoline was clearly increased with the increased polarity solvent (acetone < acetonitrile < ethanol < methanol). Methanol and seventy percent of ethanol were shown to be good solvents for extracting didehydrostemofoline with nearly the same yield. Comparative analysis of didehydrostemofoline in the root extracts of *S. collinsiae* by different extraction Methods (sonication, reflux, Soxhlet, maceration, percolation) using 70% ethanol showed that refluxing and sonication gave the highest amount of didehydrostemofoline.

**Discussion:** Methanol and seventy percent ethanol were shown to be good solvents for extracting didehydrostemofoline. Seventy percent ethanol which has a safety profiles over methanol was chosen as the appropriate solvent for *Stemona* extraction. Using 70% ethanol, refluxing and sonication gave the highest amount of didehydrostemofoline. Reflux promoted high yield of crude extract, required short extracting time and less amount of solvent. It is also simple, inexpensive, and convenient for upscaling industrial process. Thus, refluxing with 70% ethanol was the recommended method and solvent for extracting *S. collinsiae* roots.

---

128. Variation of Insecticidal Didehydrostemofoline and Stemofoline Contents in *Stemona collinsiae* Roots in Thailand

*Sumet Kongkiatpaiboona,b; Wandee Gritsanapan*

*aDepartment of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Thailand  
bDrug Discovery and Development Center, Thammasat University, Thailand*
Background: *Stemona* plants have been traditionally used as natural pesticides and medicinal plants for a long time. *S. collinsiae* Craib has been interested for its insecticidal activity supported by many scientific research studies. The roots contain didehydrostemofoline and stemofoline as active components. Variation of active compounds affects their promised biological activities. The study of variability of didehydrostemofoline and stemofoline contents could provide a basis for standardization of *S. collinsiae* extract for a better source and for further development as pharmaceutical and insecticidal products.

Objective: The aim of this study was to quantitatively analyze and compare didehydrostemofoline and stemofoline contents in *S. collinsiae* roots collected from various locations in Thailand.

Methods: Eight samples of *S. collinsiae* roots were collected from various wild forests in the eastern, southeastern, and central floristic regions of Thailand. Each sample was dried, ground and separately extracted with 70% ethanol by refluxing, which was found to be the appropriate extraction method. The extract was concentrated under reduce pressure at 45°C using a rotary vacuum evaporator. The concentrated extract was then evaporated on a boiling water bath until a constant weight was obtained. The crude extract was dissolved in 70% ethanol and analyzed by the validated HPLC method.

Results: The contents of didehydrostemofoline and stemofoline in the dried powder of *S. collinsiae* ranged from 0.37 to 0.78 and 0.012 to 0.119 %w/w while in the 70% ethanolic extracts contained 0.53 to 1.08 and 0.016 to 0.167 %w/w, respectively. Characteristic fingerprints of the components in the extracts provided a powerful tool for identification of this *Stemona* species.

Discussion: The contents of didehydrostemofoline and stemofoline in various sources of *S. collinsiae* roots collected from different floristic regions of Thailand and their characteristic fingerprints could be used as guidance for standardization of *S. collinsiae* extracts. The data also indicated better sources of *S. collinsiae* roots in Thailand as active raw materials for pharmaceutical and insecticidal products development.

129. Inhibitory Effect of *Stemona* Alkaloids on Acetylcholinesterase Activity

*Sumet Kongkiatpaiboona,b; Piyanuch Rojsanga;c; Pongtip Sitisarna; Wandee Gritsanapana*

*a Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Thailand
*b Drug Discovery and Development Center, Thammasat University, Thailand
*c Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Mahidol University, Thailand

Background: Acetylcholinesterase (AChE) is one of the most important enzymes in many living organisms. It plays an important role in nerve signal transmission, and therefore cholinesterase inhibition is the treatment of choice for Alzheimer’s disease. In searching for potential lead compounds for further development, we investigate the acetylcholinesterase inhibition effect of *Stemona* alkaloids.

Objective: This study was aimed to investigate the acetylcholinesterase inhibitory activity of *Stemona* alkaloids.

Methods: Eleven *Stemona* alkaloids belonging to three skeletal types, i.e., protostemonine-type (didehydrostemofoline, stemofoline, stemocurtisine, stemocurtisinol, stemokerrine, oxystemokerrine), croomine-type (croomine), and stichoneurine-type (tuberostemonine, tuberostemonine-A,
tuberostemonine N, neotuberostemonine), were isolated from the roots of various *Stemona* plants. The AChE activity was determined using the Ellman’s colorimetric assay in 96-well plate. Activity of the enzyme was calculated as percentage of velocities compared to that of the assay using buffer without any inhibitor.

**Results:** At the concentration of 0.1 mg/ml, protostemonine alkaloid-derivatives could inhibit AChE more than 50% whereas stichoneurine-derivatives and croomine could inhibit AChE in a wide range close to 50%, and 25.68%, respectively. Therefore, serial dilutions were conducted to determine IC\textsubscript{50} of protostemonine-derivatives. Didehydrostemofoline, stemofoline, stemocurtisine, stemocurtisinol, stemokerrine, and oxystemokerrine inhibited AChE with IC\textsubscript{50} of 50.55, 39.53, 96.13, 104.75, 78.96, and 88.12 µg/ml, respectively. Galanthamine, which was used as a positive control, inhibited AChE with IC\textsubscript{50} of 0.48 µg/ml.

**Discussion:** Protostemonine-type alkaloids of *Stemona* plants could possess acetylcholinesterase inhibitory activity. The highest effect was observed in stemofoline and didehydrostemofoline with IC\textsubscript{50} of 39.53 and 50.55 µg/ml, respectively. However, the inhibition activity of these compounds was lower than that of galanthamine standard (IC\textsubscript{50} 0.48 µg/ml). Our results provide useful information on further structural modification and utilization of these natural products.

---

130. **TLC-Densitometric Analysis of Didehydrostemofoline in *Stemona collinsiae* Roots**

*Sumet Kongkiatpaiboona,b; Wandee Gritsanapana*

\(^a\)Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Thailand
\(^b\)Drug Discovery and Development Center, Thammasat University, Thailand

**Background:** *Stemona collinsiae* has been traditionally used as a natural pesticide for a long time. Didehydrostemofoline is a major active component, which possesses potent insect toxicity. In order to standardize good quality raw material form *S. collinsiae* root, a thin layer chromatography (TLC)-densitometric method was developed and validated for quantitative analysis of major active component didehydrostemofoline.

**Objective:** This study was aimed to develop and validate a TLC-densitometric method for quantitative analysis of didehydrostemofoline in *S. collinsiae* roots.

**Methods:** A TLC-densitometric method has been developed for determination of didehydrostemofoline in *S. collinsiae* root extract at UV maximum absorption 300 nm. The analysis was performed on TLC aluminum sheets precoated with silica gel 60 F\textsubscript{254} using dichloromethane: ethyl acetate: methanol: ammonium hydroxide (70:25:5:1) as a mobile phase. The method was validated for linearity, precision, accuracy, limit of detection (LOD), and limit of quantitation (LOQ).

**Results:** Didehydrostemofoline showed linearity within the concentration range of 40-320 ng/spot with correlation coefficient (r) 0.995. Intraday and interday precision studies showed the relative standard deviation (RSD) < 4%. Accuracy of the method was determined by a recovery study of didehydrostemofoline at 3 different levels and found to be 95.9, 104.3, and 103.5%, with an average of 101.2%. The LOD and LOQ were 6.88 and 22.94 ng, respectively. The contents of didehydrostemofoline in the methanol extract and dried root powder of *S. collinsiae* were 1.27 ± 0.089 and 0.735 ± 0.048 %w/w, respectively.
Discussion: The developed method is simple, precise, specific and accurate and can be used for quantification of didehydrostemofoline in plant materials, extracts and products containing this compound. It is suitable for routine analysis of many samples of *S. collinsiae* extract and its products at the same time.

### 131. Species-specific Accumulation Trends of Alkaloids in *Stemona* species

*Sumet Kongkiatpaiboona,b; Vichien Keeratinijakalc; Harald Gregerd; Wandee Gritsanapan*

*aDepartment of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Thailand*

*bDrug Discovery and Development Center, Thammasat University, Thailand*

*cDepartment of Agronomy, Faculty of Agriculture, Kasetsart University, Thailand*

*dChemodiversity Research Group, Faculty Center of Biodiversity, University of Vienna, Austria*

**Background:** *Stemona* spp. have traditionally been used as medicinal plants and insecticides. The Thai vernacular name “Non Tai Yak” generally refers to various *Stemona* spp, but they were shown to possess a great chemical diversity. *Stemona* raw material purchased from the local markets are often not properly identified or may be mixtures of various species. Therefore, a broad-based phytochemical comparison was carried out to detect species-specific accumulation trends of *Stemona* alkaloids which should contribute as chemical markers for natural grouping.

**Objective:** This study was aimed to establish a phytochemical comparison of *Stemona* plants in Thailand.

**Methods:** 42 samples of *Stemona* roots representing eight species were collected from different locations in Thailand. Major alkaloids were isolated and their structures elucidated by NMR- and MS-analyzes. The methanolic extracts of all samples were compared by HPLC coupled with diode array or evaporative light scattering detectors.

**Results:** Thai *Stemona* were mostly characterized by alkaloids derived either from a protostemonine- or stichoneurine-type skeleton. The latter characterized *S. tuberosa* and *S. phyllantha* accumulating species-specific isomers of tuberostemonine. *S. collinsiae* clearly deviated by protostemonine-type derivatives dominated by didehydrostemofoline and small amounts of stemofoline. *S. kerrii* were distinguished by stemokerrine and small quantities of oxystemokerrine, whereas *S. curtisii* showed an infraspecific variation accumulating either the pyrroloazepine stemofoline or the pyridoazepine stemocurtisine. By contrast, *S. cochinchinensis*, *S. aphylla*, and *S. rupestris*, mainly distributed in the dry habitats, showed a general reduction of alkaloids, mostly consisting of traces of protostemonine only.

**Discussion:** The present survey showed a clear chemical segregation between protostemonine- and stichoneurine-type alkaloids in Thai *Stemona* species, simultaneously informing about the distribution of the biologically highly active stemofoline derivatives of the former and tuberostemonine derivatives of the latter structural type.

### 132. Variation of Alkaloids Content in *Stemona curtisii* Roots in Thailand

*Sumet Kongkiatpaiboona,b; Vichien Keeratinijakalc; Wandee Gritsanapan*

*aDepartment of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Thailand*
Background: *Stemona* plants (Stemonaceae) have been traditionally used as natural pesticides and medicinal plants. *S. curtisii*, the dominant species distributed in the South and Southwest of Thailand, has been of interest for its insecticidal properties. Variation of active components affects their promised biological activities. Therefore, the study of variability of the contents of bioactive components was done.

Objective: This study was aimed to determine and comparison the alkaloid contents in *Stemona curtisii* roots in Thailand.

Methods: Ten samples representing *S. curtisii* were obtained from various locations in Thailand. Each powdered sample of *S. curtisii* roots was accurately weighed and exhaustively extracted with methanol in an ultrasonic bath. The concentrated extract was adjusted the volume with methanol and analyzed with the validated HPLC method.

Results: The contents of the major alkaloids oxystemokerrine, stemocurtisine, stemocurtisinol, and stemofoline in dried powder of *S. curtisii* roots ranged from 0.0458 to 0.3299, 0.0354 to 0.2368, 0.0149 to 0.1040, and 0.0849 to 0.2139% (w/w), respectively.

Discussion: A remarkable infraspecific variation of alkaloid composition was observed in *S. curtisii* collected from different geographical provenances in the South and Southwest of Thailand with a humid climatic condition almost all year round. This study would provide a basis for standardization of *S. curtisii* raw materials for a better source for further insecticidal development.

133. Insecticidal Activity and Alkaloids Composition of *Stemona curtisii* Roots Growing in Thailand

*Sumet Kongkiatpaiboona,b; Stefan Mikulicicc; Vichien Keeratinijakald; Harald Gregerc; Wandee Gritsanapana*

*a*Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Thailand

*b*Drug Discovery and Development Center, Thammasat University, Thailand

*c*Chemodiversity Research Group, Faculty Center of Biodiversity, University of Vienna, Austria

*d*Agronomy Department, Faculty of Agriculture, Kasetsart University, Thailand

Background: *Stemona curtisii* Hook. f., a traditional insecticide plant distributed in South and Southwest of Thailand, attracted attention for its insecticidal properties caused by specific alkaloids. *S. curtisii* root extracts and their formulations have been commercially used as bio-pesticide in agriculture by farmers in Thailand. However, a variation in phytochemical constituents was observed in *S. curtisii* and the effectiveness of the local-made preparations is always a concern.

Objective: This study was aimed to determine the insecticidal activity of *Stemona curtisii* roots in Thailand and their alkaloids composition.

Methods: Ten samples of *S. curtisii* roots, collected from various localities in Thailand, were analyzed for their major components oxystemokerrine, stemocurtisine, stemocurtisinol, and stemofoline with the validated HPLC method. Chronic feeding bioassays against neonate larvae of the polyphagous pest
insect *Spodoptera littoralis* Boisduval (Lepidoptera, Noctuidae) was done to evaluate their insecticidal properties.

**Results:** Insecticidal activities of ten *S. curtisii* extracts were evaluated. The highest insect toxicity with 100% lethality and 0% growth rate at 2.5 mg/g was found in a collection from Surat Thani accumulating only stemofoline as major component, whereas less activity was found in samples without detectable amounts of this compound, inferring its stronger insecticidal effect than other alkaloids.

**Discussion:** Stemofoline possesses stronger insecticidal effect than other alkaloids, suggesting its suitability to be used as a bioactive chemical marker for the quality assessment and standardization of *S. curtisii* raw materials, extracts, and finished products from this plant. The present study serves a basis for further development of *S. curtisii* roots as a high potential natural insecticidal product.

