

## REDOX BIOLOGY IN HEALTH AND DISEASE



Redox Biology Center

## REDOX BIOLOGY IN HEALTH AND DISEASE

Monday August 29<sup>th</sup> to Friday September 20<sup>th</sup>  
Unidad de Posgrado, UNAM  
Instituto de Investigaciones Biomédicas, UNAM

### INSTRUCTORS

Dr. Ma. Eugenia Gonsebatt Bonaparte  
Departamento de Medicina Genómica y Toxicología Ambiental  
Instituto de Investigaciones Biomédicas  
[margen@unam.mx](mailto:margen@unam.mx)

Dr. Rodrigo Franco  
Redox Biology Center  
University of Nebraska-Lincoln  
[rfrancocruz2@unl.edu](mailto:rfrancocruz2@unl.edu)

Dr. Oleh Khalimonchuk  
Redox Biology Center  
University of Nebraska-Lincoln  
[okhalimonchuk2@unl.edu](mailto:okhalimonchuk2@unl.edu)

### AUDIENCE

This course is designed for 20-25 graduate students (Ph.D. or masters) to be enrolled. It is expected that students interested will have a research area/project somehow linked to Redox Biology. Students should have a general background on cell/molecular biology, biochemistry, physiology. It is not necessarily to be an expert in all the topics to be discussed. A basic background on oxidative stress and redox biology, or experience in this area is preferable as this course will provide an advanced overview of the subject. This course is registered as part of the **Posgrado en Ciencias Biológicas, Biología Experimental y Biomedicina**, but can be attended by students from other Graduate Programs and Institutions. This course involves some lectures and presentations in English by the students.

### COURSE OBJECTIVES

1. Provide a broad and advanced overview of redox-based biochemical processes (including energy generation, metabolism, oxygen transfer, cell signaling, gene regulation, protein modification, and enzyme catalysis) with an emphasis on recent progress.
2. Develop depth of knowledge regarding redox-active species and radicals, and antioxidant molecules and enzymes, and the roles for redox cofactors in structure and function of cellular macromolecules.
3. Overview the biochemical, molecular and genetic basis of redox-related diseases and therapeutics.
4. Introduce commonly utilized methods for redox biology research.
5. Integrate redox-related research topics and questions through the discussion or recent literature.

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### COURSE MATERIALS

1. Redox Biochemistry (by R Banerjee, Published by Wiley) Free Radical Biology and Medicine (by B Halliwell and JMC Gutteridge, Published by Oxford)
2. Redox Signaling and Regulation in Biology and Medicine (by CS Jacob and PG Winyard, Published by Wiley)
3. Oxidative Stress and Redox Regulation (by U Jacob and D Reichmann, Published by Springer)
4. Molecular Basis of Oxidative Stress (by FA Villamena, Published by Wiley)
5. Reference books: Any medium level biochemistry textbook (e.g., D Voet and JG Voet, 3<sup>rd</sup> edition; Lehninger, 5<sup>th</sup> edition)
6. Redox Biology Center educational resource: [http://genomics.unl.edu/RBC\\_EDU/](http://genomics.unl.edu/RBC_EDU/)
7. A Dropbox link to articles and course materials will be provided.  
[https://www.dropbox.com/sh/I9I7I79idh0272n/AABV\\_njCTyeTJrHJQjF8PtPRa?dl=0](https://www.dropbox.com/sh/I9I7I79idh0272n/AABV_njCTyeTJrHJQjF8PtPRa?dl=0)

### COURSE EVALUATION (100 POINTS = 10 GRADE)

(1) **One written multiple-choice final exam to be held on September 16<sup>th</sup>** (50 points)

(2) **One lead paper/topic discussion** (25 points):

- Everyone should read ALL the papers before coming to class including additional commentaries and supplementary information and be ready to actively participate in the discussion.
- Papers will be reviewed in 1 hr, and the discussion will be led by a student (each student leads one paper).
- The student that leads the discussion will present a review on background information and provide an introduction to the area of research (no more than 15 min) prior to starting the discussion of the paper. Paper assignments will be done at the initial meeting on August 8 (see calendar below). The leading student should prepare no more and no less than 9 full Figures (from the main manuscript or Supplementary Data) in a Power Point Presentation so that 9 students present the data individually. (the student is welcomed to select from the supplementary data those figures that he/she considers more important for the discussion).
- Throughout and at the end of the paper discussion, the leading student has to integrate the data published in other relevant papers with the manuscript revised, and this will also include:
  - Criticize data
  - Emphasize significance and impact of presented results.
  - Provide future research directions

(3) **Class participation** (25 points)

- Attendance of 80% required to pass the course
- Participation in the discussion of papers. Students will individually describe the data presented in the paper figures.

