# Summer Institute of Advanced Epidemiology and Preventive Medicine

**Exposure Assessment for Environmental Epidemiology Course – Summer Course 2013 Outline**

Sunday – Thursday (July 7th - July 12th)

14:00 to 18:30

Led by: Michael Brauer, PhD  
Israeli Collaborators: Chava Peretz, PhD; Itzhak Benenson, PhD; David Broday, PhD

Course Coordinator: Gali Cohen – co.gali@gmail.com

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Lecturer</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun, 7th</td>
<td>14:00-15:30</td>
<td>Michael Brauer</td>
<td>Overview: Exposure assessment in environmental health; Spatial and temporal variability; Intake fraction</td>
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<tr>
<td></td>
<td>16:00-17:30</td>
<td>Michael Brauer</td>
<td>Applications to epidemiology</td>
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<td></td>
<td>17:45-18:30</td>
<td>Michael Brauer &amp; Chava Peretz</td>
<td>Applications to risk assessment – <strong>group exercise in class</strong></td>
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<tr>
<td>Mon, 8th</td>
<td>14:00-15:30</td>
<td>Michael Brauer</td>
<td>Exposure modeling I: Exposure factors, time –activity, questionnaires</td>
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<td></td>
<td>16:00-17:30</td>
<td>Michael Brauer &amp; Itzhak Benenson</td>
<td>Exposure modeling II: Dispersion models, Geospatial models (Interpolation, Kriging, Co-kriging, Land use regression), Remote sensing</td>
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<tr>
<td></td>
<td>17:45-18:30</td>
<td>Michael Brauer &amp; Itzhak Benenson</td>
<td><strong>Computer exercise in class</strong></td>
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<tr>
<td>Tue, 9th</td>
<td>14:00-15:30</td>
<td>David Broday</td>
<td>Exposure measurement I: Environmental monitoring in Israel and various exposure assessment strategies</td>
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<td></td>
<td>16:00-17:30</td>
<td>Michael Brauer</td>
<td>Exposure Measurement II: Passive sampling, direct reading instrumentation, integrated exposure sampling, biomonitoring</td>
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<td></td>
<td>17:45-18:30</td>
<td>Michael Brauer</td>
<td><strong>Design your own exposure assessment</strong></td>
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<tr>
<td>Day, Date</td>
<td>Time</td>
<td>Instructor(s)</td>
<td>Topic</td>
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<tr>
<td>Wed, 10th</td>
<td>14:00-15:30</td>
<td>Michael Brauer</td>
<td>Residential exposures (Indoor-outdoor relationships, Indoor sources); Consumer products</td>
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<td></td>
<td>16:00-17:30</td>
<td>Chava Peretz</td>
<td>Determinants of exposure modeling – <strong>computer exercise</strong></td>
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<td></td>
<td>17:45-18:30</td>
<td>Michael Brauer</td>
<td><strong>Design your own exposure assessment</strong></td>
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<tr>
<td>Thurs, 11th</td>
<td>14:00-15:30</td>
<td>Chava Peretz</td>
<td>Exposure misclassification (impacts on exposure-response relationships); Study efficiency</td>
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<td></td>
<td>16:00-17:30</td>
<td>Chava Peretz</td>
<td>Examples of Israeli studies</td>
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<tr>
<td></td>
<td>17:45-18:30</td>
<td>Michael Brauer</td>
<td><strong>Design your own exposure assessment</strong></td>
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<tr>
<td>Fri, 12th</td>
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<td><strong>Final exam (For those who wish to receive academic credit for the course)</strong></td>
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**Notes:**
- **Computer Exercise:**
- **Design your own exposure assessment:**
- **Examples of Israeli studies:**
- **Final exam (For those who wish to receive academic credit for the course):**
Summer Course - Environmental Exposure Assessment for Epidemiological Studies

7th - 12th July, 2013

Led by: Michael Brauer, ScD (The University of British Columbia)
Israeli Collaborators: Chava Peretz, PhD (Tel-Aviv University); Itzhak Benenson, PhD (Tel-Aviv University); David Broday, PhD (Technion)

Description: The course will introduce classical, contemporary, and cutting-edge approaches to the estimation of human exposure to environmental agents as it relates to epidemiologic studies as well as risk assessment, regulatory compliance, exposure source/route apportionment, and susceptibility factors.