---

**Scientific Posters Session 2 Abstracts (#134-170)**
Friday, May 30
11:45 a.m. -1:15 p.m.

**134. Quantification of Bioactive Chemical Markers in *Stemona collinsiae* Roots by HPLC Method**

*Sumet Kongkiatpaiboona,b; Wandee Gritsanapan*

*a* Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Thailand  
*b* Drug Discovery and Development Center, Thammasat University, Thailand

**Background:** *Stemona* plants have been traditionally used as an insecticide, scabicide, for the treatment of skin and respiratory diseases. *S. collinsiae* Craib is one of the most interesting species in *Stemona* genus that is widely used in Central, East, Northeast, and Southeast of Thailand. The accumulation of didehydrostemofoline and stemofoline in the roots leads to high insecticidal activity of this plant. In order to standardize good quality raw material from *S. collinsiae* root extracts, a HPLC method was developed and validated for quantitative analysis of major active components didehydrostemofoline and stemofoline.

**Objective:** This study was aimed to develop and validate a HPLC method for quantitative analysis of didehydrostemofoline and stemofoline in *S. collinsiae* roots.

**Methods:** Eight samples of *S. collinsiae* roots were collected from various locations in Thailand. Each sample was dried, ground and separately extracted with 70% ethanol by refluxing. HPLC was carried out using a Hypersil BDS C18-column eluted with methanol: 1 mM ammonium acetate (55:45) with a flow rate of 1 ml/min and detection at 295 nm. Method validation was performed to assure its linearity, precision, accuracy, and limits of detection and quantitation.

**Results:** A HPLC method was developed for analyzing the contents of didehydrostemofoline and stemofoline in *S. collinsiae* root extracts. From the various mobile phases trialed, the system containing 55% methanol in 1 mM ammonium acetate solution gave symmetric peaks and provided the most efficient separation and speed. Didehydrostemofoline and stemofoline showed a linear relationship within the range of 0.5-432.3 and 0.5-188.4 µg/ml, respectively. The method was shown to be precise
with RSD <2%. The average recovery of didehydrostemofoline and stemofoline were 98.80 and 99.97%, respectively.

**Discussion:** The developed and validated HPLC method was found to be appropriate for the analysis of didehydrostemofoline and stemofoline in *S. collinsiae* root extracts. This work would be useful as a guide for the standardization of *S. collinsiae* root extract raw materials and their finish pesticidal products.

---

135. **Insecticidal Activities of Traditional Insecticide Plants “Non Tai Yak” (**Stemona** spp.) in Thailand**

*Sumet Kongkiatpaiboona,b; Stefan Mikulicic;c; Vichien Keeratinijakal;d; Harald Gregerc; Wandee Gritsanapan*a*

*aDepartment of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Thailand*

*bDrug Discovery and Development Center, Thammasat University, Thailand*

*cChemodiversity Research Group, Faculty Center of Biodiversity, University of Vienna, Austria*

*dAgronomy Department, Faculty of Agriculture, Kasetsart University, Thailand*

**Background:** *Stemona* plants have been traditionally used as natural pesticides and medicinal plants. Despite their diversity, the same vernacular name of “Non Tai Yak” has been used for various species in Thailand because of their similar root shapes. However, a variation in phytochemical constituents in different species was observed and leads to the different biological activities.

**Objective:** This study was aimed to evaluate the insecticidal activities of various *Stemona* species growing in Thailand.

**Methods:** Thirty-three samples representing 7 species and one unidentified species was tested using chronic feeding bioassays with neonate larvae of the polyphagous pest insect *Spodoptera littoralis* Boisduval (Lepidoptera, Noctuidae).

**Results:** Potent insect toxicity was observed in all *S. collinsiae* samples, unidentified *S.* sp. sample and some samples of *S. curtisi*. *S. kerrii* possessed moderated insecticidal activity while *S. aphylla* and *S. rupestris* showed low to moderate insecticidal activity. *S. tuberosa* and *S. phyllantha* showed insignificant insecticidal activity. Stemofoline and its derivatives didehydrostemofoline were found to be the key active compounds which can be found as major components in the active samples, while less activity was found in samples without detectable amount of this compound, inferring their stronger insecticidal effect than other alkaloids.

**Discussion:** *Stemona* samples containing stemofoline and didehydrostemofoline showed potent insecticidal activities. Hence, these compounds can be used as bioactive chemical markers for the quality assessment of *Stemona* raw materials, extracts, and their finished products for further pharmaceutical and agricultural development.

---

136. **“Vote & Vax” Student Pharmacist Initiative for Free Immunization Clinic on Election Day**

*Lisa Lebovitz, JD, Assistant Dean for Academic Affairs; Cherokee Layson-Wolf, PharmD, CGP, BCACP, FAPhA, Associate Dean for Student Affairs and Associate Professor, Department of Pharmacy Practice and Science*
University of Maryland School of Pharmacy

The objectives of this student-led initiative were to provide a free influenza vaccination clinic on Election Day, increase immunization rates among an underserved population, and demonstrate pharmacists’ roles in health promotion and disease prevention. The national Vote & Vax initiative works with local public health providers to launch vaccination clinics at or near polling places. In 2010, Maryland student pharmacist organizers analyzed vaccination and polling site statistics and then contacted local health departments to identify clinic locations, obtain sponsorship for vaccinations, and finalize immunization protocols. The event was promoted through media outlets. In 2010, the Vote & Vax clinic provided 153 vaccinations; 42 individuals received an influenza vaccination for the first time. It was the only Vote & Vax initiative held in Maryland during the 2010 election season. During the 2012 elections, a total of 221 free flu shots were given at two locations. More than 30 students and faculty were involved each time. The University of Maryland School of Pharmacy’s Vote & Vax initiative was honored in 2011 with an Immunization Excellence Award by the Maryland Partnership for Prevention, and recognized by the Maryland Legislature’s House of Delegates with a resolution. Lessons learned were published for schools of pharmacy who wish to conduct similar programs. The Vote & Vax initiative reinforces the benefits of expanding pharmacists’ roles and provides student pharmacists with experience implementing a public health event and interacting with other health care practitioners and the public. Plans are underway for Maryland Vote & Vax 2014.

137. An Effective Programmatic Assessment Process for Continuous Quality Improvement

Lisa Lebovitz, JD, Assistant Dean for Academic Affairs; Richard Dalby, PhD, Professor and Associate Dean for Academic Affairs
University of Maryland School of Pharmacy

The University of Maryland School of Pharmacy leads pharmacy education, scientific discovery, patient care, and community engagement in the state of Maryland and beyond. This mission is reflected in the programmatic outcomes of the institutional assessment plan that was developed and endorsed as part of 2010 strategic planning process. Through programmatic assessment, the school seeks to understand and improve curricular effectiveness and peripheral factors that impact the learning environment. Tools used to understand program-level quality include course evaluations, instructor evaluations, and academic performance campus comparisons. Simple graphs enable faculty to quickly analyze their results. Established metrics include academic performance between campuses, course evaluation completion rate and documentation of course evaluation review by course managers, faculty and the department chair, vice chair, and mentors as needed. Benchmarks for each metric include equivalent academic performance between campuses, 80% course evaluation response rate, and 100% documentation of faculty review to assure completion of the feedback loop. High benchmarks were intentionally set for each metric because continuous quality improvement of a PharmD program is best measured through the success of its students and faculty. In the last six semesters, the overall course evaluation response rate has been between 67% and 78% each semester. The return rate for documentation of review by faculty and vice chairs is 100%. Students benchmark their performance against their peers by reviewing their class rank, which is provided to each individual via email by the Office of Academic Affairs every semester. The school benchmarks graduating class performance on the North American Pharmacist Licensure Examination (NAPLEX) against peer institutions and longitudinally, as well as between campus cohorts. Faculty can benchmark themselves against other faculty who taught during the given semester by reflecting on their average instructor rating in conjunction with the other
ratings on the graph. This process is easily transferable to other colleges and schools of pharmacy, regardless of the type of academic records and registration system and online survey tool for course evaluations. It is evident that students at the main campus and the distance campus continue to perform equivalently and with excellence throughout all four years of the program, faculty and vice chairs are actively engaged with the review of their courses and teaching effectiveness, and although the course evaluation response rate tends to fluctuate, students are aware that their perspectives are heard and valued.

138. Metabolic syndrome screening in drugstore, Pathum thani Province, Thailand

Kusawadee Maluongnon1, Ph.D.; Natthida Kanama3; Wanichaya Meesiriroj3; Wathanyuta Keawwichian3
1Lecturer, Faculty of Pharmacy, Thammasat University, Thailand
3Pharmacy Student, Rangsit University, Thailand

Background: Metabolic syndrome is a serious health condition which can lead to coronary heart disease, heart attack, and stroke. National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) (NCEP ATPIII) defines the criteria for metabolic syndrome if any of 3 risk factors present 1) waist circumference > 102 cm in men, >88 cm in women 2) blood pressure ≥130/85 mmHg 3) fasting blood glucose ≥ 110 mg%.4) HDL cholesterol <40 mg% in men, <50 mg% in women 5) Triglycerides >150 mg%.

Objective: The study aimed to screen the patient for metabolic syndrome at the drugstore.

Method: Survey study, using the guideline developed by Community Pharmacy Association (Thailand) and National Health Security Office (Thailand) according to the NCEP ATPIII, the criteria for the screening in Thai population including 1) waist circumference > 90 cm. in men, >80 cm. in women 2) blood pressure ≥130/85 mmHg/ patient with hypertension taking hypertensive agents and 3) fasting blood glucose ≥ 110 mg%. These three criteria for screening metabolic syndrome at the drugstore are easy and not consume time. The patient, age over 34, who met 3 of the risk factors, was considered to have a condition of metabolic syndrome. Three drugstores in Pathum thani province were selected as study sites by simple random sampling technique. The screening project started from August to September, 2013. The subjects of the study were well-informed about the objective of the screening and signed the inform consent.

Results: From 132 subjects (87 men and 45 women) with the average age of 52.3 ± 11.8, three of them have metabolic syndrome condition (achieved 3 of the risk factors). In addition, 23 (17.42%) and 66 (50%) subjects have 2 and 1 risk factors, respectively. These high-risk groups were suggested to have their blood cholesterol and triglyceride tested at the hospital since they had the possibility of the metabolic syndrome. Forty subjects (30.30%) have none of the risk factors and were informed about the risk of metabolic syndrome and how to promote their health. The satisfaction evaluation found that all subjects were satisfied with the screening project (average score 4.28±out of 5).

Conclusion: The result showed that community pharmacist’s roles of chronic disease screening are important since there is benefit in early detection of metabolic syndrome and appropriate treatment can prevent the patient from cardiovascular disease.

Keywords: Metabolic syndrome, screening, drugstore
139. Risk Factors for recurrent atrial fibrillation after cardiac surgery

Mantiwee Nimworapan\textsuperscript{1,2,3}, PharmD; Richard Cosgrove\textsuperscript{4}, PharmD, BCPS; Asad Patanwala\textsuperscript{5}, PharmD, BCPS; Chanadda Chinthamit\textsuperscript{6}, BSPharm; Hussain T. Bakhsh\textsuperscript{5}, PharmD; Robyn Basken\textsuperscript{4}, PharmD, BCPS; Irbaz Bin Riaz\textsuperscript{1}, MBBS, MD

\textsuperscript{1}University of Arizona Medical Center, USA
\textsuperscript{2}University of Arizona College of Pharmacy, USA
\textsuperscript{3}Chiang Mai University, Thailand
\textsuperscript{4}University of Arizona Medical Center, Pharmacy Services Department, USA
\textsuperscript{5}U of Arizona College of Pharmacy, Department of Pharmacy Practice and Science, USA
\textsuperscript{6}U of Arizona College of Pharmacy, Department of Pharmaceutical Economics, Policy, and Outcomes, USA

**Background:** Postoperative atrial fibrillation (POAF) is the most common complication after cardiac surgery. Its prevalence is approximately 30% after coronary artery bypass grafting (CABG) surgery, 40% after valve replacements or repair, and 50% after combined procedures. POAF is generally transient and self-limited but it can result in increased risk of stroke, renal failure, heart failure and increased mortality. When it causes complications or requires additional treatment it prolongs hospital stay and increases costs. Beta-blockers are considered the first-line treatment in the postoperative period hyper adrenergic state. Amiodarone, a class III antiarrhythmic agent, with additional adrenergic blocking activity is an alternative agent for the management of POAF. Amiodarone can cause conversion to sinus rhythm, control heart rate and improve hemodynamic status. POAF can recur despite treatment with amiodarone.

**Objective:** The objective of this study was to (1) determine the incidence of recurrent POAF, (2) identify the risk factors of recurrent POAF, and (3) define the dose and duration of amiodarone therapy for treatment for POAF.

**Method:** This is a retrospective cohort study. The medical records of patients who had atrial fibrillation after heart surgery at the University of Arizona Medical Center from January 1, 2011 through December 31, 2013 will be reviewed for recurrent POAF event until patient discharged from hospital. Multiple logistic regression analysis will be performed to develop a prognostic model and to evaluate the impact of variation of amiodarone therapy on the outcome.

**Results and Conclusions** of this study will be presented.

140. Use of Videoconferencing to Advance US-Thai Collaboration: The Chulalongkorn Experience

Jeanine K. Mount\textsuperscript{1}, RPh, PhD; Suntaree Watcharadomrongkun\textsuperscript{2}, BSc (Pharm), MSc, PhD; Anuchai Theeraroungchaitsri\textsuperscript{1}, BSc (Pharm), MSc, PhD; Kittiyot Yotsombut\textsuperscript{2}, BSc (Pharm), MSc

\textsuperscript{1}School of Pharmacy, Bouvé College of Health Sciences, Northeastern University, Boston, Massachusetts, USA
\textsuperscript{2}Department of Social and Administrative Pharmacy, Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok, Thailand
**Background:** Videoconferencing can promote collaboration by linking of geographically separated faculty and students. The Department of Social and Administrative Pharmacy (SAP), Faculty of Pharmaceutical Sciences, Chulalongkorn University has used videoconferencing for nearly 10 years to facilitate teaching/learning and research efforts.

