

SUBMISSION DEADLINE DATE  
 5/1/2001



033955  N  
 AGREEMENT  P/NB  
 NUMBER  C  
 S

**TRANSMITTAL AND APPROVAL FORM FOR GRANTS & CONTRACTS**

1. PROJECT TITLE: Effects of nonuniform distributions of radioactivity			
2. PRINCIPAL INVESTIGATOR: Roger W. Howell, Ph.D.		DEPT: Radiology	PHONE: 5067
3. FUNDING AGENCY: USPHS			
4. AGENCY PROGRAM TITLE: NCI		PROJECT AMOUNT: \$1,222,268	PROJECT START DATE: 7/1/2000
5. PURPOSE: <input checked="" type="checkbox"/> RESEARCH <input type="checkbox"/> SERVICE <input type="checkbox"/> TRAINING/EDUCATION <input type="checkbox"/> RESEARCH/SERVICE <input type="checkbox"/> PLANNING			
7. TYPE: <input type="checkbox"/> NEW APPLICATION <input type="checkbox"/> COMPETING <input type="checkbox"/> SUPPLEMENT <input type="checkbox"/> REVISION <input type="checkbox"/> OTHER <input checked="" type="checkbox"/> NON-COMPETING <input type="checkbox"/> RESUBMISSION <input type="checkbox"/> MODIFICATION <input type="checkbox"/> SUBCONTRACT			
8. HUMAN SUBJECTS:	<input checked="" type="checkbox"/> NO; <input type="checkbox"/> PENDING;	<input type="checkbox"/> APPROVED ON: / /	PROTOCOL NO.:
9. ANIMALS:	<input checked="" type="checkbox"/> NO; <input type="checkbox"/> PENDING;	<input type="checkbox"/> APPROVED ON: / /	PROTOCOL NO.:
10. RADIOISOTOPES:	<input type="checkbox"/> NO; <input type="checkbox"/> PENDING;	<input checked="" type="checkbox"/> APPROVED ON: 12 / 15 / 99	PROTOCOL NO.: 108
11. BIOHAZARDS:	<input checked="" type="checkbox"/> NO; <input type="checkbox"/> PENDING;	<input type="checkbox"/> APPROVED ON: / /	PROTOCOL NO.:
12. RECOMBINANT DNA:	<input checked="" type="checkbox"/> NO; <input type="checkbox"/> PENDING;	<input type="checkbox"/> APPROVED ON: / /	PROTOCOL NO.:

**NEED FOR COMMITMENT OF ADDITIONAL INSTITUTIONAL RESOURCES (BEYOND GRANT / CONTRACT BUDGET REQUEST)**

- 1. SALARIES  NO  YES
- 2. LABORATORY SPACE/OFFICE SPACE/OTHER SPACE  NO  YES
- 3. MECHANICAL, ELECTRICAL, PLUMBING (HVAC) SERVICES  NO  YES
- 4. SPACE ALTERATION OR RENOVATION  NO  YES
- 5. MAJOR EQUIPMENT  NO  YES
- 6. HOSPITAL/MENTAL HEALTH SERVICES/FACILITIES  NO  YES
- 7. RESEARCH INCLUDES, AFFECTS OR IMPACTS URBAN/MINORITIES  NO  YES

NOTE: IF ANSWER IS "YES" TO ONE OR MORE OF THESE, ATTACH SHEET(S) PROVIDING DETAILS, INCLUDING WHO WILL PAY COSTS OF PROVIDING SERVICES. DOCUMENT, FOR ITEMS 5 AND 6, APPROVAL BY THE RESPONSIBLE CHIEF(S) OR SERVICE AND HOSPITAL/MENTAL HEALTH ADMINISTRATION.

**REVIEW AND APPROVAL PROCESS**

	DATE IN	DATE OUT		DATE IN	DATE OUT
1. PRINCIPAL INVESTIGATOR / PROGRAM DIRECTOR	4/25	4/25	5. VP LEGAL MANAGEMENT (IF REQ'D)		
2. DEPARTMENT CHAIR/UNIT HEAD	4/25		6. VP FINANCE/CHIEF FINANCIAL OFFICER (IF REQ'D)		
3. MANAGER, GRANTS & CONTRACTS	4/25/01	4/25/01			
4. DEAN / ASSOCIATE DEAN/UNIT HEAD	4/25/01	4/26/01			

A-00951

# Application for Continuation Grant

Review Group <b>RAD</b>	Type <b>5</b>	Activity <b>R01</b>	Grant Number <b>CA83838-02</b>
Total Project Period			
From: <b>07/01/2000</b>		Through: <b>06/30/2005</b>	
Requested Budget Period			
From: <b>07/01/2001</b>		Through: <b>06/30/2002</b>	

To be verified by applicant. Check information in Items 1 through 6. If incorrect, furnish correct information in Item 13.