Qualitative and quantitative methods in exposure science will be covered, including surrogate measures, exposure modeling (themes: geographic information systems and geospatial data, land use regression, dispersion modeling) and biological markers of exposure, in addition to methodological concepts such as exposure measurement error and efficient study design. Emphasis will be placed on examples from air pollution but other media and environmental stressors will also be included. Thus, in lectures, review of literature, case studies and practical exercises, students will gain familiarity with exposure assessment concepts and methodology and their applications to environmental health.

Learning objectives: At the end of this this course participants should be able to:

1. Describe the general concepts of exposure assessment as applied to environmental health, including epidemiology, risk assessment and evaluation of product safety.
2. Explain common approaches (direct and indirect measurement, modeling, biomarkers) to assess exposures to environmental contaminants
3. Use geo-statistical approaches to develop a basic exposure assessment for an environmental hazard
4. Illustrate how routinely collected information on environmental contaminants and human behavior can be used to estimate exposure
5. Understand how to use simple measurements to directly assess exposure
6. Appreciate the role of exposure misclassification in environmental epidemiology
7. Design an exposure assessment strategy for a selected environmental hazard
Exercises: No advance preparation before the first class session is needed but if you are so inclined it may help you to think about these in advance – the exercises will be discussed in detail and explained during the class sessions and time will be provided to work through the exercises.

**Design your own exposure assessment (Tuesday July 9, Wednesday July 10, Thursday July 11)**

We work through some exposure assessment approaches together in class, using topics/scenarios/settings that students identify. Students should identify an exposure/source, health outcomes of interest and (if desired) an epidemiologic study design (with rationale for design)

- The more specifics that can be provided the better

- Submit a few sentences to michael.brauer@ubc.ca (We will have time to work through ~6 of these suggested scenarios during the course)

- Considering a maximum budget of ~$100,000 (see estimated costs) **we will work together as a class to design an exposure assessment strategy for this epidemiologic study.**

<table>
<thead>
<tr>
<th>Approach</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Questionnaire</td>
<td>10 x N</td>
</tr>
<tr>
<td>Physical Modeling</td>
<td>35,000</td>
</tr>
<tr>
<td>Personal monitoring</td>
<td>200 x N</td>
</tr>
<tr>
<td>Ambient monitoring</td>
<td>1000 x 1 month x 1 location</td>
</tr>
<tr>
<td>Biomonitoning</td>
<td>500 x N</td>
</tr>
<tr>
<td>GeoData/analysis</td>
<td>5,000 (existing data mapping/interpolation)</td>
</tr>
<tr>
<td>GeoData/analysis</td>
<td>20,000 (modeling)</td>
</tr>
</tbody>
</table>

N: sample size. Costs are hypothetical and generic. In reality these will vary considerably based on specific exposures, existing data/expertise, etc.
1. Warm-up Exercise (Sunday July 7):

- Consider the previous 24 hrs. For a hypothetical exposure to a contaminant in:
  - Air (Group 1)
  - Residential Water (Group 2)
  - Food (Group 3)
  - Household furnishings (Group 4)

- How did the factors indicated below impact exposure?

- Within your group, identify the suspected highest and lowest exposures in your group based on each factor that is relevant to the exposure? (e.g. if transportation distance and mode are important, who has the mode and longest/shortest transportation distance and what were these distances?)

Factors: Residential location, Transportation (Mode, Distance, Time), Work/school location, Type of work, Types of activities, Use of products, Activities (exercise/recreation, hobbies, tasks, etc.), Foods consumed, [Impact of age/demographics all of the above]

2. Applications in epidemiology (Sunday July 7):


For the above two examples of epidemiologic studies, we will review the exposure assessment approach (not necessary, but if you want you can read these in advance).

- Can you suggest possibilities for exposure misclassification?