**Objectives:** 1) Describe and categorize SAP videoconferencing activities, 2) discuss outcomes of these activities, and 3) recommend strategies for enhancing international collaboration using videoconferencing.

**Methods:** In-depth interviews of ten key informants (SAP faculty, graduate students, staff) were content analyzed. Experience with videoconferencing uses (teaching, learning, research), process evaluation (feasibility, cost, satisfaction), and outcomes were analyzed.

**Results:** Videoconferencing has been used as a communication channel for teaching/learning in the SAP graduate program since 2005. Various commercial (i.e., Telepresence, Microsoft Lync) and non-commercial (e.g., Skype, Google Hangout) software programs have been used. Since 2012, Microsoft Lync has been used because of its robust presentation features (e.g., PowerPoint, Word, Excel), pointing and annotation tools, advanced meeting scheduling, recording, content sharing (e.g., desktop, whiteboard, polls), and instant messaging. The SAP program used videoconferencing in 4 ways: 1) having local instructors teach evening or weekend classes that accommodate work schedules of adult learners, 2) inviting instructors in foreign countries give lectures or presentations, 3) having remote experts serve on thesis committees or as thesis advisor/co-advisor, and 4) facilitating research activities among national and/or international collaborators. Teaching/learning activities were the most common use. During 2013-14, videoconferencing was used in most graduate courses and in all graduate seminars. MSLync’s synchronous communication facilitated high-level Discussion that is central to graduate courses. The most complex use involved team-teaching of a Medication Use Behavior course by US and Thai instructors. The US instructor recorded lectures and hosted them on an LMS for self-study before class then gave remote lectures and Discussion with students for 8 weeks. The Thai instructor taught remaining sessions and course wrap-up with face-to-face sessions. Continuing research topic consultation involving a US professor and a Thai student was found in one case. Involvements remain limited in number and scope due to instructors’ lack of experience and training, and need for time to get accustomed to new technology.

**Discussion:** Videoconferencing enhances and advances teaching/learning and research activities in pharmacy, opening collaboration opportunities that are flexible in place and time, and relatively low cost. Reducing barriers and training users will increase educational opportunities and expand learning. Leader support (e.g., resources, budget) is needed for enlarging national and international collaborations.

---

**141. The cost efficiency analysis of biosimilar compared with originators erythropoiesis-stimulating agents (ESAs) to manage chemotherapy-induced anemia in Thailand**

Wansamorn Ngamdee $^{1,2}$, Chanadda Chinthammit $^3$, Ivo Abraham $^{1,4,5}$

$^1$ Center for Health Outcomes and Pharmacoeconomic Research, College of Pharmacy, University of Arizona, USA

$^2$ Department of Pharmacy, Phramongkutklao Hospital, Thailand

$^3$ Pharmaceutical Economics, Policy, and Outcomes, College of Pharmacy, University of Arizona, USA
Background: Cancer-induced anemia is a common complication of cancer treatment that results in decreased quality of life. Erythropoiesis-stimulating agents (ESAs) was found significantly associated with increase in hemoglobin levels and quality of life.

Objectives: To estimate the cost efficiency of the originator and biosimilar ESAs in a range of different fixed and weight-based dosing schemes; to determine the relative cost savings of treatments with biosimilar epoetin α over the originator ESAs; and to estimate the incremental number of patients access to primary antineoplastic therapy in a hypothetical panel of 10,000 ESA-treated cancer patients.

Methods: The direct costs of ESAs regimen of 6 cycles at 3-week intervals with ESAs initiated at week 4 and continued for 15 weeks were calculated and subsequently applied to five scenarios with both fixed and weighted-based dosing schemes. The 5 scenarios included: 15-week continuous standard dose (CSD); sustained dose escalation (SDE) to 1.5 times or double of the standard dose at week 7, continued for 12 weeks; and discontinued dose escalation (DDE) to 1.5 times or double of the standard dose at week 7 for a 3-week period, followed by a standard dose for 9 weeks.

Results: Compared with originators, biosimilar epoetin α yielded the lowest average total costs of 136,500 Baht and 96,915 Baht for fixed and weight-based dosing, respectively. In fixed-dosing scheme, the average saving cost with use of biosimilar epoetin α ranged from 51,264.14 Baht (27.30%) to 114,749.24 Baht (45.67%). While, it ranged from 36,397.53 Baht (27.30%) to 117,149.37 Baht (54.73%) in weight-based dosing. Biosimilar epoetin α conversion saving from darbepoetin α once weekly and once every 3 weeks in both schemes led to the greatest incremental number of patients access to rituximab (119.76 to 156.54 patients), bevacizumab (224.86 to 293.91 patients) and trastuzumab (282.63 to 369.43 patients).

Discussion: The biosimilar epoetin α is the most cost-efficient to manage chemotherapy-induced anemia in cancer patient over the originator ESAs. The cost savings of treatment with biosimilar epoetin α potentially leads to increase in accessibility to primary antineoplastic therapy.

142. In Vivo and In Vitro Hemostatic Activity of Chromolaena odorata Leaf Extracts

Hataichanok Panditha; Yuvadee Wongkrajang; Suchitra Thongpraditchote; and Wandee Gritsanapana

Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, 447 Sri Ayudthaya Rd., Ratchathewi, Bangkok 10400, Thailand.

Department of Physiology, Faculty of Pharmacy, Mahidol University, 447 Sri Ayudthaya Rd., Ratchathewi, Bangkok 10400, Thailand.

Background: Chromolaena odorata (L.) R.M.King & H.Rob. (Asteraceae) or Siam weed has long been used to stop bleeding in Thailand and many countries. Only the aqueous leaf extract was investigated in in vivo and there have been conflicting results of in vitro hemostatic mechanisms of this plant.

Objective: The most appropriate C. odorata leaf extract that promoted the highest hemostatic activity and the hemostatic mechanisms of these plant extracts will be investigated.
Methods: The lyophilized aqueous leaf extract and alcoholic (50, 70, and 95% ethanol) extracts from the fresh and dried leaves were investigated both in vivo and in vitro. The bleeding time in male Wistar rats was measured to investigate the hemostatic effect. The hemostatic mechanisms were tested using in vitro platelet aggregation and blood coagulation tests in sheep plasma.

Results: All extracts displayed significantly reducing bleeding time (<2.5 min) in rats but did not induce platelet aggregation or blood clotting in the in vitro study. The in vitro blood clotting times of all extracts were > 0.6 min. Seventy percent of ethanolic extract from the dried leaves proved to be the extract producing the highest hemostatic activity in vivo with the bleeding time of 1.85 min.

Discussion: The in vivo study with rats confirmed the significant ability of this plant extract to stop bleeding. However, the sufficient amount of calcium and active compounds which are aggregating and clotting agents to enhance blood coagulation and platelet aggregation in in vitro tests should be further studied.

Keywords: Chromolaena odorata, Siam weed, hemostatic activity, bleeding time, Wistar rats

143. In Vivo Anti-inflammatory Activity of Extracts from Chromolaena odorata Leaves of Different Thai Provenances

Hataichanok Panditha; Yuvadee Wongkrajangb; Suchitra Thongpraditchoteb and Wandee Gritsanapanana
anaDepartment of Pharmacognosy, Faculty of Pharmacy, Mahidol University, 447 Sri Ayudthaya Rd., Ratchathewi, Bangkok 10400, Thailand.
bDepartment of Physiology, Faculty of Pharmacy, Mahidol University, 447 Sri Ayudthaya Rd., Ratchathewi, Bangkok 10400, Thailand.

Background: Chromolaena odorata (L.) R.M.King & H.Rob. (Asteraceae) or Siam weed has long been used for treatment of wounds in Thailand and many countries. Anti-inflammatory activity is one of the mechanisms enhancing wound healing.

Objective: This study focused on the in vivo anti-inflammatory activity of 70% ethanolic extracts from C. odorata leaves collected from different provenances in Thailand.

Methods: Seventy percent ethanolic extracts, which extracted from the mature leaves collected from different provenances in 4 parts of Thailand, i.e. Samut Sakhon (Central), Nakhon Ratrasima and Yasothon (North-East), Chanthaburi (East) and Surat Thani (South). The anti-inflammatory effect of 10% w/v extracts was conducted using ethylyphenylpropionate (EPP)-induced ear edema model in male Sprague-Dawley rats. The percentage of swelling and inhibition were calculated and compared with the standard and control groups.

Results: All 70% ethanolic extracts showed significance difference on anti-inflammatory activity. While percentage of inflammatory inhibition of indomethacin was set at 100%, the 70% ethanolic extract from Yasothon (North-East) presented the highest activity at 42.73% inflammatory inhibition. Whereas, other extracts from Samut Sakhon, Chantaburi, Nakhorn Ratrasima and Surat Thani showed similar percentage of inflammatory inhibition at 38.92, 38.01, 37.04 and 32.58, respectively (p < 0.001).
Discussion: *C. odorata* leaf extracts showed moderate anti-inflammatory activity in *in vivo*. The different effectiveness on this activity of *C. odorata* leaf extracts might be from different amounts of active compounds in the extracts. Therefore, the contents of active components in *C. odorata* leaf extracts should be further investigated.

Keywords: Anti-inflammatory activity, Asteraceae, *Chromolaena odorata*, Siam weed

144. Determination of Calcium Content and Hemostatic Activity of Siam Weed Leaf Extracts

Hataichanok Pandith\textsuperscript{a}; Yuvadee Wongkrajang\textsuperscript{b}; Suchitra Thongraditchote\textsuperscript{b} and Wandee Gritsanapan\textsuperscript{a}

\textsuperscript{a}Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, 447 Sri Ayudthaya Rd., Ratchathewi, Bangkok 10400, Thailand.

\textsuperscript{b}Department of Physiology, Faculty of Pharmacy, Mahidol University, 447 Sri Ayudthaya Rd., Ratchathewi, Bangkok 10400, Thailand.

Background: Siam weed (*Chromolaena odorata*) has been used as a hemostatic agent to stop bleeding in rural areas of Thailand for centuries. The blood coagulation activity is due to 4',5,6,7-tetramethoxyflavone, which has been isolated and identified. Working synergistically with this compound, calcium is a significant contributor to enhance blood coagulation. However, there has been no report comparing the calcium content in Siam weed leaves collected from different provenances as of now.

Objective: The aims of this study were to determine the calcium content in Siam weed leaf extracts collected from 10 different locations in Thailand and to compare the hemostatic activity of the extracts containing the highest and lowest calcium quantities.

Methods: The 70% ethanolic leaf extracts of Siam weed which leaves were collected from 10 provinces in Thailand were determined. The calcium content in each extract was analyzed by atomic absorption spectrophotometer (AAS). The highest and lowest calcium containing extracts were chosen for investigation of the hemostatic activity in Sprague-Dawley rats while 70% ethanol was used as a control. The incision was made at a foot pad of each rat using a No.11 blade. Length and depth of each wound were 1x0.1 cm. The 20 µl of each extract or control was applied to the wound. Bleeding time was recorded immediately after making the wound until the blood stop.

Results: Calcium contents in 10 Siam weed leaf extracts were in the range 1 to 7 ppm. The leaf extract containing the highest (6.58 ppm) and the lowest (1.46 ppm) calcium levels were from Yasothon and Nakhon Ratcasima provinces, respectively. The time it took to completely stop bleeding of the extracts with the highest and the lowest calcium contents and the control were found to be 1.52, 1.37 and 3.34 min, respectively. The results showed that the extract containing lower amount of calcium could stop bleeding faster than the higher calcium extract. This implied that some other chemical constituents were responsible for hemostasis.

Discussion: We concluded that calcium content in Siam weed leaves was not the only one factor that promoted the hemostatic activity. Therefore, active compounds in the leaf extract should be further separated and identified. Standardization based on amount of the active components should be determined.

Keywords: Siam weed, calcium content, stop bleeding
145. HPLC Quantitative Analysis of Scutellarein Tetramethyl Ether: the Active Component of *Chromolaena odorata* Leaf Extract

*Hataichanok Pandith and Wandee Gritsanapan*

Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, 447 Sri Ayudthaya Rd., Ratchathewi, Bangkok 10400, Thailand.

**Background:** *Chromolaena odorata* (L.) King and Robinson (Siam weed) is a medicinal herb used for stop-bleeding, anti-inflammation and wound healing in tropical countries for centuries. It contains various bioactive components. Among them, scutellarein tetramethyl ether has been reported as a bioactive component for blood coagulation.

**Objective:** In our previous study, it was shown as a bioactive component for anti-inflammation. In this study, we developed the HPLC analytical method for quantitative determination of this compound in *C. odorata* leaf extract.

**Methods:** The method was validated for its linearity, precision, accuracy, limit of detection (LOD) and limit of quantitation (LOQ). HPLC was carried out using a BDS Hypersil C18-column eluted with methanol:1% acetic acid (60:40) with a flow rate of 1 mL/min and detection at 268 nm.

**Results:** Scutellarein tetramethyl ether showed a linear relationship within the range of 12.5–500 μg/ml. The method was shown to be precise with RSD < 2%. The average recovery was > 98%. The average content of scutellarein tetramethyl ether in the extract was 102.9 μg/ml.

**Discussion:** The proposed HPLC method was appropriate for the analysis of scutellarein tetramethyl ether in *C. odorata* extract and would be useful for standardization of this plant extract.