1. TITLE OF PROJECT  
**EFFECTS OF NONUNIFORM DISTRIBUTIONS OF RADIOACTIVITY**

2a. PRINCIPAL INVESTIGATOR OR PROGRAM DIRECTOR (Name and address, street, city, state, zip code)  
**HOWELL, ROGER W  
UNIV OF MED & DENTISTRY OF NJ  
DEPT OF RADIOLOGY  
185 S ORANGE AVE  
MSB F 451 NEW JERSEY MED SCHOOL  
NEWARK, NJ 07103**

4. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)  
**UNIV OF MED & DENTISTRY OF NJ  
NEW JERSEY MEDICAL SCHOOL  
185 SOUTH ORANGE AVE  
NEWARK, NJ 07103-2714**

2b. E-MAIL ADDRESS  
**rhowell@umdnj.edu**

5. ENTITY IDENTIFICATION NUMBER  
**1221775306A2**

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT  
**RADIOLOGY**

2d. MAJOR SUBDIVISION  
**NEW JERSEY MEDICAL CENTER**

3. ORGANIZATIONAL CODE  
**01 SCHOOL OF MEDICINE**

6. TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL  
**MANAGER GRANTS AND CONTRACTS  
30 BERGEN ST  
NEWARK, NJ 07103-3000**

E-MAIL ADDRESS **grants\_newark@umdnj.edu**

Complete the following (see instructions).

7. HUMAN SUBJECTS

7a. If Yes, Exemption no.  or IRB approval date  Full IRB or  Expedited Review

7b. Assurance of compliance no.

8. VERTEBRATE ANIMALS

8a. If "Yes," IACUC approval date  No  Yes

8b. Animal welfare assurance no.

9. COSTS REQUESTED FOR NEXT BUDGET PERIOD  
9a. Direct \$ **157,500** 9b. TOTAL \$ **247,275**

10. INVENTIONS AND PATENTS (See instructions)

No  Yes If "Yes,"  Previously reported  Not previously reported

11. PERFORMANCE SITE(S) (Organizations and addresses)  
**UMDNJ New Jersey Medical School  
Department of Radiology  
185 South Orange Ave., Newark, NJ 07103**

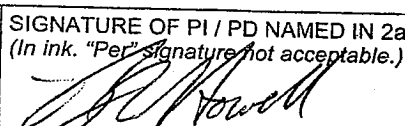
12a. PRINCIPAL INVESTIGATOR OR PROGRAM DIRECTOR (Item 2a) <b>Roger W. Howell, Ph.D</b>	AREA CODE <b>973</b>	TELEPHONE NO. AND FAX NO. <b>972-5067 972-6474</b>
12b. NAME OF ADMINISTRATIVE OFFICIAL (Item 6) <b>MR. RICHARD WAGNER</b>	<b>973</b>	<b>972-6456 972-3425</b>
12c. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION (Item 15) <b>NEIL S. CHERNIACK, MD, DIRECTOR RESEARCH AND CLINICAL AFFAIRS</b>	<b>973</b>	<b>972-7766 972-3585</b>

E-MAIL ADDRESS **cherniac@umdnj.edu**

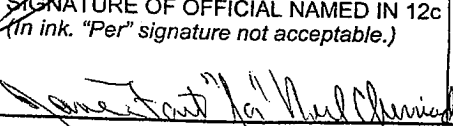
13. USE THIS SPACE FOR CORRECTIONS TO ITEMS 1 THROUGH 6. INDICATE THE NUMBER(S) WHERE ANSWERS APPLY.

A-00952

14. PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR ASSURANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. I agree to accept responsibility for the scientific conduct of the project and to provide the required progress reports if a grant is awarded as a result of this application.