**IMPORTANT:** You must understand that this course requires a bit of reading and participation. The complete list of papers is given below so plan to read and prepare the papers thoroughly ahead of time for their active discussion or presentation, particularly when you have to lead the paper discussion. It is expected that you will spend August (before the course starts) working on the papers, taking and notes, so that the afternoon before the class you just review your notes.

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Discuss this in detail with your advisor. **Two papers will be discussed per day. If your plan to read them the night before, it is very unlikely that you will be ready to discuss them.**

Usually, a full afternoon should be dedicated per paper. "I did not read the papers" is not an excuse!!! Attend the initial Meeting (August 8<sup>th</sup>) to discuss class expectations, grading and paper assignments, or contact the instructors. All papers will be provided in a dropbox link, but you should be able to find them online and if not you should take initiative and contact the authors to provide you with a pdf copy that would include all supplementary data.

Certificates of Attendance will be given at the end of the course for all attendees (auditing or enrolled students) as long as they have attended the course (80%), participated in the class and discussion of manuscripts and obtained a pass grade in the exam (60% or correct answers). Only enrolled students will be required to lead and present a paper. Final grade will be given no later than one week after the final exam.

### COURSE CONTENT:

#### **Introduction to the Course** (*Dr. Franco*)

Course overview

#### **Redox-based biochemical process** (*Dr. Khalimonchuk*)

Evolution and redox-based biochemical reactions, Reduction/Oxidation Reactions, Oxygen metabolism & Mitochondria, Redox enzymes, Protein folding-disulfide bond, Cofactors, Fe-S clusters, Redox-active Inorganic elements

#### **Oxidative Stress and Antioxidant systems** (*Dr. Gonsebatt and Franco*)

Free Radicals, Reactive Species of Oxygen and Nitrogen, Glutathione, Ascorbate, Superoxide dismutase, Catalase, Protein Oxidation and Turnover, Lipid oxidation, Oxidative DNA-damage and Repair

#### **Redox Homeostasis and Signaling** (*Dr. Franco*)

Signal transduction pathways regulated by Hydrogen Peroxide, Nitric Oxide, Hydrogen Sulfide. Thiol-based oxidoreductases and Oxidative Post-translational Modifications.

#### **Redox-Related Diseases & Therapeutics** (*Dr. Franco*)

Host Defense, Cancer, Neurodegeneration, Diabetes, Aging and others. Programmed Cell Death Pathways. Combating disease – Research progress, Success and challenge in the clinics

#### **Methods in Redox Biology** (*Dr. Franco*)

Detection of reactive oxygen and nitrogen species. Use and determination of antioxidants. Redox Proteomics, Redox Metabolism and Redox Sensors. Determination of Redox Potential

### SCHEDULE AND LOCATION

This course will be held at the Unidad de Posgrado of the Universidad Nacional Autónoma de México. Circuito de Posgrado S/N, Coyoacán, Cd. Universitaria, 04510. Ciudad de México, México. This course is scheduled from **Monday to Friday 8.30-11.00 AM**, a break of 1 h and a second session from **12.00-2.30 PM**, for a 25 h of course in one-week, 65 h total. At the end of the course, a certificate of attendance and/or a grade will be provided according to the guidelines of the institution.

## REDOX BIOLOGY IN HEALTH AND DISEASE

The mini-symposium will be held at the Instituto de Investigaciones Biomédicas Sede del Tercer Circuito Exterior, Coyoacán, Cd. Universitaria, 04510. Ciudad de México.