**Keywords:** *Chromolaena odorata*, Siam weed, HPLC, Scutellarein tetramethyl ether, standardization

146. Hemostatic and Anti-inflammatory Components from *Chromolaena odorata* Leaf Extract in Rat Models

*Hataichanok Pandith*; *Yuvadee Wongkrajang*; *Suchitra Thongpraditchote* and *Wandee Gritsanapan*

*Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, 447 Sri Ayudthaya Rd., Ratchathewi, Bangkok 10400, Thailand.*

*Department of Physiology, Faculty of Pharmacy, Mahidol University, 447 Sri Ayudthaya Rd., Ratchathewi, Bangkok 10400, Thailand.*

**Background:** *Chromolaena odorata* (L.) King and Robinson (Siam weed) has been used as hemostatic agent to stop bleeding and anti-inflammatory agent when the scutellarein tetramethyl ether has been reported as an active component. However, it has no report on hemostatic and anti-inflammatory activities of this component in animal models.
Objective: In this study, we studied both hemostatic and anti-inflammatory activities in rats of scutellarein tetramethyl ether and two more major compounds; stigmasterol and one unknown compound which were isolated from *C. odorata* leaf extract.

Methods: The hemostatic and anti-inflammatory activities were assessed using a bleeding time and ethyl phenylpropiolate (EPP)-induced ear edema models in Sprague-Dawley rats, respectively.

Results: The scutellarein tetramethyl ether at 0.2 mg/10 µl/paw could immediately stop the bleeding. In contrary, stigmasterol and unknown at the same concentration did not have ability to stop bleeding. The 70% ethanolic extract at 2 mg/20 µl/ear exhibited low relative percent inhibition of indomethacin (37.61%) on ear edema within 2 h after application. However, all components at 0.4 mg/20 µl/ear exhibited high relative percent inhibitions (> 70%).

Discussion: Our data presented that scutellarein tetramethyl ether is hemostatic component of *C. odorata*. This compound, stigmasterol and unknown are also active anti-inflammatory components of this plant. This is the first report on an active hemostatic component of *C. odorata* in animal model.

Keywords: *Chromolaena odorata*, hemostasis, anti-inflammatory activity, bioactive component, animal model

147. Relationship Between Scutellarein Tetramethyl Ether and Calcium Amounts in *Chromolaena odorata* Leaf Extracts on Hemostatic Activity in Rat Model

Hataichanok Pandith and Wandee Gritsanapan

Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, 447 Sri Ayudthaya Rd., Ratchathewi, Bangkok 10400, Thailand.

Background: *Chromolaena odorata* (L.) King and Robinson (Siam weed) is a medicinal herb used as hemostatic agent to stop bleeding in tropical countries for centuries. Scutellarein tetramethyl ether and calcium have been reported as active components for stop-bleeding. From our investigation using a bleeding time model in rat, The 70% ethanolic dried leaf extract displayed the highest hemostatic activity which could stop bleeding within 1.85 ± 0.05 min. Furthermore, the scutellarein tetramethyl ether could immediately stop bleeding after 0.2 mg/10 µL application to the wound.

Objective: In this study, we investigated the relationship of scutellarein tetramethyl ether and calcium amounts to the hemostatic activity of extracts from those various solvent extractions.

Methods: The scutellarein tetramethyl ether and calcium contents were determined using validated HPLC analytical method and atomic absorption spectroscopy, respectively.

Results: The results displayed the positive correlation between the active components and the hemostatic activity. However, the scutellarein tetramethyl ether seemed to have more influence on this activity. The 70% ethanolic dried leaf extract which exhibited the highest hemostatic activity yielded the highest amount of scutellarein tetramethyl ether (308 ppm) and moderated amount of calcium (4.57 ppm). In contrary, the lyophilized aqueous extract from fresh leaves which exhibited the lowest hemostatic activity (2.47 ± 0.02 min) yielded the lowest amount of scutellarein tetramethyl ether (1 ppm) although it yielded the highest amount of calcium (11.97 ppm). We have also determined the amounts of both active components in the extracts, whose leaves were collected from various parts of
Thailand. The results presented that various amounts of active components did not depend on the geographical feature. Scutellarein tetramethyl ether varied in the range of 116-420 ppm while the calcium content varied in the range of 1.46-6.58 ppm.

Discussion: These data suggested that standardization of plant extracts on both contents of scutellarein tetramethyl ether and calcium are necessary for further development.

Keywords: Chromolaena odorata, Hemostatic activity, Scutellarein tetramethyl ether, calcium, standardization

148. Effect of Siam weed extract and its bioactive component scutellarein tetramethyl ether on anti-inflammatory activity through NF-κB pathway

Hataichanok Pandith\textsuperscript{a,b}; Xiaobo Zhang\textsuperscript{a}; Yuvadee Wongkrajang\textsuperscript{c}; Suchitra Thongpraditchote\textsuperscript{c}; Wandee Gritsanapan\textsuperscript{b} and Seung Joon Baek\textsuperscript{a}

\textsuperscript{a}Department of Biomedical and Diagnostic Sciences, The University of Tennessee, Knoxville, TN 37996, USA
\textsuperscript{b}Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Bangkok 10400, Thailand
\textsuperscript{c}Department of Physiology, Faculty of Pharmacy, Mahidol University, Bangkok 10400, Thailand

Background: Siam weed (Chromolaena odorata (L.) King and Robinson) is a medicinal herb used for wound healing and inflammation-related diseases.

Objective: In this study, we evaluated the molecular mechanism by which Siam weed extract (SWE) and its bioactive components, scutellarein tetramethyl ether (scu), stigmasterol, and isosakuranetin affect anti-inflammatory activity.

Methods: The expression of several inflammatory proteins in RAW 264.7 (murine) macrophages was assessed by Western blot and reverse transcription-polymerase chain reaction (RTTQR). Biochemical assays including prostaglandin E2 (PGE2) and nitric-oxide (NO) quantification were performed. Luciferase promoter activity and immunocytochemistry of Nuclear factor-κB (NF-κB) were investigated.

Results: Cyclooxygenase-2 (COX-2) and inducible nitric oxide synthase (iNOS) are critical proinflammatory proteins. The level of protein and mRNA expression of these enzymes induced by lipopolysaccharide (LPS) was dramatically suppressed by treatment with SWE, scu, or stigmasterol compounds in a dose-dependent manner. They also reduced PGE2 and NO release. We further analyzed the NF-κB pathway and found that the scu compound suppressed IκB kinase complex alpha/beta (IKKα/β) and Inhibitory-kappa-B-alpha (IκBα), thereby suppressing COX-2 and iNOS expression.

Discussion: This is the first report of the anti-inflammatory molecular mechanism in SWE and/or its bioactive component scu, indicating alteration NF-κB pathway and further providing potential uses in the treatment of inflammatory-related diseases.

Keywords: Siam Weed, Chromolaena odorata, Scutellarein tetramethyl ether, Stigmasterol, Isosakuranetin, NF-κB pathway
149. Hemostatic and Wound Healing Properties of *Chromolaena odorata* Leaf Extract

Hataichanok Pandith\textsuperscript{a,b}; Xiaobo Zhang\textsuperscript{a}; Jason Ligget\textsuperscript{a}; Kyung-Won Min\textsuperscript{a}; Wandee Gritsanapan\textsuperscript{b} and Seung Joon Baek\textsuperscript{a}

\textsuperscript{a}Department of Biomedical and Diagnostic Sciences, College of Veterinary Medicine, University of Tennessee, 2407 River Drive, Knoxville, TN 37996-4542, USA

\textsuperscript{b}Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, 447 Sri Ayutthaya Road, Ratchathewi, Bangkok 10400, Thailand

**Background:** *Chromolaena odorata* (L.) King and Robinson (Siam weed) extract has been used to stop bleeding and in wound healing in many tropical countries. However, its detailed mechanisms have not been elucidated.

**Objective:** In this study, we examined the molecular mechanisms by which Siam weed extract (SWE) affected hemostatic and wound healing activities.

**Methods:** The effect of SWE on cell migration and proliferation were investigated using scratch essay in Balb/c 3T3 fibroblast cells. The expression of several hemostatic and wound healing proteins in undifferentiated promonocytic cell lines (U937) and Balb/c 3T3 fibroblast cells, respectively were assessed using Western blot and reverse transcription-polymerase chain reaction (RT-PCR)/ or Quantitative Real-Time-PCR. Luciferase promoter activity of heme oxygenase-1 (HO-1) was investigated.

**Results:** SWE promoted Balb/c 3T3 fibroblast cell migration and proliferation. Subsequently, we found that heme oxygenase-1 (HO-1), the accelerating wound healing enzyme, was increased at the transcriptional and translational levels by SWE treatments. The HO-1 promoter analyzed with luciferase assay was also increased by treatment of SWE in a dose-dependent manner. This induction may be mediated by several kinase pathways including MEK, p38MAPK, AKT, and JNK. Quantitative real-time PCR using U937 cells revealed that thromboxane synthase (TXS), a potent vasoconstrictor and platelet aggregator, was increased and MMP-9, an anti-platelet aggregator, was decreased in the presence of SWE.

**Discussion:** Our studies presented that SWE accelerated hemostatic and wound healing activities by altering the expression of genes, including HO-1, TXS, and MMP-9.

**Keywords:** *Chromolaena odorata*, Siam weed, Balb/c 3T3 cells, U937 cells, HO-1, Wound healing

150. Development of supporting clinical skills by e-learning in drug therapy monitoring


School of Pharmacy, Eastern Asia University, Bangkok, Thailand

**Background:** E-learning platforms are cost-effective, consistent, faster, supportive to cognitive retention, easy updating by instructors and manageable with self-pace by students as learning-center. Authors incorporated an e-learning to enhance clinical skill in pharmacotherapy for Parkinson’s disease.
Objective: To develop e-Learning for pharmacy students enrolled in pharmacotherapy, a platform for Parkinson’s disease with subsequent assessment of: (1) Success of learning before/after participation based on test-score results. (2) Participant satisfaction based on satisfactory score.

Methods: The fourth year pharmacy students enrolled in pharmacotherapy course during the year 2013 were prospected for e-Learning. The course contents were adapted from physician manual for diagnosis and treatment in general practice from Parkinson’s disease and Movement disorders Research and Training Center of Thailand published in 2010. The assessment tools consist of the equivalent 20-item pre-test and post-test examination papers and the 20-item, five domains satisfactory survey questionnaire. Descriptive statistics to compare test scores for pre-learning, post-on-ground learning and post-online learning with 95% CI significant at p<0.05 were analyzed. The dependency of tested score employed Spearman’s rank correlation coefficient. The reliability test of total satisfaction score employed intra-class correlation with Chronbach’s alpha coefficient.

Results: The contents of e-Learning developed is equivalent to 2 hours of on-ground learning which comprises of introduction, epidemiology, etio-pathophysiology, clinical presentation, differential diagnosis, treatment algorithms, common motor complications, clinical monitoring and assessment. The pre-test on-ground learning score and post-test on-ground learning score, post-test on-ground learning score and post-test e-learning score of the same student set reflected Spearman’s rank correlation coefficient of 0.289 (p=0.231) and 0.252 (p=0.298) respectively, indicating independency of score. The mean (SD) of test score at different tests for the same student set were 3.526(1.896), 6.894(1.629) subsequent to on-ground learning and 9.473(0.841) subsequent to e-Learning respectively. The score reflected mean score difference (SD), [95% CI] at -3.368(2.290)[-4.472, -2.264],p<0.001 and -5.947(1.899)[-6.862, -5.031],p<0.001 respectively. The reliability of 20-item,5 domains of score reflected with Chronbach’s alpha coefficient of 0.867 indicating consistent total score with item score.

Discussion: The e-learning project should foster further development with other subjects. There were some shortcomings in terms of small sample size and the test results should be validated against actual score of final examination.

Conclusion: The e-Learning support clinical skill developments are beneficial to the pharmacy student education. The 4th year pharmacy student performed better after subsequent e-Learning.

151. Experimental and Theoretical Studies of the Interaction between Lipid Membrane and Ceragenin CSA-13

Jutarat Pimthon1; Rungtip Jueati1; Jiraphun Jittikoon;1 Alexander D MacKerell Jr 2; Opa Vajragupta1
1 Center of Excellence for Innovation in Drug Design and Discovery, Faculty of Pharmacy, Mahidol University, Bangkok, Thailand 10400
2 Department of Pharmaceutical Sciences, University of Maryland, Baltimore, Maryland, United States 21201

Background: Ceragenin CSA-13, a cholic acid derivative, has been proposed as a novel template for development of more potent and specific antibiotics. It exerts a rapid bactericidal activity against a broad range of bacterial species, while its hemolytic activity is relatively low. Unfortunately, the precise
mechanism of action is not entirely clear. It has been speculated that CSA-13 interacts with lipid components of the bacterial cell membrane, causing membrane disruption.

**Objective:** The purpose of the study was to investigate the mechanism of membrane perturbation by ceragenin CSA-13 using MD simulation and the leakage experiments.

**Methods:** By means of MD simulations, single component POPG or POPE lipid bilayers were used to mimic cell membranes. The initial conformations of the ceragenin CSA-13 was modeled using the Discovery 2.5 studio. All simulations were performed using the CHARMM program. Simulations were carried out using explicit solvent, counter ions, periodic boundary conditions, with the NPT ensemble at a temperature of 303 K and a pressure of 1 atm. The leakage experiments were performed with calcein-loaded single-component liposomes comprised of anionic POPG, anionic DOPG, and zwitterionic DOPC lipids; and with two-component liposomes including, DOPG:DOPE, DOPC:DOPG, DOPE:DOPC, and POPG:POPE lipids. Leakage of calcein from liposomes was monitored after 5-min incubation with ceragenin CSA-13 by measuring fluorescence intensity at 520 nm (excitation at 490 nm). For determination of 100% dye-release, 1% of Triton X-100 solution (1% in HEPES buffer) was added to dissolve the vesicles.