SIGNATURE OF PI / PD NAMED IN 2a (In ink. "Per" signature not acceptable.)  DATE **4/25/2001**

15. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge. I accept the obligation of comply with Public Health Service terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 12c (In ink. "Per" signature not acceptable.)  DATE **4/26/01**

DETAILED BUDGET FOR NEXT BUDGET PERIOD--DIRECT COSTS ONLY		FROM	THROUGH	GRANT NUMBER		
PERSONNEL (Applicant Organization Only)		TYPE APPT. (months)	% EFFORT ON PROJ.	DOLLAR AMOUNT REQUESTED (omit cents)		
NAME	ROLE ON PROJECT			SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Roger W. Howell, Ph.D.	Principal Investigator	12	25	21,915	5,479	27,394
Dandamudi V. Rao, Ph.D.	Investigator		5			
Anupam Bishayee, Ph.D.	Research Associate	12	100	37,254	9,314	46,568
Marek Lenarczyk, Ph.D.	Postdoctoral Fellow	12	100	29,832	7,987	37,819
Helene Z. Hill, Ph.D.	Investigator	12	5	5,600	1,400	7,000
<b>SUBTOTALS</b> →				<b>94,601</b>	<b>24,180</b>	<b>118,781</b>
CONSULTANT COSTS						
EQUIPMENT (Itemize)						
SUPPLIES (Itemize by category)						
						19,240
TRAVEL						3,120
PATIENT CARE COSTS		INPATIENT				
		OUTPATIENT				
ALTERATIONS AND RENOVATIONS (Itemize by category)						
OTHER EXPENSES (Itemize by category)						
						16,359
<b>SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD</b>						<b>157,500</b>
CONSORTIUM/CONTRACTUAL COSTS		DIRECT COSTS				
		FACILITIES AND ADMINISTRATION COSTS				
<b>TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD (Item 9a, Face Page)</b> →						<b>157,500</b>

<b>PROGRESS REPORT SUMMARY</b>		GRANT NUMBER R01 CA83838	
PRINCIPAL INVESTIGATOR OR PROGRAM DIRECTOR Roger W. Howell, Ph.D.		PERIOD COVERED BY THIS REPORT	
APPLICANT ORGANIZATION UMDNJ - New Jersey Medical School		FROM 07/01/2000	THROUGH 06/30/2001
TITLE OF PROJECT (Repeat title shown in Item 1 on first page)			

- a. Human Subjects (Complete Item 7 on the Face Page)  
 Use of Human Subjects     Change     No Change Since Previous Submission
- b. Vertebrate Animals (Complete Item 8 on the Face Page)  
 Use of Vertebrate Animals     Change     No Change Since Previous Submission

(SEE INSTRUCTIONS)

Has there been a change in the other support of key personnel since the last reporting period? (If yes, explain the changes, if no state so.) NO.

Will there be, in the next budget period, significant rebudgeting of funds from what was approved for this project? (If yes, please explain; if no, so state.) NO

Will there be, in the next budget period, a change in the level of effort for key personnel from what was approved for this project? (Significant change in level is defined as a reduction of 25% or more of your stated commitment.) NO

Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25 percent of the current year's total budget? NO

GENDER AND MINORITY INCLUSION					Study Title		
Provide the number of subjects enrolled in the study <i>to date</i> (cumulatively since the most recent competitive award) according to the following categories. (See Page 8 for definitions.) If there is more than one study, provide a separate table for each study. In addition, report on the subpopulations which are included in the study.					>		
	American Indian or Alaskan Native	Asian or Pacific Islander	Black, not of Hispanic Origin	Hispanic			
Female							
Male							
Unknown							
TOTAL							

## Progress Report Summary

a. **Specific Aims.** No change

b. **Studies and Results.**

Substantial progress has been made toward achieving the Specific Aims outlined in our original proposal. As stated in the proposal, our work has commenced with detailed studies on two radiochemicals, namely tritiated thymidine ( $^3\text{HTdR}$ ) and  $^{125}\text{I}$ -labeled iododeoxyuridine ( $^{125}\text{IdU}$ ).