- What modifications would you suggest to reduce this misclassification?
3. Applications in risk assessment (Sunday July 7):

- Make a source-receptor model for a complex exposure* and use it to produce estimates of exposure# for a risk assessment
  - Identify the major exposure pathways and routes
  - How would you expect exposures to differ between
    - A pregnant woman
    - A 2 yr old infant
  - What is the greatest source of uncertainty in your estimate?
  - Be sure to consider both levels in different media/microenvironments and behavioral exposure factors

- *Mercury (Groups 1,2)
- *Organophosphate pesticides (Groups 3,4) (you can choose to consider the full group of compounds or a specific pesticide such as chlorpyrifos or malathion)
  - #Minimally, identify the main factors that determine exposure levels and variability in exposure and identify possible data sources.
- # Ideally, prepare a rough quantitative estimate for pregnant women and 2 yr old infants

Background:

Mercury

- http://www.epa.gov/hg/exposure.htm

Pesticides

- http://www.epa.gov/opp00001/factsheets/riskassess.htm
4. Questionnaires (Monday July 8)

- You are asked to help assess exposure for a case control of myocardial infarction and the potential relationship with community noise amongst residents of Tel-Aviv.
- While you may have access to other sources of data (noise models, measurements – you can state your assumptions) one key tool for the exposure assessment is a questionnaire.
- Develop a mini-questionnaire (5-10 questions) to aid in the assessment exposure to important sources of noise in an urban area and provide a short explanation for the (inclusion of) each question.
- (do not worry about confounders and health outcomes, these are included in other portions of the questionnaire/study approaches)

5. Exposure Modeling II – in class computer exercise (Monday July 8). Details provided in class

6. Determinants of Exposure - in-class computer exercise (Wednesday July 10). Details provided in class.

Bibliography (*conceptual/background; #example)

….Not necessary to read! These are provide for you in case you want more detail or to follow up on course materials.


Course Lecturers

Michael Brauer, ScD

Michael Brauer is a Professor in the School of Population and Public Health at the University of British Columbia (UBC). He joined the UBC faculty in 1991 in the Department of Medicine and served as Director of the School of Environmental Health from 2003-2008. He currently serves as the Occupational and Environmental Health theme co-lead in SPPH and is Director of the Bridge Program, a strategic training fellowship program linking public health, engineering and policy. He also holds associate appointments in the Division of Respiratory Medicine and the Institute for Resources, Environment and Sustainability at UBC. Dr. Brauer received bachelor’s degrees in Biochemistry and Environmental Sciences from the University of California-Berkeley (1986) and a doctorate in Environmental Health from Harvard University (1990). He was a visiting scientist at the Institute of Environmental and Occupational Medicine at Arhus University in Denmark (1991), at the Institute for Risk Assessment Sciences at Utrecht University in The Netherlands (2000) and at the East-West Center in Hawaii, USA (2008). Dr. Brauer’s research emphasis is on the assessment of exposure and health impacts of air pollution, with specific interest in transportation-related and biomass air pollution. He has participated in monitoring and epidemiological studies throughout the world and served on advisory committees to the World Health Organization (WHO), the US National Academy of Sciences and Institute of Medicine, the Royal Society of Canada, the International Joint Commission and governments in North America and Asia. He is an Associate Editor of Environmental Health Perspectives.

Chava Peretz, PhD

Chava Peretz is a senior lecturer in the Department of Epidemiology, School of Public Health at Tel Aviv University. Dr. Peretz received bachelor’s degree in Mathematics and Statistics from Tel Aviv University (1976) and a PhD in Occupational and Environmental Health from the Institute for Risk Assessment Sciences at Utrecht University in The Netherlands (2003). She completed her postdoc in the Department of Occupational and Environmental Health at Washington University, Seattle, USA. She cooperates with the Porter School of Environmental studies at Tel Aviv University, the Ministry of Environmental Protection, the Environment and Health Fund and Maccabi Healthcare Services on issues in environment and health, and is a member of the editorial board of the Israeli Journal- Ecology and Environment. She also initiated a variety of workshops on environment and health issues. Dr. Peretz’s research emphasis is on air pollution and health outcomes (e.g. mortality, birth defects, cardio-pulmonary diseases) on climate change and health (e.g. mortality, foodborne infectious diseases) and on neuro-epidemiology, especially in Parkinson’s disease.