**Result and Discussion:** Studies on single-component liposomes demonstrated that ceragenin CSA-13 effectively induced calcein leakages by interacting with negatively charged POPG and DOPG vesicles, while also exhibiting weak dye-leakage activity in DOPC vesicles. Using two-component vesicles, leakage varied showing a higher leakage for POPG:POPE than DOPG:DOPE vesicles. This can be explained by a difference in the packing characteristic of the lipid acyl chains in which DO species contain two unsaturated chains giving loose packing density. The experimental results were in good agreement with the MD calculations indicating that the positively charged parts of ceragenin CSA-13 preferentially bind to the negatively charged PG headgroup, leading to increases of ceragenin CSA-13 at the membrane-water interface, and subsequently causing membrane destabilization by the increased membrane fluidity. Moreover, the MD simulations revealed that the hydrophobic portions of the ceragenin CSA-13 enhanced its penetration into membrane lipid core. Using a combination of experiments and simulations can help to better understand the mechanism of membrane perturbation by ceragenin CSA-13.

152. **Model of integrating community learning into Thai PharmD curriculum**

Chanuttha Ploylearmsang¹,²; Kritsanee Saramunee¹,²; Surasak Chaiyasong¹,²; Somsak Arparsrithongsakul¹,²; Thanapong Poophalee¹,²

¹Social and Administrative Pharmacy Group, Faculty of Pharmacy, Mahasarakham University, Thailand
²Social Pharmacy Research Unit, Faculty of Pharmacy, Mahasarakham University, Thailand

**Background:** Consumer protection and providing home health care are important roles for Thai pharmacists. These roles normally involve working in community in order to detect and tackle community health problems. PharmD students need to understand community culture and lifestyle to be able to work better in this setting. Training students is thus necessary to enhance this competency.

**Objective:** To describe details of community learning program used in Thai PharmD curriculum and to demonstrate primary outputs of the program.
Methods: Community learning program was developed by Social and Administrative Pharmacy (SAP) teaching group, Faculty of Pharmacy, Mahasarakham University. One community, 200-household size and within a 10-kilometer radius of the pharmacy school, was selected to be a learning place. The program was integrated into 2-credits modules run in two consecutive semesters for year-2 students. Social Pharmacy, describing principles of health, health behaviors and medical anthropology, was a keystone module in semester 1. At the first visit, students invited one family to be their host for a regular meeting. For the next two, they learned this community in all aspects using the 7-community learning tools, a well-known tool used in anthropology and social health in Thailand. Public Health Pharmacy was set in semester 2, explaining principle of public health, health system and policy. Students visited the community twice in this semester to investigate health status and use of medicines and health products. They were assigned to interview one or two members (≥ 18 years) of the host family using a survey form developed by SAP team.

Results: Students produced community information following the 7-instruments including (1) geo-social map, (2) family trees of host families, (3) structure of community board, (4) community health system, (5) community calendar, (6) community history, and (7) autobiography of key persons. Students interviewed 162 community members. Of those, 112 forms were usable. Participated members age ranged from 18 to 83 years. Majority were female (73.0 %), married (79.3%), primary school educated (69.4%), and farming/agriculture (61.3%). Almost one-fifth were drinkers (18.9%), while 1 in 10 were smokers (12.6%). About a third had high risk of diabetes (33.9%). Inappropriate use of medicines and advertising health products improperly were found.

Discussion: Community learning program integrated in PharmD curriculum provides students an opportunity to gain experience of working in community. Activities included in the program can help identify community health problems, which will be useful for planning interventions/campaigns to promote healthy community in the next academic year.

153. Quality evaluation of turmeric capsules prepared in Thai hospitals

Werayut Pothitirat1; Chutimon Meunkaew1; Ruxjinda Wattanalai1; Chanai Noisang2; Wandee Gritsanapan3
1Faculty of Pharmacy, Siam University, Bangkok, Thailand
2Thai Traditional Medicine College, Rajamangakala University of Technology Thanyaburi, Pathumthani, Thailand
3Faculty of Pharmacy, Mahidol University, Bangkok, Thailand

Turmeric rhizome capsules are popularly used for treatment of flatulent and dyspepsia. Standardized turmeric is recommended by Thai Herbal Pharmacopoeia (THP). This study evaluated physical and chemical properties, i.e. weight variation, disintegration time, contents of moisture, volatile oil, total curcuminoid and microbial contamination, of turmeric capsules prepared by 10 different hospitals in Thailand. The results revealed that weight variation, disintegration time and moisture content of all samples were conformed with the THP standard while 90% of the samples contained volatile oil and total curcuminoids within the recommended amounts. For microbial contamination, 70% of samples contained exceeded amounts of total aerobic bacteria, yeasts and molds. However, Staphylococcus aurous, Pseudomonas aeruginosa and Clostridium spp. were not found in all samples. The results showed that most of turmeric capsules prepared in hospitals in Thailand have high standards in terms of
physical and chemical qualities. However, a sanitary in manufacturing process of turmeric capsules has to be more concern.

---

154. Polysaccharide extraction from Parkia timoriana seeds

*Srisomporn Preeprame, Natsajee Nualkaew, and Prapatsorn Sirisawat*

*Faculty of Pharmaceutical Sciences, Khon Kaen University*

**Background:** *Parkia timoriana* seeds give mucilaginous polysaccharide when soaking in water and the seeds are interesting to be the sources of purified polysaccharide.

**Objectives:** To compare between extraction with hot and cold water for selection in an appropriate method which made the most yield of polysaccharide extract from *Parkia timoriana* seeds and to analyze the monosaccharide compositions of polysaccharide by Thin Layer Chromatography.

**Methods:** including step 1: *Parkia timoriana* seeds was divided into 2 groups for hot and cold extraction with distillated water. Then, add 70% Ethanol to collect the precipitate. The precipitate was evaporated and freezes dry to calculate the yield of polysaccharide. Step 2: Purification of polysaccharide was done by dialysis method to get the polysaccharide. Step 3: Determination of polysaccharide was done with Dubois’ reaction and determination with UV spectrophotometer at 480 nm. The protein in the polysaccharide was determined with UV spectrophotometer at 260 nm. Step 4: The polysaccharide was hydrolyzed and examined monosaccharide composition by Reverse Phase Thin Layer Chromatography to compare with 8 standard monosaccharides.

**Results:** The result showed that hot extraction of *Parkia timoriana* seeds had pure polysaccharide more than cold extraction 2.43 times. The proportion of polysaccharide to protein by hot and cold extraction was 0.188 and 0.155 respectively. The galactose was the major monosaccharide composition in the polysaccharide. The conclusion and discussion of this study were the hot extraction was the most appropriate method and galactose was monosaccharide composition in the polysaccharide extract from *Parkia timoriana* seeds. This study data can be used for extraction of polysaccharide in other plants. In addition, the biological test and health products development was interested.

**Keywords:** *Parkia timoriana*, Polysaccharide, extraction

---

155. The influence of hydroxycarboxylic acids on the solubilization of haloperidol

*Prisada Rakkaew¹; Jiraphong Suksiriworapong¹²; Doungdaw Chantasart¹²*

¹ *Department of Pharmacy, Faculty of Pharmacy, Mahidol University, Rajthevi, Bangkok, 10400 Thailand*
² *Center of Excellence in Innovative Drug Delivery and Nanomedicine*

**Background:** Haloperidol, an antipsychotic drug, is a basic compound with low water solubility which is a major problem of drug formulation. The interaction with acid species is one strategy to enhance solubility of basic drugs.

**Objective:** The aim of this study was to investigate the influence of hydroxycarboxylic acids (i.e., citric acid, tartaric acid and lactic acid) on the drug solubilization.
Methods: The studied acids contain different chain lengths and numbers of hydroxyl and carboxyl groups. Haloperidol solubility was determined in various concentrations (0-270 mM) of different acids in water.

Results: It was found that the addition of acid in water incremented the drug solubility which further increased with the increasing acid concentration. The drug solubility was enhanced by 51 to 751 times compared to the solubility in water without acids. Additionally, the solubility of haloperidol was further investigated in 0.1 mM citrate buffer pH 3 and 6 with the addition of acids. The result showed that the haloperidol solubility significantly increased in buffer pH 3 but decreased in buffer pH 6 as compared to that in water. However, the highest drug solubility enhancement was observed in both buffered and non-buffered systems added with citric acid, followed by the systems with lactic acid and tartaric acid, respectively. The solubilization of haloperidol by the addition of acids in water and buffer pH 3 took place predominantly via the presence of unionized species of added acids at low pH. Meanwhile the buffer pH 6 reduced the amount of unionized species available for drug solubilization and decreased the haloperidol solubility.

Discussion: From the results, it can be concluded that the solubility of haloperidol depended on concentration and type of added acids, but the main effect on drug solubility is the pH of medium. Ultimately, these obtained data can be further used for the development of haloperidol delivery system.

156. Standard Cost Lists for Health Economic Evaluation in Thailand

Arthorn Riewpaiboon, B Pharm, M Sc in Pharm, PhD
Division of Social and Administrative Pharmacy, Department of Pharmacy, Faculty of Pharmacy, Mahidol University, Bangkok

This analysis was undertaken to generate a set of standard costs for medical services and those incurred by patients receiving treatment, for use in health economic evaluations. Medical service unit cost data were derived from a survey of 3,091 hospital medical services in five hospitals, disaggregated by type of hospital (district or provincial/regional) and analyzed using the relative value unit method. Patient-borne ambulatory cost values were derived from data gathered through 905 patient interviews that took place in six health centers, three district hospitals and three provincial/regional hospitals. The survey gathered data on costs arising from the distance travelled to access the medical service, the time spent in the healthcare facility, as well as travel and meal costs. The analysis generated a set of standard cost data for Thailand that will make conducting economic evaluations more accurate, faster and more convenient, as well as allowing better comparability between studies. This is the first standard cost menu that has been developed specifically for Thailand, and as such should be revised and refined in the future. Some areas that would benefit from revision are suggested.

Keywords: Medical service, unit cost, standard cost list, health economic evaluation, Thailand
157. Measurement of costs for health economic evaluation

Arthorn Rirewpaiboon B Pharm, MSc, PhD
Division of Social and Administrative Pharmacy, Department of Pharmacy, Faculty of Pharmacy, Mahidol University, Bangkok 10400, Thailand.

The provision of guidelines on cost measurement for health economic evaluations enable research to be more standardized and hence more comparable, which offers clear benefits for policy formulation and health management. The guidelines herein focus on three aspects—the cost of health intervention/health care programs, the cost of illness/health risks, and use of costs in health economic evaluation. For each aspect, the main concepts and methods are outlined, and recommendations for the Thai context are presented. There is particular focus on how to calculate various costs according to different evaluation methods and perspectives, how to evaluate source of cost data, how to make value adjustments and how to present cost measurement findings.

Keywords: Cost, cost measure, methods, guidelines, economic evaluation, Thailand

158. Safety of Intravitreal Bevacizumab Injection for Neovascular Age-Related Macular Degeneration and Diabetic Macular Edema: A Systematic Review

Sermsiri Sangroongruangsri1*; Usa Chaikledkaew1
1Social and Administrative Pharmacy Excellence Research (SAPER) Unit, Department of Pharmacy, Faculty of Pharmacy, Mahidol University
447 Sri-Ayudthaya Road, Payathai, Ratchathewi, Bangkok 10400 Thailand

Background: Bevacizumab (IVB) has been widely used as an off-label treatment for treating neovascular age-related macular degeneration (AMD) and diabetic macular edema (DME) because its substantial lower cost than the approved drug named ranibizumab. However, there are concerns about possible serious adverse events (SAEs) of IVB particularly rare events and evidences supporting its safety profile remain inconclusive.

Objective: To examine ocular and systemic SAEs of IVB in the treatments of neovascular AMD and DME.

Methods: The articles were searched from Pubmed and Centre for Reviews and Dissemination. Randomized controlled trials (RCTs), cohort studies, systematic reviews, or meta-analyses which reported SAEs of IVB compared with placebo or other anti-VEGF drugs in the treatment of neovascular AMD or DME were included. Studies which IVB were given in conjunction with other ocular procedures or therapies and articles published in non-English languages were excluded.

Results: Only 11 articles were included in this review. The number of RCTs, retrospective studies or systematic reviews was 3, 2, and 5, respectively. Most studies concluded that the treatment with IVB was safe and well-tolerated. The incidences of endophthalmitis and arteriothrombotic events (i.e., ocular and systemic SAEs) in neovascular AMD and DME patients were low. Non-SAEs commonly found in both IVB and IVR groups are subconjunctival hemorrhage, increased intraocular pressure and mild ocular inflammation. Most studies concluded that IVB and IVR have similar safety profile and low incidence of SAEs.
Discussion: The results should be interpreted cautiously due to the limitations of previous studies, particularly small sample size for evaluating rare SAEs. High quality evidence is still required. The valid safety profile of IVB in comparison to IVR might be useful in treatment selection and decision making to allocate the resources for treatment of neovascular AMD and DME.