*$^3\text{HTdR}$  Studies.* Publication 1 details our progress with regard to assessing the effects of nonuniform distributions of  $^3\text{HTdR}$  in our multicellular cluster model. Briefly, Chinese hamster V79 cells were labeled with tritiated thymidine, mixed with unlabeled cells, and multicellular clusters (~1.6 mm in diameter) were formed by gentle centrifugation. The short-range  $\beta$  particles emitted by  $^3\text{H}$  impart only self-irradiation of labeled cells without significant cross-irradiation of unlabeled bystander cells. The clusters were assembled in the absence or presence of 10% dimethyl sulfoxide (DMSO), and/or 100  $\mu\text{M}$  lindane. DMSO is a hydroxyl radical scavenger, whereas lindane is an inhibitor of gap junctional intercellular communication. The clusters were maintained at 10.5°C for 72 h to allow  $^3\text{H}$  decays to accumulate, dismantled, and the cells were plated for colony formation. When 100% of the cells were labeled, the survival fraction was exponentially dependent on the mean radioactivity per labeled cell. A two-component exponential response was observed when either 50 or 10% of the cells were labeled (Fig. 2, Publication 1). Though both DMSO and lindane significantly protected the unlabeled or bystander cells when 50 or 10% of the cells were labeled, the effect of lindane was greater than that of DMSO (Table 1, Publication 1). In both cases, the combined treatment (DMSO + lindane) elicited maximum protection of the bystander cells. These results suggest that the bystander effects caused by nonuniform distributions of radioactivity are affected by the fraction of cells that are labeled. Furthermore, at least a part of these bystander effects are free radical-initiated and likely to be gap-junction mediated. Support for gap junction mediated bystander effects comes not only from the protection of bystander cells afforded by lindane, but also from flow cytometry data that is described in Publication 1. Functional gap junctional intercellular communication in V79 cells was demonstrated through the use of calcein AM dye and fluorescent activated cell sorting (Fig 5, Publication 1). Lindane has a pronounced impact on the communication observed. As stated in the proposal, these studies were planned as the initial studies to be carried out toward achieving Specific Aims 1, 2, and 4.

Studies aimed at achieving the goals outlined in Specific Aims 3 were also described in Publication 1. Specifically, the kinetics of intracellular  $^3\text{HTdR}$  was monitored during the entire experiment (Fig. 3, Publication 1) so that the number of intracellular decays and absorbed dose could be determined. This information was fed into our multicellular dosimetry model and it was calculated that the labeled cells received an absorbed dose that was about 140 times that received by the unlabeled cells.

*$^{125}\text{IdU}$  Studies.* As with  $^3\text{HTdR}$ , our three-dimensional tissue culture model was used to investigate the biological effects of nonuniform distributions of DNA-incorporated  $^{125}\text{I}$  in V79 cells. These studies are detailed in Publication 2. Cells were labeled with  $^{125}\text{I}$ -iododeoxyuridine, mixed with unlabeled cells, and multicellular clusters were formed by gentle centrifugation. Using our theoretical dosimetry computer code, we showed that the highly localized energy deposition caused by  $^{125}\text{I}$  decays results in very high equivalent doses delivered to the labeled cells and low equivalent doses delivered to the unlabeled cells. The clusters were assembled and then maintained at 10.5°C for 72 h to allow  $^{125}\text{I}$  decays to accumulate, dismantled, and the cells were plated for colony formation. When 100% of the cells were labeled, the survival fraction was exponentially dependent on the mean radioactivity per labeled cell (Fig. 1, Publication 2). A two-component exponential response was observed when either 50 or 10% of the cells were labeled (Fig. 2, Publication 2). These experimental data, coupled with theoretical dosimetry

calculations, indicate that bystander effects play an important role in the killing of unlabeled cells when nonuniform distributions of DNA-incorporated  $^{125}\text{I}$  are present.

#### **c. Significance.**

Predicting the biological effects of nonuniform distributions of radioactivity has been a persistent problem for decades that has hampered the ability of scientists to assess risks from inadvertent exposures to radioactivity and predict therapeutic outcome in the clinical use of radioactivity. This problem has been due in part to the lack of experimental models that allow one to create nonuniform distributions in a highly reproducible fashion, thereby allowing the collection of data required to develop useful theoretical models. The experimental data accrued over this past year will go a long way toward ultimately enhancing our capacity to predict the effects of nonuniform distributions of radioactivity. Among the experimental findings important to this goal is the fact that unlabeled bystander cells can suffer damage simply by being adjacent to cells that are labeled even though the unlabeled cells are not significantly irradiated. This dispels the long-standing notion that the effects of radiation are limited to those cells that are traversed by radiation and experience DNA damage as a consequence of the insult. Ultimately, it is anticipated that knowledge of these so-called bystander effects will have a pronounced impact on the modeling of biological response to radiation. Additionally, we have begun elucidating the mechanisms involved in these bystander effects. Our experiments show that the events leading to damage in bystander cells are initiated by free radicals and are mediated by gap junctional intercellular communication.

#### **d. Plans.**

In the coming year we plan to spend substantial effort on sorting the labeled and unlabeled cells so that biological effects can be monitored in each subpopulation. Our preliminary studies in this area have been quite successful and we do not anticipate any problems in achieving this very important portion of Specific Aim 4. We also will emphasize mutation studies that are an important component of Specific Aims 1 and 2. Experiments that delineate the mechanism of bystander cell death will also be undertaken as per Specific Aim 5. Finally, the Po-210 studies will be initiated to study the effects of nonuniform distributions of alpha particle emitting radionuclides.

