

The Human Placenta Project (HPP)

Understanding Human Placental Structure and Function in Real Time

2nd Annual Meeting

Incorporating omics and imaging into the HPP



National Institutes of Health
Natcher Conference Center (Building 45)
Bethesda, MD
April 27–28, 2015

Meeting Goals

- To bring together a group of broad thinkers that includes technical subject matter experts, placental biologists, and clinicians to discuss the value and limitations of various omics and imaging methods to achieve HPP goals
- To include participants who have experience with technologies that have never been applied to placental assessment in hopes that novel solutions might emerge
- To leverage this breadth of expertise and perspectives to inform the broader project roadmap and prioritize steps for moving forward

Schedule of Events

Monday, April 27, 2015

Location: Ruth Kirschstein Auditorium and Breakout Rooms

8:30 – 9:00 am	Registration/Sign-in Poster Set-up	
9:00 – 9:20	Welcome, Introductions, and General Orientation	Alan Guttmacher Cathy Spong

Scientific Presentations:

Short talks providing a brief orientation to the topic and its relevance to the HPP

Location: Ruth Kirschstein Auditorium

9:20 – 9:50	Overview Lecture on Omics	John Tsang
9:50 – 10:20	Proteomics/Metabolomics	Lance Liotta
10:20 – 10:35	Break	
10:35 – 11:05	Genomics/Epigenomics	Kjersti Aagaard
11:05 – 11:35	Transcriptomics/MicroRNA	Yoel Sadovsky

11:35 am – 1:00 pm	Lunch, Posters, and Group Photograph	
1:00 – 1:30	Ultrasound	Alfred Abuhamad
1:30 – 2:00	MRI	Penny Gowland
2:00 – 2:30	Biological Sensors	Erica Forzani
2:30 – 2:45	Break	

Small Group Discussions:
In-depth discussions of each approach's value to the HPP: Strengths, weaknesses, and opportunities
Location: Breakout Rooms

2:45 – 4:45	Breakout Sessions (held in parallel) <i>Instructions to attendees at end of agenda</i>	
	<ul style="list-style-type: none"> • Proteomics/Metabolomics 1 (Balcony B) • Proteomics/Metabolomics 2 (Balcony C) • Genomics/Epigenomics 1 (Room A) • Genomics/Epigenomics 2 (Room F) • Transcriptomics/miRNA 1 (Room C) • Transcriptomics/miRNA 2 (Room G) • Imaging 1 (Room E1) <i>*Presentation of example US application with potential use for HPP</i> • Imaging 2 (Room E2) 	<p>Susan Fisher</p> <p>Lance Liotta</p> <p>Diana Bianchi</p> <p>Kjersti Aagaard</p> <p>Graham Burton</p> <p>Yoel Sadovsky</p> <p>Alfred Abuhamad *Harvey Kliman</p> <p>Penny Gowland</p>
4:45 – 5:00	Reconvene in Ruth Kirschstein Auditorium Preparation for Day 2	Alan Guttmacher Cathy Spong

Tuesday, April 28, 2015
Location: Ruth Kirschstein Auditorium

8:30 – 8:40 am	Day 2 Welcome and Outline of the Day	Alan Guttmacher Cathy Spong
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Breakout Reports and Large Group Discussion:
Plenary discussions guided by the listed discussion leader(s)

8:40 – 9:20	Proteomics/Metabolomics	Lance Liotta Susan Fisher
9:20 – 10:00	Genomics/Epigenomics	Kjersti Aagaard Diana Bianchi
10:00 – 10:40	Transcriptomics/miRNA	Yoel Sadovsky Graham Burton

10:40 – 10:50	Break	
10:50 – 11:30	Imaging	Alfred Abuhamad Penny Gowland
11:30 am – 12:00 pm	Blue Sky Group Discussion	Alan Guttmacher Cathy Spong
12:00 – 1:00	Lunch	

Scientific Presentations Lessons learned and future possibilities

1:00 – 1:30	Lessons from the Microbiome	David Relman
1:30 – 2:00	Lessons from the Human Genome Project	Alan Guttmacher
2:00 – 2:30	Advances in Cellular Imaging	Jennifer Lippincott-Schwartz

Roadmap Discussion:

- What needs to be done and in what order?
- Who are the necessary stakeholders?
- How does HPP fit into the larger placental biology picture and the mission of NICHD?

Group discussion leaders: Alan Guttmacher/Cathy Spong

2:30 – 3:00	First Steps: Prioritization of steps to move the project forward
3:00 – 3:30	Gaps: Discussion of gaps, required stakeholders, and possible solutions
3:30 – 4:00	Placing HPP into Clinical Practice: Exploring the potential and current barriers for incorporating the HPP into clinical practice

Workshop Outcomes

4:00 – 4:30	Summary Meeting takeaways and plans for moving forward	Alan Guttmacher Cathy Spong
4:30	Meeting Adjourns	

The overarching goals of the breakout sessions are to determine:

- The *current value* of the selected approach to the HPP
- The *potential value* of the approach in the future to the HPP
- The *urgent questions* to address in order to advance the HPP

Factors for consideration:

Cost/time-labor involved/technical feasibility/multiple sample sources/compliance/data quality/degree of variability/signal to noise and confounders/availability of validated bioinformatics/safety/ patient inconvenience/proven value in clinical diagnostics/etc.