Keywords: intravitreal injection; bevacizumab; neovascular age-related macular degeneration; diabetic macular edema

159. 3D-QSAR studies on chromone derivatives as topoisomerase I inhibitors

P. Songmuang; C. Prapaipak; H. Khawsuk; J. Ungwitayatorn; N. Phosrithong

Faculty of Pharmacy, Siam University, Bangkok, Thailand
Faculty of Pharmacy, Mahidol University, Bangkok, Thailand

DNA Topoisomerase I play critical roles in cellular processes, in which it is involved in DNA replication, transcription, and chromosome segregation. Topoisomerase I inhibitors are a new class of anticancer agents which aimed to interrupt DNA replication in cancer cells, resulting cell death. The goal of these studies was to identify structural features necessary to increase topoisomerase I inhibitory activity and further use these features to design novel anticancer agents. Comparative Molecular Field Analysis (CoMFA) and Comparative Molecular Similarity Indices Analysis (CoMSIA) based on three dimensional quantitate structure activity relationship (3D-QSAR) studies were conducted on a series of 16 chromone derivatives as topoisomerase I inhibitor agents. The best CoMFA and CoMSIA model obtained from AM1 geometry optimization and database alignment. The satisfactory CoMFA model predicted a cross-validated $r^2 (q^2) = 0.646$ and noncross-validated $r^2 = 0.999$ indicating that electrostatic and steric properties play a significant role in potency. The best CoMSIA model, based on steric, electrostatic, and hydrophobic fields, gave $q^2 = 0.732 \text{and } r^2 = 0.995$, $SEE=0.009$ and $F=155.558$. The resulting contour maps produced by the best CoMFA and CoMSIA models could be used to understand the important structural features responsible for the design and development of new highly active topoisomerase I inhibitors

160. Community pharmacist’s monitoring on the quality use of medicines in the accredited community pharmacies in Maha Sarakham and Roiet provinces

Phayom Sookaneknun, PharmD, PhD*, Juntip Kanjanasilp, PhD*, Duangtip Hongsamut, PhD*, Jongkol Sutiso#, Pittaya Leugrisree#, Paramaporn Dawongsap#, Siraporn Boontansang#, Tharita Kajornjarutkul#, Nootchana Kumsopa#, Poowadol Watyotha#, Apirak Taksin#,

* Lecturer, #PharmD students, National Health Security Office (NHSO)
Primary Care Practice Research Unit, Faculty of Pharmacy, Mahasarakham University

Community pharmacists have an important role in monitoring patients to enhance the efficacy of the treatment and quality use of medicines. The purpose of this study was to compare the effects of the community pharmacy service in providing quality use of medicines (drug related problems, drug use behavior and patient satisfaction) between the control and treatment groups. Patients who enrolled to this study came to the accredited community pharmacies during October – December 2011 and were taking at least one medication for common illness or chronic illness. Randomized allocation with
permuted block was designed. The treatment group received a usual pharmacy service plus informative calendar and telephone follow-up every week while the control group received only a usual pharmacy service. The pharmacy service for quality use of medicine was collaborated for referral with 5 community health centers and community health volunteers. This study was done in 9 accredited community pharmacies.

There were 280 patients enrolled to the study. At the pre-test, the treatment group showed 91 drug related problems and 66 problems in the control group. The post-test, the drug related problems were reduced 54.0% in the treatment group and 29.1% in the control group. The most common drug related problems found at the pre-test were 1) noncompliance (38.1% and 26.2%, in the treatment and control groups respectively) 2) miscellaneous (e.g. duplicate medications; 16.5% and 12.8 %, respectively) and 3) adverse drug reactions (5.8% and 5.0% respectively). Most pharmacist interventions were education 74.1% and 87.1% in the treatment and control groups, respectively) and changing drugs were found 7.4% and 6.5% in the treatment and control groups, respectively. Drug use behaviors were better in the treatment group when compared with the control group including reading a label, no double dose when missing, self-dose adjustment, and action if running of medication before the next appointment (p<0.05). The treatment group were more satisfied to the information received by a pharmacist and the counseling area in the pharmacy made them comfortable when compared to the control group (p<0.05).

In conclusion, patients who received the quality use of medicine service get benefits from the management drug related problems with a pharmacist including duplicated therapy and adverse drug reaction. Development of long term collaboration between community pharmacies and primary care unit should be further supported.

Keywords: quality care of drug use, pharmacist, accredited pharmacy, drug-related problem, Thailand

161. Immersive Faculty Development Program in Interprofessional Education

Stacy Taylor, PharmD, MHA*; Tamara Bennett, MSPAS**; Mikael Jones, PharmD*; Kevin Schuer, MSPAS, MPH**; Virginia Valentin, MCMS**; Mandy Jones, PharmD, MSPAS*

*University of Kentucky College of Pharmacy
**University of Kentucky College of Health Science Physician Assistant Studies

Background: Currently in the U.S., interprofessional education (IPE) is a required curricular element for accreditation for most health professions education programs. According to the Interprofessional Education Collaborative (IPEC) Expert Panel Report, it is essential that faculty be adequately prepared to deliver effective IPE.

Objective: To pilot a faculty development program in interprofessional education and to determine the utility of this program as a valid mode by which to develop faculty for IPE.

Methods: Faculty from the University of Kentucky Colleges of Pharmacy and Health Science Physician Assistant (PA) Studies were recruited to participate in a 3-part faculty development program as follows: 1) Online training modules consisting of assigned readings, videos, and reflective writing; 2) Live, 1-hour just-in-time training session; 3) Facilitating physician assistant and pharmacy students in a simulated Team-Based Medical Error Disclosure activity.
Results: Thirteen faculty members were enrolled in the faculty development program. Data collection is ongoing and includes surveys and assessments related to knowledge, competence, degree to which the program met learning objectives, and faculty member satisfaction. Data will be used for quality improvement purposes for the faculty development program.

Discussion: Current research indicates that active learning and immersive activities such as these are an important aspect to include in faculty development programs as they provide faculty learners an opportunity to actively apply learned skills in a real IPE activity. If this immersive faculty development program is successful, it will be considered for inclusion as a component of the official faculty development program for the University of Kentucky Interprofessional Core Curriculum and would include approximately 120 faculty members from the participating health-care colleges (Communication Sciences and Disorders, Dentistry, Medicine, Nursing, Pharmacy, Physician Assistant, and Physical Therapy).

162. A Cost-Utility and Budget Impact Analysis of Drug Treatments in Pulmonary Arterial Hypertension Associated with Congenital Heart Diseases

Watsamon Thongsri1,2*; Thanaporn Bussabawalai2; Pattara Leelahavarong2; Usa Chaikledkaew1,2; Kritvikrom Durongpisitkul3; Suthep Wanitkun4; Suree Sompradeekul5; Tarinee Tangcharoe6; Yot Teerawattananon2
1Social and Administrative Pharmacy Excellence Research (SAPER) Unit, Department of Pharmacy, Faculty of Pharmacy, Mahidol University, 447 Sri-Ayudthaya Road, Payathai, Ratchatevi, Bangkok 10400 Thailand
2Health Intervention and Technology Assessment Program (HITAP), Nonthaburi, Thailand, 6th Floor, 6th Building, Department of Health, Ministry of Public Health, Tiwanon Road, Muang, Nonthaburi 11000, Thailand
3Department of Pediatric, Faculty of Medicine, Siriraj Hospital Mahidol University, Bangkok, Thailand, 2 Prannok road, Siriraj, Bangkoknoi, Bangkok 10700
4Department of Pediatrics, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand 270 Rama VI Road, Ratchatewi, Bangkok, Thailand 10400
5Department of Medicine, Faculty of Medicine, Siriraj Hospital Mahidol University, Bangkok, Thailand, 2 Prannok road, Siriraj, Bangkokknoi, Bangkok 10700
6Division of Cardiology, Department of Medicine, Ramathibodi hospital, Mahidol University, Bangkok, Thailand, 270 Rama VI Road, Ratchatewi, Bangkok, Thailand 10400
*Corresponding author

Background: Pulmonary arterial hypertension associated with congenital heart disease (PAH-CHD) is a rare condition with narrowing coronary arteries in the lungs. Currently, in Thailand, only sildenafil is a pulmonary selective drug included in the National List of Essential Medicines (NLEM) as the first line treatment, while iloprost and bosentan have not been included in the NLEM as the second-line treatment, yet. Nevertheless, until now there has been no economic evaluation information related to these drugs available in Thailand.

Objective: This study aimed to assess the cost-utility of drug treatments in PAH-CHD.

Methods: The study population was the patients with PAH-CHD with severity in functional class (FC) II and III according to the World Health Organization classification. Cost-utility analysis using a Markov
model was used to estimate the costs and health outcomes over lifetime period using a societal perspective. The first-line treatment compared beraprost and sildenafil with standard treatment. The second-line treatment compared sildenafil combined with iloprost and sildenafil combined with bosentan with sildenafil switched to standard treatment in case of no response to sildenafil as the first-line treatment. Health outcome was quality adjusted life years (QALYs) gained. Probabilistic sensitivity analyses were performed to investigate the effect of parameter uncertainty.

**Results:** In PAH-CHD patients aged ≤ 30 years, for the first-line treatment, compared with standard treatment, the ICERS of beraprost were 192,752 (FC II) and 201,308 (FC III) THB per QALY gained and the ICERS of sildenafil were 249,770 (FC II) and 226,802 (FC III) THB per QALY gained. For the second-line treatment, compared sildenafil switch to standard treatment, the ICERS of sildenafil plus iloprost were 1,440,409 (FC II) and 3,298,720 (FC III) THB per QALY gained and the ICERS of sildenafil plus bosentan were 805,528 (FC II) and 2,147,137 (FC III) THB per QALY gained.

**Discussion:** As the first-line treatment, both beraprost and sildenafil were close to being cost-effective. If the price of sildenafil 20 mg was decreased to 19-26 THB, it would be cost-effective in the Thai context. Furthermore, in case of no response to sildenafil as the first-line treatment, all second-line treatments were not cost-effective in the Thai context. Therefore, sildenafil should be used as the first-line treatment in PAH-CHD patients in FC II or III if its price was reduced to be cost-effective.

---

163. **Computational model evidence for a complex containing DAT, VMAT, and D2 receptors and for pH regulation of dopamine leak from storage vesicles**

*Lane J. Wallace, Kayla H. Cierniak, Andrew T. Zurlinden, Alex D. Klausing*

*Division of Pharmacology, College of Pharmacy*

**Background:** The combination of an antipsychotic drug and an inhibitor of dopamine transporter (DAT) exerts several effects on dopamine nerve terminals (varicosities) that have not yet been explained.

**Objective:** The goal of this project is to explain these effects using computer simulation models of dopaminergic varicosities.

**Method:** The simulation model utilizes rate equations for dopamine synthesis and metabolism and for transport of dopamine and its metabolite, DOPAC, between compartments. Drug effects were simulated by changing values of parameters thought to be impacted by the drugs. When such changes failed to provide a model output that matched published experimental data, additional changes were made using a trial and error process until model output matched experimental data. A set of parameters was found that provided model output closely matching published data for extracellular dopamine, extracellular DOPAC, tissue dopamine, tissue DOPAC, and rate of dopamine synthesis.

**Results:** The results document that
- D2 receptor antagonism increases extracellular dopamine by 63% with a compensatory increase in rate of dopamine synthesis
- D2 receptor antagonism increases extracellular DOPAC by 100% with a compensatory increase in rate of dopamine synthesis
Some but not all antipsychotic drugs increase the rate of passive diffusion of dopamine out of storage vesicles. Rate of dopamine synthesis increases proportionally to the rate of increase of diffusion. DAT inhibition decreases rate of dopamine removal from signaling space. DAT inhibition decreases rate of secretion of dopamine by 70%. Combination of drugs reverses decreased rate of secretion elicited by inhibitors of DAT alone. Combination of drugs decreases rate of dopamine storage by vesicular monoamine transporter (VMAT) by 60%. Combination of drugs decreases rate of destruction of DOPAC by 50%.

Discussion: We postulate the following biological explanation for these observations. (1) Some (but not all) antipsychotic drugs are lipophilic weak bases. These accumulate in storage vesicles, partially alkalize the vesicle, and increase amount of diffusible neutral dopamine. Some tyrosine hydroxylase is located on storage vesicles, and activity of this enzyme increases in proportion to increases in rate of passive diffusion of dopamine out of vesicles. (2) DAT, VMAT, and D2 receptors exist in a complex such that pharmacological inhibition of both D2 receptors and DAT results in decreased activity of VMAT.

164. Integration of Interprofessional Simulation to Enhance Communication among Professional Students Caring for the Critically Ill

Heather Brennan Congdon, PharmD, BCPS, CDE1; Jeffrey P. Gonzales, PharmD, BCPS, FCCM2; Karen Clark PhD, RN, Alumna, CCRN2; Kelley Macmillan, Ph.D., MSW3; Adriana Guerra, MPH, RRT4

1University of Maryland School of Pharmacy
2University of Maryland School of Nursing
3University of Maryland School of Social Work
4Salisbury University Respiratory Therapy Program

Objective: Evaluate the impact of an interprofessional course utilizing high fidelity simulation on student self-reported ability to identify patient problems, assess patient severity, and communicate within an interprofessional team.

Methods: A course involving pharmacy, nursing, social work, and respiratory therapy was implemented in fall 2011 and utilized high fidelity simulation in an attempt to enhance communication skills amongst the professions regarding the care of critically ill patients. An IRB approved survey was administered to students on the first and last day of class. Students ranked their ability to perform tasks regarding problem identification, illness severity assessment, and communication skills for three critically ill patient case scenarios. The rating scale was 1-6; 1 represented the least confidence/ability to perform the specified task and 6 represented the most confidence/ability to perform the task. Results were analyzed through Chi-square statistics.

Results: 15 students enrolled for the class (6 pharmacy, 6 nursing, 3 social work). 14 students completed the pre-class survey and 11 students completed the post-class survey. There was a significant improvement in student perceived patient problem identification (p=0.03). Student perception of communication ability with each of the professions also improved significantly (p=0.004 for communicating with respiratory therapists; p=0.01 for social workers; p=0.002 for nurses and p=0.002 for pharmacists).
Discussion: A pilot interprofessional course using high fidelity simulation to teach critical care patient management principles significantly enhanced problem identification and communication amongst the professions involved. Further utilization of this survey in future offerings of this class is needed to ensure validity and reliability.

165. Navigator-Facilitated Care Coordination Algorithm to Improve Outcomes of Underserved Primarily Latino Patients with Uncontrolled Diabetes

Heather Brennan Congdon, PharmD, BCPS, CDE; Barbara H. Eldridge, MBA, PA-C; Hoai An Truong, PharmD, MPH, AE-C; Faramarz Zarfeshan, RPh

1University of Maryland School of Pharmacy
2Primary Care Coalition of Montgomery Country
3University of Maryland Eastern Shore School of Pharmacy
4ALFA Specialty Pharmacy

Objective: To determine the impact of an interprofessional navigator-facilitated care coordination algorithm on diabetes control in underserved, primarily Latino patients using a safety-net clinic as their medical home.