#### **e. Publications.**

1. Bishayee, A., Hill, H. Z., Stein, D., Rao, D. V., and Howell, R. W. Free-radical initiated and gap junction-mediated bystander effect due to nonuniform distribution of incorporated radioactivity in a three-dimensional tissue culture model, *Radiat. Res.* 155: 335-344, 2001.
2. Howell, R. W. and Bishayee, A. Bystander effects caused by nonuniform distributions of DNA-incorporated  $^{125}\text{I}$ , *Micron*. In press, 2001.

#### **f. Project-Generated Resources.**

*Web Site.* The web site that was promised in the proposal has been set up in a preliminary fashion. The address is <http://www.umdj.edu/pixelweb/radiologyweb/> This site is only in its infancy and will be substantially revised over the next year with particular emphasis on inclusion of the raw experimental data obtained through this support. As stated in the proposal, the purpose of this raw data is to allow other scientists access to the data for use in theoretical modeling.

CHECKLIST

GRANT NUMBER

R01 CA83838

1. ASSURANCES/CERTIFICATIONS (See Instructions, Page 10)

The following assurances/certifications are made and verified by the signature of the OFFICIAL SIGNING FOR APPLICATION ORGANIZATION on the FACE PAGE of the application. If unable to certify compliance where applicable, provide an explanation and place it after this page.

•Human Subjects; •Vertebrate Animals; •Debarment and Suspension; •Lobbying; •Delinquent Federal Debt; •Research Misconduct; •Civil Rights (Form HHS 441 or HHS 690); •Handicapped Individuals (Form HHS 641 or HHS 690); •Sex Discrimination (Form HHS 639-A or HHS 690); •Age Discrimination (Form HHS 680 or HHS 690); •Financial Conflict of Interest.

2. PROGRAM INCOME (See Instructions, Page 10.)

All applications must indicate whether program income is anticipated during the period(s) for which grant support is request. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

3. FACILITIES AND ADMINISTRATION (F & A) COSTS

Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of forprofit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office. F&A costs will not be paid on foreign grants, construction

grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, and specialized grant applications.

DHHS Agreement dated: 6/14/99

No Indirect Costs Requested.

No DHHS Agreement, but rate established with \_\_\_\_\_

Date \_\_\_\_\_

CALCULATION\*

Entire proposed project period:

Amount of base \$ 157,500 x Rate applied 57 % = Indirect costs \$ 89,775

Add to total direct costs from form page 2 and enter new total on FACE PAGE, Item 9b.

\*Check appropriate box(es):

Salary and wages base

Modified total direct cost base

Other base (Explain below)

Off-site, other special rate, or more than one rate involved (Explain below)

Explanation (Attach separate sheet, if necessary.):

A-00957

**BIOGRAPHICAL SKETCH**

Give the following information for all *new* key personnel.  
Copy this page for each person.

NAME		POSITION TITLE	
Marek Lenarczyk		Post-doctoral fellow	
EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing. Include postdoctoral training.)			
INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
National Institute of Hygiene, Warsaw, Poland	Ph.D.	1988	Biology/radiobiology
University of Warsaw, Warsaw, Poland	M.Sc.	1980	Microbiology

RESEARCH AND PROFESSIONAL EXPERIENCE: Concluding with present position, list, in chronological order, previous employment, experience, and honors/ Include present membership on any Federal Government public advisory committee. List, in chronological order, the titles, all authors, and complete references to all publications during the past three years and representative earlier publications pertinent to this application. If the list of publications in the last three years exceeds two pages, select the most pertinent publications. DO NOT EXCEED TWO PAGES.