General structure of the breakout sessions:

The breakout group will divide into small groups of 4–5 people to maximize participation. The groups will spend 1.5 hours answering the 4 high-level questions below. Each small group will write down up to 4 answers for each question on post-its (1 answer per post-it) and place them on the corresponding sheets around the room. During the last 30 minutes of the breakout session, the group leaders will guide the discussion to determine the key ideas that should be included in their breakout reports for the following day.

The four high-level questions:

1. What can we detect? How early in pregnancy can we detect it?
(*oxygenation, perfusion, glucose, etc.*)
2. What are the key technical challenges (especially early)?
 - Easy or hard to overcome?
 - Is there new tech that needs to be developed?
 - Is there any next big thing?
3. What are the key practical challenges?
(*cost, time, etc.*)
 - Easy or hard to overcome?
4. What is the overall value to the HPP?
 - Major strengths (Is there any field where it has been especially valuable for disease monitoring?)
 - Are there combinations of tech that would add value?
 - What are the urgent questions we need to address?

Additional questions are provided on the following pages to use as a guide to help inform the high-level questions.

What is the state of the technology?

- What is the current capability?
- What can we detect and how early can we do so? (what structures, details of perfusion, oxygenation, etc.)
- What are the key *technical* challenges for non-invasive assessment of the placenta in pregnant woman in vivo using MRI versus ultrasound versus other imaging modalities *especially at early times in gestation*? Are they easy or hard to overcome?
 - Resolution
 - Sensitivity
 - Motion artifacts
 - Variability
 - Data processing
 - Safety
 - Throughput
 - Standardization
- What are the key *practical* challenges to the imaging modalities? Are they easy or hard to overcome?
 - Cost in general or cost to obtain enough samples for reasonable statistical power
 - Intellectual property hurdles
 - Limits due to safety concerns and clinical guidelines
 - Patient acceptability (noise/time/discomfort/etc.)
 - Standardization across individual research groups
 - Lack of infrastructure for use in low resource settings
- Is there new technology that needs to be developed to improve the use of the imaging modality? (hardware/software/improved contrast agents/etc.)
- Is there any “next big thing” for this technology on the horizon?
 - Novel tech or combinations of tech (combined imaging or imaging plus something else?)

Is it feasible and cost-effective for use in the HPP?

- Do the costs (time/materials/labor) have an impact on feasibility/utility?
- Have they been dropping? Are they expected to drop?
- Will cost make it prohibitive to obtain enough samples to attain reasonable statistical power?

Overall Value for the HPP

- Is there an imaging technology that can be used right now to advance the goals of the HPP?
 - Are there combinations of imaging technologies that increase the likelihood of providing value to the HPP?
- Are there roadblocks we need to overcome that would increase the value of the technology for advancing the HPP?
- Are there banked images that could be leveraged immediately?
- What are the urgent questions that need to be addressed to determine the value of the technology for the HPP?

What is the state of the technology?

- Is the omic proving to be especially valuable across any field of science?
- What are the key *technical* challenges ?
 - Variability
 - Sensitivity
 - Signal/Noise Ratios
 - Sample quality/availability
 - Bioinformatics
 - Data standardization/comparison across individual research groups
 - Other?
- What are the key *practical* challenges to the imaging modalities?
 - Cost
 - Lack of infrastructure for use across low-resource settings
 - Intellectual property hurdles
 - Limits due to safety/ethical concerns and clinical guidelines including return of results
 - Patient acceptability (time/discomfort/etc.)
 - Would there be a limit to the number of samples that could be safely obtained?
 - Would sample collection be easy and likely acceptable to pregnant women?
 - Standardization across individual research groups
 - Other?
- Is there new technology that needs to be developed to improve the use of this omic? (sample prep/processing/data interpretation, etc.)
- Is there any “next big thing” for this omic on the horizon? (e.g., wearable sensors, continuous monitoring, etc.)

Has it been applied to the placenta?

- What studies have been done? If so, did they provide new insights? If not, why not? Has it been done only on delivered placentas, or is there potential for use during pregnancy?
- Are there biobanked samples that could be leveraged immediately to explore the value of this omic?

Is it feasible and cost effective for use in the HPP?

- Do the costs (time/materials/labor) have an impact on feasibility/utility?
- Have they been dropping? Are they expected to drop?
- Will cost make it prohibitive to obtain enough samples to attain reasonable statistical power?
- How would you rate this compared to other omics for HPP?
- Which one or two other omics are most important to combine with this one?

Overall Value for the HPP

- Can the technology be used right now to advance the goals of the HPP?
- Are there roadblocks we need to overcome that would increase the value of the technology for advancing the HPP?
- What are the urgent questions that need to be addressed to determine the value of the technology for the HPP?