<b>REDOX BIOLOGY IN HEALTH AND DISEASE COURSE</b> <b>Unidad de Posgrado, UNAM</b>	
<b>Schedule</b>	<b>Description</b>
<b>08/08/16</b> 9.00 AM-11.00 AM	Initial Meeting to discuss class expectations and grading <i>If you cannot attend this meeting you should contact the instructors for them to inform you about the specifics of the class.</i>
<b>29/08/16</b> 8.30 AM-11.00 AM	Course Overview ( <i>Dr. Franco</i> ) <b>“Redox-based biochemical processes”</b> ( <i>Dr. Khalimonchuk</i> )
11.00 AM-12.00 PM	Break
12.00-2.30 PM	Papers to be discussed 1. Martinez-Reyes I et al. (2016) TCA Cycle and Mitochondrial Membrane Potential Are Necessary for Diverse Biological Functions. <i>Mol Cell</i> . 61:199 2. Martelli A et al. (2015) Iron regulatory protein 1 sustains mitochondrial iron loading and function in frataxin deficiency. <i>Cell Metab</i> . 21:311
<b>30/08/16</b> 8.30 AM-11.00 AM	<b>“Redox-based biochemical processes”</b> ( <i>Dr. Khalimonchuk</i> )
11.00 AM-12.00 PM	Break
12.00-2.30 PM	Papers to be discussed 3. MacDonald G et al. (2014) Memo is a copper-dependent redox protein with an essential role in migration and metastasis. <i>Sci Signal</i> . 7(329):ra56. doi: 10.1126/scisignal.2004870. 4. Tsunoda S et al. (2014) Intact protein folding in the glutathione-depleted endoplasmic reticulum implicates alternative protein thiol reductants. <i>Elife</i> . 2014 29;3:e03421.
<b>31/08/16</b> 8.30 AM-11.00 AM	<b>“Oxidative Stress and Antioxidant systems”</b> ( <i>Dr. Gonsebatt, Dr. Franco</i> )
11.00 AM-12.00 PM	Break
12.00-2.30 PM	Papers to be discussed 5. Zucker SN et al. Nrf2 amplifies oxidative stress via induction of Klf9. <i>Mol Cell</i> . 53(6):916-28. 6. Bailey AP et al. Antioxidant Role for Lipid Droplets in a Stem Cell Niche of <i>Drosophila</i> . <i>Cell</i> . 163(2):340-53.
<b>01/09/16</b> 8.30 AM-11.00 AM	<b>“Oxidative Stress and Antioxidant systems”</b> ( <i>Dr. Franco</i> )
11.00 AM-12.00 PM	Break
12.00-2.30 PM	Papers to be discussed 7. Gad H et al. (2014) MTH1 inhibition eradicates cancer by preventing sanitation of the dNTP pool. <i>Nature</i> . 508(7495):215-21. 8. Wei N et al. (2014) Oxidative stress diverts tRNA synthetase to nucleus for protection against DNA damage. <i>Mol Cell</i> . 56(2):323-32.
<b>02/09/16</b> 8.30 AM-11.00 AM	<b>“Redox Homeostasis and Signaling”</b> ( <i>Dr. Franco</i> )
11.00 AM-12.00 PM	Break
12.00-2.30 PM	Papers to be discussed 9. Shao D et al. (2014) A redox dependent mechanism for regulation of AMPK activation by Thioredoxin1 during energy starvation. <i>Cell Metab</i> . 19(2):232-45.

