Management and Funding of the Lab

The CBL is operated as part of the Radiation Emergency Assistance Center/Training Site (REAC/TS) of the Oak Ridge Institute for Science and Education (ORISE). The reestablishment of the CBL was funded by the U.S. Department of Energy's (DOE) National Nuclear Security Administration (NA-40) and the Office of Worker Safety and Health (EH-51), as well as the U.S. Nuclear Regulatory Commission.

REAC/TS is recognized as the established leader in the management of medical accidents involving radiation, both nationally and internationally. A team of leading experts in emergency management and radiation incident response, REAC/TS provides training and consultation to its clients, such as DOE and the Centers for Disease Control and Prevention.

ORISE is a DOE institute focusing on scientific initiatives to research health risks from occupational hazards, assess environmental cleanup, respond to radiation medical emergencies, support national security and emergency preparedness, and educate the next generation of scientists. ORISE is managed by Oak Ridge Associated Universities.

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About the Director

Dr. Gordon Livingston holds degrees from three universities including a Ph.D. in genetics from the University of Washington in Seattle, which was followed by a postdoctoral fellowship at the University of Nijmegen in the Netherlands in the field of radiobiology. Throughout his career his research interests have focused on human cytogenetic responses to environmental adversity. Dr. Livingston has over 25 years of experience in the field of clinical and radiation cytogenetics including environmental (Chernobyl), occupational (radiation workers), and medical (patients) exposures. Prior to coming to Oak Ridge to assume technical direction of the lab, Dr. Livingston served as an occupational and environmental health consultant specializing in human cytogenetics for the National Research Council/National Institute for Occupational Safety and Health.

Contact Information

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Cytogenetic Biodosimetry Laboratory

Oak Ridge, Tennessee

An International Emergency Resource for Radiation Dose Analysis

Managed by

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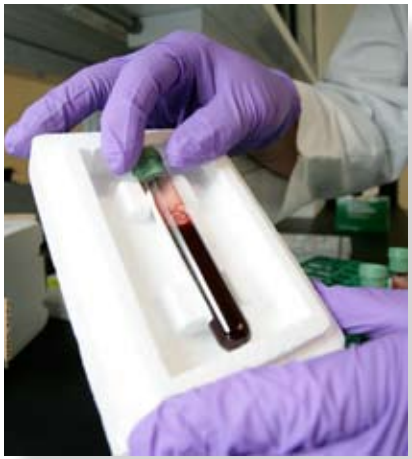
What is Cytogenetic Biodosimetry?

In the absence of a physical dosimetry device, estimating an individual's radiation dose requires some type of biological dosimeter. Cytogenetic biodosimetry can fill the gap.

- Ionizing radiation can cause genetic alterations that modify chromosomal DNA in humans and other organisms.
- Cytogeneticists carefully analyze blood cultures from exposed individuals to quantify chromosomal structural abnormalities that are biological indicators of radiation exposure.
- Accurate dose estimates are essential for physicians providing care and making life-saving decisions for patients.



The Need for a Lab

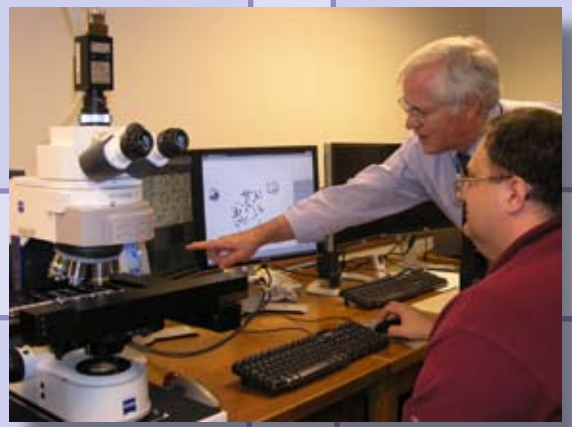
The use of radiation for medical, industrial, research, and other purposes raises the risk of accidental human exposure. In addition, the growing threat of nuclear terrorism increases the risk of deliberate use of radiological and nuclear materials to harm everyday citizens. The Cytogenetic Biodosimetry Laboratory (CBL)—one of only two federally funded facilities of its kind—has been reestablished to assist the medical community in the evaluation, triage, and management of victims with radiation injuries and to strengthen the nation's response to radiological terrorism. The lab works with physicians, hospitals, and other healthcare providers to give timely and accurate dose estimates resulting in more effective medical response for victims and their communities.

Cytogenetic Biodosimetry: The Process

Once the CBL receives blood samples, the analysis process involves several stages: culturing lymphocytes, harvesting cells from the cultures, staining chromosomes, and then microscopic analysis.

STEP 1. Lymphocytes from peripheral blood samples are cultured under sterile conditions in an incubator at 37°C for 48 hours, using a standard growth medium rich in vitamins, minerals, and other supplements.

STEP 2. During harvest, culture tubes are centrifuged and cells are re-suspended in a weak salt solution, which allows the chromosomes to separate and spread evenly on microscope slides.



STEP 3. Because human chromosomes are very small, it is necessary to magnify the actual images up to 1,000x in order to examine their structure. Staining allows them to be visible at this magnification. Slides are then mounted, using very thin glass cover slips, and prepared for microscopic analysis.

STEP 4. A cytogeneticist analyzes the chromosomal images for dicentrics, radiation-specific chromosomal aberrations. The number of dicentrics is directly related to the ionizing radiation dose. A dicentric chromosome is abnormal due to the presence of two centromeres rather than one. The centromere is the point where the two chromatids are connected.