Methods: An algorithm was created by an interprofessional team to coordinate diabetes-related services (diabetes self-management education, medication therapy management, nutrition, endocrinology) based on specific criteria for patients with poorly controlled diabetes. Over a six month period, patients with A1C≥9% were identified through an electronic registry and contacted via phone by a navigator to schedule the recommended services based on the algorithm. A tracking tool was designed and included in the patient’s medical record, indicating dates of navigator contact, selected diabetes-related services and the appointment dates for such services. A1C was the primary outcome measure evaluated both before and after receiving referral algorithm services (i.e. patients served as their own control). Paired Student’s t-test was used to analyze the data.

Results: Pre- and post-service A1C data was available for 45 patients. Average A1C decreased from 10.6±1.2% to 8.8±2.1% (p<0.001). Among the 34 patients who demonstrated improvement in A1C from baseline (76%), the average decrease was 2.5 percentage points (10.6±1.1% to 8.1±1.7%), p<0.001. Thirty-two (76%) of the 45 patients were Latino. In that subset of patients, average A1C improved from 10.6±1.2% to 9.1±2.2% (p=0.0013). Average A1C for non-Latino patients improved from 10.4±1.0 to 8.0±1.4% (p=0.0004).

Discussion: Interprofessional navigator-facilitated care coordination had a positive and rapid impact on A1C for low income, uninsured, primarily Latino patients with poorly controlled diabetes.

166. Promoting Medication Use with Generic Name in Medical and Pharmacy School, Mahasarakham University, Thailand

Chanuttha Ploylearmsang; Somsak Arparsrithongsakul; Thanapong Phuphalee; Teerapong Srisil; Teabpaluck Sirithanawutichai; Sirinart Tongsiri

1Social Pharmacy Research Unit, Faculty of Pharmacy, Mahasarakham University, Thailand
2Clinical Pharmacy Research Unit, Faculty of Pharmacy, Mahasarakham University, Thailand
Background: Rational Use of medicines (RUM) requires quality use of medicines with the appropriateness, effectiveness, safety, rational cost and benefit to patients. One of 12 WHO interventions to promote RUM is the problem-based pharmacotherapy training in undergraduate curricula. Moreover, WHO guide to good prescribing recommends health professionals to support RUM by prescribing medicines with their generic names. To promote RUM in school training, both Faculty of Medicine and Faculty of Pharmacy have a joint educational intervention.

Objective: To promote medication prescribing and dispensing with generic name in the institutional trainings

Methods: This 9-month action research was done by a educational research team between 2 faculties. Samples were medical students and pharmacy students registered in the first semester of the academic year of 2013 (June-October 2013). An study intervention was pre-clinic training by pharmacy and medical lecturers composed of 2 contents; 1) Principles of RUM and prescribing medicines with generic name for students before having internship rotation (51 medical students year 3 and 75 pharmacy students year 5) and 2) problem-based training in courses of pharmacology and pharmacotherapy for 207 pharmacy students (year 3-4).

Results: Two lectures of RUM principle and the benefit of medication prescribing and dispensing with generic name were done; 1) Family medicine 3 course for medical students and 2) Pharmacoeconomics course for pharmacy students. The students' self assessment after the lecture revealed that all of them understood the concepts RUM and medication use with generic name. Students explained the benefits of using generic name of medicine; 1) reducing the potentially duplicated medication 2) reducing medication errors and drug interactions 3) supporting the cost-effective medicine 4) not supporting the sale promotion of pharmaceutical company and 5) supporting the international understanding on medicine within health professionals and between them and patients. After the case study and problem-based training in pharmacology and pharmacotherapy courses, 99.5% of pharmacy students showed the skill of dispensing medicine with generic name. A trade name of sulfonamides (Bactrim®) was mostly found. Cephaolosporins and Sulfonamides were medicine groups that students (30.4% and 24.2%, respectively) wrote generic names incorrectly.

Discussion: The pre-clinic intervention in the lecture courses and problem-based training courses can enhance medical and pharmacy students to concern on RUM and medication use with generic name and to train their skill of writing the correct generic name of medicine. these will be a initiate point for supporting students to be the health professionals for RUM practice.

167. The Effect of Disruption of Circadian Rhythm on Vascular Function in Lean (C57BL/6) and Obese, Leptin Resistant (dT/dt) Mice

Nitirut Nernpermpisooth*; Suwan thirawarapan*; Wisuda Suvitayavat*; David W. Stepp**
*Department of Physiology, Faculty of Pharmacy, Mahidol University, Bangkok, Thailand
** Vascular Biology Center, Georgia Regents University, Atlanta, Georgia, U.S.A

An artificial light or shift work at night might disturb a circadian gene oscillation and behavior which has been known to associate with cardiovascular and metabolic risks. However, the mechanisms of circadian disruption on vascular function still remain unclear. The aim of this study is to determine whether
disruption of the circadian rhythm impairs the vascular function in lean (C57/BL6) mice (LM) and enhances the vascular dysfunction in obese, leptin resistant (db/db) mice (OB). Lean and obese male mice, age 10-11 weeks were subjected to normal 12:12 h light-dark cycle or constant darkness to disrupt the circadian rhythm for 4 weeks. The metabolic parameters, vascular reactivity of thoracic aorta and small mesenteric artery were evaluated. In addition, daily rhythmic expression of clock genes (BMAL1, CLOCK, NPAS2, PER1, PER2, CRY1), clock output gene (DBP), vascular relaxation-related genes (eNOS, GTPCH1), and superoxide-related genes (NOXs, SODs) were also investigated. Circadian disruption had no effect on glucose metabolism in LM, while marked increase in fasting serum glucose and HbA1C levels in OB. OB had stronger aortic vasoconstriction to 5-HT than LM. Circadian disruption enhanced the response to 5-HT only in LM. In small mesenteric artery, the vasoconstriction to PE was not altered by obesity or circadian disruption. While the endothelium-dependent dilation to Ach was attenuated in OB and depressed in LM subjected to constant darkness. In the presence of L-NAME, the vasodilator responses were attenuated in both LM and OB. SNP-mediated relaxation was impaired in LM subjected to constant darkness but was not observed in OB. In small mesenteric artery, the rhythmic expression of PER1 and DBP was depressed in OB. Circadian disruption altered the daily oscillation of CLOCK, NPAS2, and PER1 and depressed gene profile of DBP in LM. The vascular profile of eNOS expression was depressed and GTPCH1 rhythmic expression was lost, both in obesity and by constant darkness. The SODs expression was also depressed in obesity and by constant darkness, while the NOXs components were generally increased in obese subjected to constant darkness. These results suggested that circadian disruption increased the vasoconstrictor property of macrovessel and impaired both endothelium-dependent and independent dilation of microvessel in lean mice without metabolic disturbances. However, circadian disruption exacerbates glycemic load but did not enhance the vascular impairment in obese mice. The interruption of nitric oxide pathways reveals an underlying mechanism of vascular impairment by circadian disruption. Aberrant clock gene oscillation and vascular dysfunction might imply a parallel interconnection.

Keywords: Circadian disruption, clock genes, obesity, vascular function, eNOS

168. Pandanus amaryllifolius Root Extract Reduces Locomotor Activity and Prolongs Sleeping Time and in Mice

Penchom Peungvicha**, Yuvadee Wongkrajang†, Boontium Kongsaktrakoon* and Rungravi Temsiririrkul

*Department of Physiology, Faculty of Pharmacy, Mahidol University,
†Department of Pharmaceutical Botany, Faculty of Pharmacy, Mahidol University, Bangkok 10400, THAILAND

Background: Some plants in Pandanus species were reported to be potential as a CNS depressant

Objective: To investigate locomotor activity and hypnotic effect of the decoction of Pandanus amaryllifolius root in mice.

Methods: Locomotor activities were measured by small-animal activity monitor (Animate, MATYS, Toyo Sangyo, Japan).
Results and Discussion: The extract at doses of 1-2 g/kg significantly decreased the spontaneous locomotor activity in a dose-dependent manner during 30 minutes after feeding. The extract at the dose 4 g/kg significantly suppressed the locomotor activity in methamphetamine-treated mice but the lower dose cannot. In addition, the extract at doses of 0.5-2 g/kg feeding prolonged the pentobarbital-induced sleeping time in both sexes of mice. This effect was not attenuated by flumazenil (a selective benzodiazepine receptor antagonist). These results suggest that the water extract of Pandanus amaryllifolius root suppressed the spontaneous and amphetamine-activated locomotor activity. The extract also potentiated the effect of pentobarbital sodium on sleep which is not implicated with benzodiazepine receptor system.

Keywords: Pandanus amaryllifolius, sleeping time, flumazenil, locomotor activity, methamphetamine

---

169. Safety and quality aspects of Thai fermented herbal beverages with selected probiotic *Lactobacillus plantarum* strain

Sririthunyalug J., Sirilun S. and Chaiyasut C. Department of Pharmaceutical Sciences, Faculty of Pharmacy, Chiang Mai University, Chiang Mai, 50200, Thailand

Lactic acid fermented herbal beverages (FHBs) have been widespread used as functional foods in Thailand. Thai people believe that these products are able to relieve disease symptoms and promote health. However, they are still household products distributed in several areas. Moreover, major contaminants which were methanol and fungus were detected in the finished products. In order to solve the problem, it is necessary to use bacterial starter to eliminate the pathogenic microbial and harmful metabolite contamination in order to control the safety and quality of the FHBs. The objectives of study were to isolate *Lactobacillus* spp. from food origins and to examine probiotic properties. The selected strain which possess the probiotic properties was used as starter culture of FHBs for developing the safe functional food products from Thai indigenous plants. Total 763 non-human origin strains isolated from fermented products containing plant were collected. A number of lactic acid bacteria (LAB) strains were isolated and primarily identified for *Lactobacillus* sp. All isolates were then evaluated for some key probiotic properties. The selected *L. plantarum* strain had growth ability in 0.15 and 0.30% (w/v) bile salt, growth ability in pH values between 3-8, exhibited strong antimicrobial activities against *Escherichia coli* ATCC 25922, *Staphylococcus aureus* ATCC 25923, *Bacillus cereus* ATCC 11778, *Pseudomonas aeruginosa* ATCC 27853 and *Candida albicans* ATCC 90028, utilizations of protein and starch. Moreover, the strain expressed the ability to obstruct the Caco-2 cell adherence of three bacterial pathogens such as *E. coli*, *Salmonella* spp. and *Shigella* spp. with the percentages of inhibition ranged 52.13 to 74.39. For the preliminary safety tests, the strain was susceptible to 9 antibiotics and did not reveal alpha and beta haemolysis. The probiotic strain was prepared to be a potentially starter culture (about 10^8 cfu/ml) for FHBs. The strain provides a starter for controlled fermentation of FHBs gave better safety and quality than obtained without starter culture. At the end of 30 day fermentation, lactic acid increased from 0.05 to 1.98% (w/v). The maximum amount (5.76x10^9 cfu/ml) of *Lactobacillus* sp. increased significantly (*P*<0.05) at 15 days of fermentation. Methanol, fusel oils, harmful metabolites...
and food-borne pathogens were not detected during 7-180 days of fermentation period. The selected probiotic strain, *L. plantarum*, could be developed as an effective starter culture for Thai FHBs products. The probiotic *L. plantarum* strain will be developed in further work as easy form of starter culture for Thai functional FHBs manufacturing.

---

**170. Evaluation of Rifaximin Therapy in the Medical Intensive Care Unit**

Ittiporn Chuatrisorn¹, PharmD, MCP, BCPS; Jeffrey P. Gonzales², PharmD, BCPS, FCCM; Asha L. Tata¹, PharmD, BCPS; Leah S. Millstein³, MD; Mangla Gulati³, MD

¹University of Maryland Medical Center, ²University of Maryland School of Pharmacy, ³University of Maryland School of Medicine; Baltimore, MD

**Purpose:** Approximately 5.5 million patients, their families, and healthcare providers bear the burden of chronic liver disease (CLD) in the United States. Hepatic encephalopathy (HE) is a complication that occurs in people with advanced cirrhosis or severe liver damage. Antibiotics have been used to decrease ammonia by reducing the growth of intestinal bacteria. Rifaximin exhibits a high tolerability profile and low clinical drug interactions compared to other antibiotics for treatment of HE. Based on direct observation, the majority of patients admitted to the medical intensive care unit (MICU) at the University of Maryland Medical Center (UMMC) for HE are started on rifaximin therapy. However, due to a lack of data, rifaximin’s place in therapy for the treatment of HE is yet to be determined. In addition, no studies have assessed the pattern of rifaximin use. This study will describe the population administered rifaximin in the MICU.

**Methods:** The study was a retrospective chart review from July 1, 2011 to June 30, 2013. This study included adult patients initiated on rifaximin therapy, during their MICU admission. Data collection included patient demographics, etiology of CLD, disease severity, pertinent laboratory data, HE participating factors, rifaximin regimen, and patient outcomes. Statistical analysis will be performed with Microsoft Excel and SPSS software version 11.5 (SPSS, Chicago, IL).

**Results:** Data collection is in progress. The results will be presented at the meeting.

**Conclusions:** This study will describe the utilization of rifaximin therapy in the MICU population and outcomes of these patients.
School Posters

These posters highlight international activities at the member schools of the US-Thai Consortium for Development of Pharmacy Education in Thailand. A representative from each school will be present at the posters to promote discussion of potential activities. The host school will provide a table with hard copy materials for distribution.

Thursday, May 29 (#201-214) - 11:45 a.m. -1:00 p.m.

201. Chang Mai University
202. Chulalongkorn University Drug and Health Products Innovation Promotion Center and Its Role in Pharmacy Student Experiential Program
203. Chulalongkorn University - Medicinal Plant and Natural
204. Chulalongkorn University - Professional and Graduate Studies
205. Chulalongkorn University - Students Activities and Supports
206. Eastern Asia University
207. Huachiew Chalermprakiet University
208. Khon Kaen University
209. Mahasarakham University
210. Mahidol University
211. Naresuan University
212. The Ohio State University
213. Prince of Songkla University
214. Rangsit University

Friday, May 30 (#215-228) - 11:45 a.m. -1:00 p.m.