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	10. Manček-Keber M et al. (2015) Toll-like receptor 4 senses oxidative stress mediated by the oxidation of phospholipids in extracellular vesicles. <i>Sci Signal.</i> 8(381):ra60. doi: 10.1126/scisignal.2005860.
<b>05/09/16</b> 8.30 AM-11.00 AM	<b>“Redox-Homeostasis and Signaling” (Dr. Franco)</b>
11.00 AM-12.00 AM	
	Break
	Papers to be discussed
12.00-2.30 PM	11. Hisatsune C et al. (2015) ERp44 Exerts Redox-Dependent Control of Blood Pressure at the ER. <i>Mol Cell.</i> 58:1015 12. Gurzov EN et al. (2014) Hepatic oxidative stress promotes insulin-STAT-5 signaling and obesity by inactivating protein tyrosine phosphatase N2. <i>Cell Metab.</i> 20(1):85-102.
<b>06/09/16</b> 8.30 AM-11.00 AM	<b>“Redox-Related Diseases &amp; Therapeutics” (Dr. Franco)</b>
11.00 AM-12.00 PM	
	Break
	Papers to be discussed
12.00-2.30 PM	13. Yee C et al. (2014) The intrinsic apoptosis pathway mediates the pro-longevity response to mitochondrial ROS in <i>C. elegans</i> . <i>Cell.</i> 2014 157(4):897-909. 14. Piskounova E et al. (2015) Oxidative stress inhibits distant metastasis by human melanoma cells. <i>Nature.</i> 527(7577):186-91.
<b>07/09/16</b> 8.30 AM-11.00 AM	<b>“Redox-Related Diseases &amp; Therapeutics” (Dr. Franco)</b>
11.00 AM-12.00 PM	
	Break
	Papers to be discussed
12.00-2.30 PM	15. Schreiner B et al. (2015) Astrocyte Depletion Impairs Redox Homeostasis and Triggers Neuronal Loss in the Adult CNS. <i>Cell Rep.</i> 12(9):1377-84. 16. Belenky P et al. (2015) Bactericidal Antibiotics Induce Toxic Metabolic Perturbations that Lead to Cellular Damage. <i>Cell Rep.</i> 13(5):968-80.
<b>08/09/16</b> 8.30 AM-11.00 AM	<b>“Methods in Redox Biology” (Dr. Franco)</b>
11.00 AM-12.00 PM	
	Break
	Papers to be discussed
12.00-2.30 PM	17. Paul BD et al. (2014) Cystathionine $\gamma$ -lyase deficiency mediates neurodegeneration in Huntington's disease. <i>Nature.</i> 509(7498):96-100. 18. Lewis CA et al. (2014) Tracing compartmentalized NADPH metabolism in the cytosol and mitochondria of mammalian cells. <i>Mol Cell.</i> 55(2):253-63.
<b>09/09/16</b> 8.30 AM-11.00 AM	<b>“Methods in Redox Biology” (Dr. Franco)</b>
11.00 AM-12.00 PM	
	Break
	Papers to be discussed
12.00-2.30 PM	19. Kirstein J et al. (2015) Proteotoxic stress and ageing triggers the loss of redox homeostasis across cellular compartments. <i>EMBO J.</i> 34(18):2334-49. 20. Menger KE et al. (2015) Fasting, but Not Aging, Dramatically Alters the Redox Status of Cysteine Residues on Proteins in <i>Drosophila melanogaster</i> . <i>Cell Rep.</i> 2015 11(12):1856-65.
<b>REDOX MINI-SYMPOSIUM</b> <b>Instituto de Investigaciones Biomedicas</b>	
<b>12/09/16</b> 8.45-9.00 AM	Opening
9.00-10.15 AM	<b>“Effect of antioxidant treatment on mitochondrial alterations in the experimental renal disease”</b>

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	Jose Pedraza-Chaverri, Facultad de Química UNAM
10.15-11.30 AM	<b>“Reactive oxygen species in fungal cell differentiation”</b> Jesús Aguirre Linares, Instituto de Fisiología Celular, UNAM
11.30 AM-12.00 PM	Break
12.00-1.15 PM	<b>“Air pollution particles and oxidative stress: implications in systemic toxicity”</b> Andrea de Vizcaya Ruiz, Departamento de Toxicología, CINVESTAV
1.15-2.30 PM	<b>“Biogenesis of oxidative phosphorylation complexes in mitochondria”</b> Xochitl Pérez Martínez, Instituto de Fisiología Celular, UNAM
<b>13/09/16</b> 9.00-10.15 AM	<b>“Cellular Redox regulation by HGF/c-Met: implications in liver diseases”</b> Luis Gomez Quiroz, Div. de Ciencias Biológicas y de la Salud, UAM Iztapalapa
10.15-11.30 AM	<b>“Physiological and pathological aspects of liver pro-oxidant activity”</b> Mauricio Díaz Muñoz, Instituto de Neurobiología, UNAM
11.30 AM-12.00 PM	Break
12.00-1.15 PM	<b>“Oxidative stress and aging: Is the free radical’s theory still valid?”</b> Mina Konigsberg, Div. de Ciencias Biológicas y de la Salud, UAM Iztapalapa
1.15-2.30 PM	<b>“Oxidative stress and inflammation in animal models of stress: therapeutic relevance of antioxidants”</b> Abel Santa Maria del Ángel, Instituto Nacional de Neurología y Neurocirugía
<b>14/09/16</b> 9.00 AM-10.15 AM	<b>“Neurotoxicity of arsenic exposure”</b> Ma. Eugenia Gonsebatt, Instituto de Investigaciones Biomédicas, UNAM
10.15-11.30 AM	<b>“Studying amyloid-<math>\beta</math>-copper interactions: Insights into redox properties and aggregation pathways”</b> Liliana Quintanar Vera, Departamento de Química, CINVESTAV
11.30 AM-12.00 PM	Break
12.00-1.15 PM	<b>“Reactive oxygen species, NADPH-oxidases and neuronal differentiation”</b> Julio Morán Andrade, Instituto de Fisiología Celular, UNAM
1.15-2.30 PM	<b>“Energy metabolism and oxidative stress in neurodegeneration”</b> Rodrigo Franco, Redox Biology Center, UNL
2.30-2.45 PM	Closing Remarks
<b>19/09/16</b> 8.30 AM-10.30 PM	Final Exam
11.30 AM	Delivery of Certificates

