Table of Contents

CONTENTS 1

COLLABORATING DEPARTMENTS AND INSTITUTIONS 4

ACKNOWLEDGEMENT OF SUPPORT 5

WEBSITES 5

DIRECTOR'S INTRODUCTION 6

STAFF NEWS 7

LABORATORY COLLOQUIA AND SEMINARS 8

STAFF LISTING 9

STAFF PHOTO 10

RESEARCH REPORTS

MICROBEAM DEVELOPMENT AND EXPERIMENTAL STUDIES

Automated Microbeam Observation Environment for Biological Analyses (AMOEBA)
Alan Bigelow, Matthew England, David Welch, and David J. Brenner 11

Real-Time Imaging and Measurement at the RARAF
Andrew D. Harken, Gerhard Randers-Pehrson, and David J. Brenner 14

Microfluidic Fluorescence-Activated Cell Sorting (microFACS) at RARAF
Andrew D. Harken, David Welch, Gerhard Randers-Pehrson, and David J. Brenner 16

Measuring Reactive Oxygen Species in Single Cells
Guy Garty, Mohammad Usman Ehsan, Jonathan V. Sweedler, and David J. Brenner 17

Single-Cell Raman Spectroscopy
Alan W. Bigelow, Manuela Buonanno, Quinn Matthews, and David J. Brenner 20

Development of a Microfluidic Device for Gene Expression Analyses of Single Cells
Hao Sun, Jing Zhu, Qiao Lin, Brian Ponnaiya, and Sally A. Amundson 22

Cell Impedance Detection within Microfluidics for Single Cell Dispensing
David Welch, Andrew D. Harken, Gerhard Randers-Pehrson, and David J. Brenner 24

A Mouse Ear Model for Microbeam-Induced Bystander Effects in vivo
Manuela Buonanno, Gerhard Randers-Pehrson, Lubomir Smilenov, Norman J. Kleiman, Erik Young, and David J. Brenner 26

The Neutron Microbeam
Yanping Xu 28

MOLECULAR STUDIES

Combination of Rad9 Downregulation with Ionizing Radiation Regulates ITGB1 Protein Levels
Constantinos G. Broustas and Howard B. Lieberman 30

Regulation of Neil1 Expression by Rad9 is Context Dependent
Sunil K. Panigrahi, Kevin M. Hopkins, and Howard B. Lieberman 33

Alpha Particle Irradiation Induces Alteration in Bystander Mouse Embryonic Stem Cells
Hongning Zhou, Roy Kong Kwan Lam, and Tom K. Hei 36

Vimentin and Notch as Biomarkers for Breast Cancer Progression
Gloria M. Calaf, Adayabalam S. Balajee, Maria T. Montalvo-Villagra, Mariana Leon, Navarrete M. Daniela, Raúl González Alvarez, Debasish Roy, Gopeshwar Narayan, and Jorge Abarca-Quinones 38

CELLULAR STUDIES

Far UVC (~200 nm): A Safe and Low-Cost Tool for Reducing Surgical Site Infections
Manuela Buonanno, Gerhard Randers-Pehrson, AlanW. Bigelow, Sheetal Trivedi, Franklin D. Lowy, Henry M. Spotnitz, Scott M. Hammer, and David J. Brenner 42

Effects of Fe Ion Particle Irradiation on Human Endothelial Barrier Structure and Function
Preety Sharma, Peter Guida, and Peter Grabham. 44

Radiation Response and Radiation-Induced Bystander Signaling in Human Glioblastoma Cells: Effects on Self-Renewal and Differentiation of Neural Stem Cells
Vladimir N. Ivanov and Tom K. Hei 47

Assaying Radiation-Induced Gene Expression Alterations as a Function of Sample Size
Brian Ponnaiya, Manuela Buonanno, Sally A. Amundson, and David J. Brenner 51

MODELING AND RISK

Potential Reduction of Contralateral Second Breast-Cancer Risks by Prophylactic Mammary Irradiation: Validation in a Breast-Cancer-Prone Mouse Model
Igor Shuryak, Lubomir B. Smilenov, Norman J. Kleiman, and David J. Brenner 54

Mathematical Modeling Predicts Enhanced Growth of X-Ray Irradiated Pigmented Fungi
Igor Shuryak, Ruth A. Bryan, Joshua D. Nosanchuk, and Ekaterina Dadachova 56

Sample Size for Estimating Effective Dose in a Cardiac CT Scan Study Using MOSFET Dosimiters
Andrew Einstein, Radoslaw Pieniazek, and Sigal Trattner 57

CENTER FOR HIGH-THROUGHPUT MINIMALLY-INVASIVE RADIATION BIODOSIMETRY

Gene Expression Responses to Internal ^{90}Sr Exposure in Mice
Sally A. Amundson, Waylon Weber, Melanie Doyle-Eisele, Sunirmal Paul, Raymond Guilmette, Dunstana Melo, and Shanaz A. Ghandhi 59

Extending Metabolomic Studies to Humans: Generation of a Radiation Signature in Urine from Individuals Exposed to Total Body Irradiation
Evagelia C. Laiakis, Tytus D. Mak, and Albert J. Fornace Jr. 62

Depletion and Recovery Kinetics of T and B Cells in C57BL/6 Mice Irradiated with γ-Rays
Erik Young, Antonella Bertucci, and Lubomir B. Smilenov 64

Assessment of Scattered Dose in Partial Body Irradiations
Radoslaw Pieniazek, Erik Young, and Lubomir B. Smilenov 65

Mapping the Dose Profile in a Capillary Irradiator Based on ^{90}Sr Sealed Sources
Guy Garty, Stephen Marino, and David J. Brenner 67

Very Low Dose *in vivo* X-Irradiation Increases γ-H2AX Foci in Lymphocytes of Young Children
Helen C. Turner, Brunhild M. Halm, Jennifer F. Lai, Vatche M. Zohrabian, Robert DiMauro, David J. Brenner, and Adrian A. Franke 68

High-Throughput Immunofluorescence Assay and Decay Kinetics of γ-H2AX in Multiple Individuals
Preety M Sharma, Brian Ponnaiya, Maria Taveras, Helen Turner, and David J. Brenner 70

A Microfluidic Device for High-Throughput γH2AX Biodosimetry
Preety Sharma, Mikhail Repin, and David J. Brenner 73

Broad-Energy Neutron Facility to Simulate Exposure from an Improvised Nuclear Device
Yanping Xu, Gerhard Randers-Pehrson, and Stephen A. Marino 76

Multicolor FISH Analysis of Ionizing Radiation Induced Micronuclei Formation in Human Lymphocytes
Adayabalam S. Balajee, Antonella Bertucci, Maria Taveras, and David J. Brenner 78

The Use of Biotech Robots for High-Throughput Preparation of Biodosimetry Samples
Mikhail Repin, Sergey Pampou, Stanley Lue, Helen C. Turner, Guy Garty, and David J. Brenner 81

THE RADIOLOGICAL RESEARCH ACCELERATOR FACILITY – an NIH-Supported Resource Center
Dir., David J. Brenner, PhD, DSc; Assoc. Dir. Gerhard Randers-Pehrson, PhD; Mgr., Stephen A. Marino, MS

Research using RARAF 84

Development of Facilities 88

Singletron Utilization and Operation 93

Training 93

Dissemination 95

Personnel 95

Recent Publications of Work Performed at RARAF 96

PUBLICATIONS 98