215. Siam University
216. Silpakorn University
217. Srinakharinwirot University
218. Thammasat University
219. Ubon Ratchathani University
220. University of Colorado
221. University of Florida
222. University of Kentucky
223. University of Utah
224. University of Washington
225. University of Wisconsin - The First International Fellowship Program in Health-System Pharmacy Administration
226. University of Wisconsin - The International Pharmacy Education Training and Education Research Fellowship Program
227. Walailak University
228. West Virginia University
<table>
<thead>
<tr>
<th>Given Name</th>
<th>Surname</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uraiwan</td>
<td>Akanit</td>
<td>University of Maryland, Baltimore/ Ubon Ratchathani University</td>
</tr>
<tr>
<td>Robert</td>
<td>Beardsley</td>
<td>University of Maryland, Baltimore</td>
</tr>
<tr>
<td>Robert</td>
<td>Brueggemeier</td>
<td>The Ohio State University</td>
</tr>
<tr>
<td>Malissa</td>
<td>Carroll</td>
<td>University of Maryland, Baltimore</td>
</tr>
<tr>
<td>Rebecca</td>
<td>Ceraul</td>
<td>University of Maryland, Baltimore</td>
</tr>
<tr>
<td>Weerachai</td>
<td>Chaijamorn</td>
<td>Siam University</td>
</tr>
<tr>
<td>Usa</td>
<td>Chaikledkaew</td>
<td>Mahidol University</td>
</tr>
<tr>
<td>Chanadda</td>
<td>Chinthammit</td>
<td>University of Arizona/ Chulalongkorn University</td>
</tr>
<tr>
<td>Ittiporn</td>
<td>Chuatrisorn</td>
<td>University of Maryland Medical Center</td>
</tr>
<tr>
<td>Heather</td>
<td>Congdon</td>
<td>University of Maryland, Baltimore</td>
</tr>
<tr>
<td>Andrew</td>
<td>Coop</td>
<td>University of Maryland, Baltimore</td>
</tr>
<tr>
<td>Wannisa</td>
<td>Dongtai</td>
<td>University of Maryland, Baltimore/ Ubon Ratchathani University</td>
</tr>
<tr>
<td>Natalie</td>
<td>Eddington</td>
<td>University of Maryland, Baltimore</td>
</tr>
<tr>
<td>Jan</td>
<td>Engle</td>
<td>University of Illinois at Chicago</td>
</tr>
<tr>
<td>Lee</td>
<td>Evans</td>
<td>Auburn University</td>
</tr>
<tr>
<td>Anjana</td>
<td>Fuangchan</td>
<td>Naresuan University</td>
</tr>
<tr>
<td>Andrew</td>
<td>Gillespie</td>
<td>Auburn University</td>
</tr>
<tr>
<td>Kristen</td>
<td>Helms</td>
<td>Auburn University</td>
</tr>
<tr>
<td>Kampanart</td>
<td>Huanbutta</td>
<td>Burapha University</td>
</tr>
<tr>
<td>Suppachai</td>
<td>Insuk</td>
<td>University of Wisconsin-Madison/ Naresuan University</td>
</tr>
<tr>
<td>Chris</td>
<td>Ireland</td>
<td>University of Utah</td>
</tr>
<tr>
<td>Bruce</td>
<td>Jarrell</td>
<td>University of Maryland, Baltimore</td>
</tr>
<tr>
<td>Lauren</td>
<td>Jonkman</td>
<td>University of Pittsburgh</td>
</tr>
<tr>
<td>Julie</td>
<td>Johnson</td>
<td>University of Minnesota</td>
</tr>
<tr>
<td>Dana</td>
<td>Joyce</td>
<td>University of Maryland, Baltimore</td>
</tr>
<tr>
<td>Paul</td>
<td>Jungnickel</td>
<td>Auburn University</td>
</tr>
<tr>
<td>Paiboon</td>
<td>Jungsuwadee</td>
<td>Roosevelt University</td>
</tr>
<tr>
<td>Juntip</td>
<td>Kanjanasilp</td>
<td>Mahasarakham University</td>
</tr>
<tr>
<td>Michael</td>
<td>Katz</td>
<td>University of Arizona</td>
</tr>
<tr>
<td>Sindhcrai</td>
<td>Keokitichai</td>
<td>Burapha University</td>
</tr>
<tr>
<td>Roongpetch</td>
<td>Keowkase</td>
<td>Srinakharinwirot University</td>
</tr>
<tr>
<td>Chris</td>
<td>Klimas</td>
<td>University of Maryland, Baltimore</td>
</tr>
<tr>
<td>David</td>
<td>Knapp</td>
<td>University of Maryland, Baltimore</td>
</tr>
<tr>
<td>Cynthia</td>
<td>Koh-Knox</td>
<td>Purdue University</td>
</tr>
<tr>
<td>Connie</td>
<td>Kraus</td>
<td>University of Wisconsin-Madison</td>
</tr>
<tr>
<td>Sarinee</td>
<td>Krittiyanunt</td>
<td>Rangsit University</td>
</tr>
<tr>
<td>Name</td>
<td>Institution</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Vithaya Kulsomboon</td>
<td>Chulalongkorn University</td>
<td></td>
</tr>
<tr>
<td>Alan Lau</td>
<td>University of Illinois at Chicago</td>
<td></td>
</tr>
<tr>
<td>Suzanne Lee</td>
<td>University of Washington</td>
<td></td>
</tr>
<tr>
<td>Areerut Leelathanalerk</td>
<td>University of Maryland, Baltimore/ Mahasarakham University</td>
<td></td>
</tr>
<tr>
<td>Donald Letendre</td>
<td>University of Iowa</td>
<td></td>
</tr>
<tr>
<td>Lisa Lebovitz</td>
<td>University of Maryland, Baltimore</td>
<td></td>
</tr>
<tr>
<td>Nanteetip Limpeanchob</td>
<td>Naresuan University</td>
<td></td>
</tr>
<tr>
<td>Earlene Lipowski</td>
<td>University of Florida</td>
<td></td>
</tr>
<tr>
<td>Rataya Luechapudiporn</td>
<td>Chulalongkorn University</td>
<td></td>
</tr>
<tr>
<td>Jodie Malhotra</td>
<td>University of Colorado</td>
<td></td>
</tr>
<tr>
<td>Kusawadee Maluangnon</td>
<td>Thammasat University</td>
<td></td>
</tr>
<tr>
<td>Sirada Maphanta</td>
<td>Naresuan University</td>
<td></td>
</tr>
<tr>
<td>Holly Mason</td>
<td>Purdue University</td>
<td></td>
</tr>
<tr>
<td>Ruth McLean-Foster</td>
<td>University of Maryland, Baltimore</td>
<td></td>
</tr>
<tr>
<td>Edward Moreton</td>
<td>University of Maryland, Baltimore</td>
<td></td>
</tr>
<tr>
<td>Jeanine Mount</td>
<td>Northeastern University</td>
<td></td>
</tr>
<tr>
<td>Daniel Mullins</td>
<td>University of Maryland, Baltimore</td>
<td></td>
</tr>
<tr>
<td>Surakit Nathisuwan</td>
<td>Mahidol University</td>
<td></td>
</tr>
<tr>
<td>Ruth Nemire</td>
<td>American Association of Colleges of Pharmacy</td>
<td></td>
</tr>
<tr>
<td>Wansamorn Ngamdee</td>
<td>University of Arizona</td>
<td></td>
</tr>
<tr>
<td>Mantiwee Nimworapapan</td>
<td>University of Arizona/ Chiang Mai University</td>
<td></td>
</tr>
<tr>
<td>Sven Normann</td>
<td>University of Florida</td>
<td></td>
</tr>
<tr>
<td>Jurairat Nunthanid</td>
<td>Silpakorn University</td>
<td></td>
</tr>
<tr>
<td>Gary Oderda</td>
<td>University of Utah</td>
<td></td>
</tr>
<tr>
<td>Boonsri Ongpipattanakul</td>
<td>Chulalongkorn University</td>
<td></td>
</tr>
<tr>
<td>Veronica Onorevole</td>
<td>Institute of International Education</td>
<td></td>
</tr>
<tr>
<td>Frank Palumbo</td>
<td>University of Maryland, Baltimore</td>
<td></td>
</tr>
<tr>
<td>Suthiporn Pattharachayakul</td>
<td>Prince of Songkla University</td>
<td></td>
</tr>
<tr>
<td>Thitima Pengsuparp</td>
<td>Chulalongkorn University</td>
<td></td>
</tr>
<tr>
<td>Sirirat Pimsuwan</td>
<td>Prince of Songkla University</td>
<td></td>
</tr>
<tr>
<td>Chanuttha Ploysamee</td>
<td>Mahasarakham University</td>
<td></td>
</tr>
<tr>
<td>Supatra Porasuphatana</td>
<td>Khon Kaen University</td>
<td></td>
</tr>
<tr>
<td>Pemmarin Potisarach</td>
<td>University of Maryland, Baltimore / Mahasarakham University</td>
<td></td>
</tr>
<tr>
<td>Nalinee Pradubyat</td>
<td>Rangsit University</td>
<td></td>
</tr>
<tr>
<td>Chutinun Prasitpuriprecha</td>
<td>Ubon Ratchathani University</td>
<td></td>
</tr>
<tr>
<td>Detpon Preechagoon</td>
<td>Khon Kaen University</td>
<td></td>
</tr>
<tr>
<td>Srisomporn Preeprame</td>
<td>Khon Kaen University</td>
<td></td>
</tr>
<tr>
<td>Chalermsri Pummangura</td>
<td>Siam University</td>
<td></td>
</tr>
</tbody>
</table>

98
<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eunice Pyon</td>
<td>Long Island University</td>
</tr>
<tr>
<td>Jeanette Roberts</td>
<td>University of Wisconsin-Madison</td>
</tr>
<tr>
<td>Magaly Rodriguez de Bittner</td>
<td>University of Maryland, Baltimore</td>
</tr>
<tr>
<td>Dhakrit Rungkitwattanakul</td>
<td>University of Maryland, Baltimore/ Siam University</td>
</tr>
<tr>
<td>Wandee Rungseevijitprapa</td>
<td>Ubon Ratchathani University</td>
</tr>
<tr>
<td>Melody Ryan</td>
<td>University of Kentucky</td>
</tr>
<tr>
<td>Duangkamon Sakloetsakun</td>
<td>Khon Kaen University</td>
</tr>
<tr>
<td>Sumon Sakolchai</td>
<td>Khon Kaen University</td>
</tr>
<tr>
<td>Rungpetch Sakulbumrungsil</td>
<td>Chulalongkorn University</td>
</tr>
<tr>
<td>Itsarawan Sakunrag</td>
<td>University of Wisconsin-Madison/ Naresuan University</td>
</tr>
<tr>
<td>Harmony Senko</td>
<td>University of Maryland, Baltimore</td>
</tr>
<tr>
<td>Fadia Shaya</td>
<td>University of Maryland, Baltimore</td>
</tr>
<tr>
<td>Jakkapan Sirithunyalug</td>
<td>Chiang Mai University</td>
</tr>
<tr>
<td>Chanthonrat Sithiwiwaran</td>
<td>Naresuan University</td>
</tr>
<tr>
<td>Douglas Slain</td>
<td>West Virginia University</td>
</tr>
<tr>
<td>Thanapat Songsak</td>
<td>Rangsit University</td>
</tr>
<tr>
<td>Phayom Sookaneknun</td>
<td>Mahasarakham University</td>
</tr>
<tr>
<td>Bernard Sorofman</td>
<td>University of Iowa</td>
</tr>
<tr>
<td>Marilyn Speedie</td>
<td>University of Minnesota</td>
</tr>
<tr>
<td>Suphat Subongkot</td>
<td>Khon Kaen University</td>
</tr>
<tr>
<td>Suchada Sukrong</td>
<td>Chulalongkorn University</td>
</tr>
<tr>
<td>Naeti Suksomboon</td>
<td>Mahidol University</td>
</tr>
<tr>
<td>Chuthamanee Suthisisang</td>
<td>Mahidol University</td>
</tr>
<tr>
<td>Wongwiwat Tassaneeyakul</td>
<td>Khon Kaen University</td>
</tr>
<tr>
<td>Stacy Taylor</td>
<td>University of Kentucky</td>
</tr>
<tr>
<td>Janet Teeters</td>
<td>American Society of Health-System Pharmacists</td>
</tr>
<tr>
<td>Sathitpong Thanaviriyakul</td>
<td>Chulalongkorn University</td>
</tr>
<tr>
<td>Thomas Thielke</td>
<td>University of Wisconsin-Madison</td>
</tr>
<tr>
<td>Songsak Thongsanit</td>
<td>Naresuan University</td>
</tr>
<tr>
<td>Pavich Tongroach</td>
<td>Ministry of Education</td>
</tr>
<tr>
<td>Siraprapa Tubtim</td>
<td>Huachiew Chalermprakiet University</td>
</tr>
<tr>
<td>Malinee Tuchinda</td>
<td>Rangsit University</td>
</tr>
<tr>
<td>Anan Udonbhornprabha</td>
<td>Eastern Asian University</td>
</tr>
<tr>
<td>Suwanna Vorarat</td>
<td>Srinakharinwirot University</td>
</tr>
<tr>
<td>Lane Wallace</td>
<td>The Ohio State University</td>
</tr>
<tr>
<td>Jinda Wangboonskul</td>
<td>Thammasat University</td>
</tr>
<tr>
<td>Chatchai Wattanapiromsakul</td>
<td>Walailak University</td>
</tr>
<tr>
<td>Salisa Westrick</td>
<td>Auburn University</td>
</tr>
<tr>
<td>Supakit Wongwiwatthanakrit</td>
<td>University of Hawaii at Hilo</td>
</tr>
<tr>
<td>Name</td>
<td>Wunsintaweekul</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Ilene</td>
<td>Zuckerman</td>
</tr>
</tbody>
</table>