This course is supported partially by the Visiting Distinguished Professor program of the Mexican Academy of Sciences (AMC), the Mexico-EUA Science Foundation (FUMEC), Posgrado en Ciencias Biológicas UNAM, and the Redox Biology Center of the University of Nebraska-Lincoln.



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Estudiante	Email	Proyecto	Adscripción / Tutor	Oyente	Art #
Albarrán Ponce, Luis Ángel	<a href="mailto:guitar_poio@yahoo.com.mx">guitar_poio@yahoo.com.mx</a>	Respuesta a bajas dosis de radiación ionizante en un modelo de ratón	IIB ME Gonsebatt	*	
Bello Monroy, Oscar	<a href="mailto:obmbeuam@hotmail.com">obmbeuam@hotmail.com</a>	Efecto del Factor de Crecimiento de Hepatocitos contra la toxicidad inducida por Isoniazida y Rifampicina en un modelo de Tuberculosis Pulmonar Progresiva	UAM-I L Gomez-Quiroz		1
Bravo López, Miriam J	<a href="mailto:natsumi504@hotmail.com">natsumi504@hotmail.com</a>	Análisis de la variación genética y epigenética del DNA mitocondrial asociada con la obesidad y sus complicaciones metabólicas	INMEGEN S Canizales Quinteros		2
Clavijo Cornejo, Denise	<a href="mailto:dence_cc@hotmail.com">dence_cc@hotmail.com</a>	Enfermedades músculo-esqueléticas <b>No ha confirmado su lugar</b>	INR	*	
de la Fuente Muñoz, César Espino	<a href="mailto:cesarespinofm@hotmail.com">cesarespinofm@hotmail.com</a>	Evaluación de la fusión/fisión y déficit mitocondrial en terminales sinápticas de hipocampo, corteza y cerebelo en el ratón triple transgénico de la Enfermedad de Alzheimer	IIB C Arias		3
Espinosa, Alejandro	<a href="mailto:alexec2803@gmail.com">alexec2803@gmail.com</a>	Evaluación de nuevas estrategias anti-inflamatorias en el control de la patogénesis asociada a isquemia cerebral experimental murina	IIB El Scitutto Conde		4
Garrido Bazán, Verónica	<a href="mailto:vero_gb17@hotmail.com">vero_gb17@hotmail.com</a>	La función de las cinasas sensoras de estrés Saka y SrkA en la función y dinámica mitocondriales, y en la respuesta de daño al DNA en Aspergillus nidulans	IFC J Aguirre		5
Garza Lombó, Carla	<a href="mailto:carla.garza@gmail.com">carla.garza@gmail.com</a>	Participación de mTOR en el transporte de aminoácidos involucrados en la síntesis de glutatión (GSH) en el cerebro del ratón	IIB ME Gonsebatt		6
Garza, Raziél	<a href="mailto:razielgarza@gmail.com">razielgarza@gmail.com</a>	<b>No ha confirmado su lugar</b>			7
Langurén Ramírez, Gabriela	<a href="mailto:gabriela_engel29@hotmail.com">gabriela_engel29@hotmail.com</a>	<b>No ha confirmado su lugar</b>	IFC L Massieu	*	
López Rivera Cristina	<a href="mailto:cristinnalr@gmail.com">cristinnalr@gmail.com</a>	Variantes alélicas de riesgo y su asociación con salud perinatal	IIB ME Gonsebatt	*	
López Valdez, Nelly	<a href="mailto:nellylopezvaldez@gmail.com">nellylopezvaldez@gmail.com</a>	Estudio del desarrollo de tolerancia en el epitelio pulmonar; diferencias por sexo en un modelo murino	Medicina UNAM T F van der		8

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			Goes		
Maciel Ruiz, Jorge Alfonso	<a href="mailto:jmaciel.lp@gmail.com">jmaciel.lp@gmail.com</a>	Evaluación de los niveles de daño en el DNA derivados de la exposición a hidrocarburos aromáticos policíclicos presentes en las partículas suspendidas de la Ciudad de México	IIB ME Gonsebatt		9
Maya, Marisol	<a href="mailto:solml83@gmail.com">solml83@gmail.com</a>	<b>No ha confirmado su lugar</b>			10
Medina Ruíz, Gabriela Itzel	<a href="mailto:gabytze@ibt.unam.mx">gabytze@ibt.unam.mx</a>	Papel de las especies reactivas del oxígeno en la regulación del citoesqueleto	IFC J Morán	*	
Mora Zenil, Janeth	<a href="mailto:janethm@email.ifc.unam.mx">janethm@email.ifc.unam.mx</a>	Papel de las especies reactivas de oxígeno en la activación de las vías de señalización que participan en el crecimiento neurítico.	IFC J Morán		11
Montesinos Cruz, Veronica	<a href="mailto:veromcpuma@gmail.com">veromcpuma@gmail.com</a>	Homeostasis redox de la célula por la exposición a nanopartículas de oxido de cerio	CINVESTAV, A De Vizcaya Ruiz		12
Nelson Mora, Janikua	<a href="mailto:janikuanelson@gmail.com">janikuanelson@gmail.com</a>	Participación del transportador xCT en la excitotoxicidad por glutamato un modelo de exposición gestacional a As	IIB ME Gonsebatt		13
Palestino Domínguez, Mayrel	<a href="mailto:mayrelpalestinodominguez@gmail.com">mayrelpalestinodominguez@gmail.com</a>	Regulación del proceso de protección y reparación inducido por el factor de crecimiento de hepatocitos en un modelo murino de pancreatitis aguda	UAM-I L Gomez-Quiroz		14
Posadas Torrentera, Yanahi	<a href="mailto:yposadas@cinvestav.mx">yposadas@cinvestav.mx</a>	Mecanismos de desensibilización del NMDAR dependientes de la interacción cobre-proteína prion y su alteración por el péptido beta-amiloide	CINVESTAV L Quintanar		15
Silva Adaya, Daniela	<a href="mailto:dan04siad@hotmail.com">dan04siad@hotmail.com</a>	<b>No ha confirmado su lugar</b>	IIB ME Gonsebatt	*	
Simoni Nieves, Arturo	<a href="mailto:blues.style@hotmail.es">blues.style@hotmail.es</a>	Regulación transcripcional de cyba (p22phox), inducida por el factor de crecimiento de hepatocitos (HGF) acoplado a su receptor c-Met en hepatocitos de ratón	UAM-I L Gomez-Quiroz		16
Ugalde Muñiz, Perla	<a href="mailto:perlifa@hotmail.com">perlifa@hotmail.com</a>	Efecto de la inflamación sistémica crónica en la neuro inflamación y su contribución en la predisposición al daño por la neurotoxina	Medicina UNAM A Chavarría Krauser		17
Zaragoza Ojeda, Paola Montserrat	<a href="mailto:montse_zaragoza@hotmail.com">montse_zaragoza@hotmail.com</a>	Análisis de la expresión de los genes de la vía AhR por efecto del benzo(ghi)perileno en células bronquiales	Hospital Infantil de México		18



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		humanas	Federico Gómez F J Arenas Huertero		
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