**RESEARCH AND PROFESSIONAL EXPERIENCES**

- 1998 - to present *National Institute of Hygiene, Warsaw, Poland, Research Assistant Professor*  
 1996- 1998 *Colorado State University, Fort Collins, Colorado, USA, Research Investigator.*  
 1995-1996 *University of Medicine and Dentistry of New Jersey, Newark, IAEA Fellow.*  
 1992-1994 *National Institute of Hygiene, Warsaw, Poland, Research Associate.*  
 1992 (Jan-Aug) *TNO-Institute of Applied Radiobiology and Immunology, Rijswijk, Netherlands. IAEA Fellow.*  
 1983- 1991 *National Institute of Hygiene, Warsaw, Poland, Research Assoc., Senior Research Assist, Resear*  
 1980-1982 *University of Warsaw, Warsaw, Poland, Graduate Assistant*

**FELLOWSHIPS AND ACADEMIC OR PROFESSIONAL HONORS**

- Non-Tenured Scientist Award to attend 11<sup>th</sup> International Congress of Radiation Research, Dublin, Ireland, July 18-23, 1999.  
 Student Travel Award to attend the Radiation Research Society/North American Hyperthermia Society Joint Annual Meeting, Louisville, Kentucky, April 25-29, 1998.  
 NASA Travel Award to attend 8th Annual Space Radiation Health Program investigators' Workshop, Brookhaven National Laboratory, Upton, New York, April 29-May 3, 1997.  
 International Atomic Energy Agency Fellow at the University of Medicine and Dentistry of New Jersey, Newark, New Jersey, USA, September, 1995-May, 1996.  
 Scientific Travel Award to attend the 10th International Congress of Radiation Research, Wurzburg, 1995.  
 Young Scientists Award to attend Joint Meetings of the European Society for Radiation Biology and the European Society for Hyperthermic Oncology, Amsterdam, Netherlands, 1994.  
 Rajchman's Scientific Award of the National Institute of Hygiene, Warsaw, Poland, 1994.  
 Young Scientists Travel Award to attend the 25th Annual Meeting of the European Society for Radiation Biology held at Stockholm, Sweden, 1993.  
 International Atomic Energy Agency Award to attend the IAEA/UNEP Seminar for Africa, Europe, the Middle East and the Mediterraen on Radiobiological Techniques in the Comparative Estimation of carcinogenic effects of Chemical Pollutants and Low-dose Radiation held at Nairobi, Kenya, 1992.  
 International Atomic Energy Agency Fellow at the TNO-Institute of Applied Radiobiology and Immunology, Rijswijk, The Netherlands, Jan.-Aug., 1992.  
 Scientific Award of the Polish Society for Radiation Research, Cracov, Poland, 1992.  
 Young Investigator Grant to attend the 8th International Congress of Radiation Research held in Edinburgh, Scotland, 1987.



## CURRENT PUBLICATIONS

- M. Lenarczyk**, S.M.Goddu, D.V.Rao, R.W. Howell (2000) Biologic dosimetry of bone marrow: Induction of micronuclei in reticulocytes after exposure to  $^{32}\text{P}$  and  $^{90}\text{Y}$ . *J.Nucl.Med.* 42, 162-169.
- M. Lenarczyk**, A.Ueno, D.B. Vannais, S.Kraemer, A.Kronenberg, J.R.Roberts, T.K.Hei, K. Tatsumi, C.A.Waldren (2000) Some effects of thiazolidine prodrugs on mutation by high LET radiations at the CD59 locus of human-hamster hybrid  $A_L$  cells. *Adv.Space.Res.* (submitted for publication)
- C.A.Waldren, A.Ueno, D.Vannais, S. Kramer S., **M. Lenarczyk**, Y.Zhang, A. Kronenberg, A.Davies, T. Hei (1999) A Brief Look at Some In Vitro Tests of Genotoxic Effects of Ionising Radiation: Experience with the AL-CD59 Assay. In: *Radiation Research, Congress Proceedings, 11<sup>th</sup> International Congress of Radiation Reserach*, Dublin, Ireland, July 18-23, vol.2, 527-530.
- M.Lenarczyk**, A.Ueno, D.Vannais, R.Warters, J.Roberts, A.Kronenberg, T.Hei, C.Waldren. Mutagenic effects of Fe-56 radiation on cultured mammalian cells. In: *Proceedings of the First Biennale Space Biomedical Investigators' Workshop*, January 11-11, 1999, Houston, Texas.
- Waldren C., Vannais D., Drabek R., Gustafson D., S. Kramer, **Lenarczyk M.**, Kronenberg A., Hei T., Ueno A. (1998) Analysis of mutant quantity and quality in human-hamster hybrid  $A_L$  and  $A_L$ -179 cells exposed to  $^{137}\text{Cs}$  gamma rays or HZE-Fe ions. *Adv.Space.Res.* 22(4), 579-585.
- Lenarczyk M.**, Slowikowska M.G., Majle T. (1997) Radiation induced adaptation in peripheral blood reticulocytes of mice. *Rocz.PZH*, 48(3), 239-244.

A-00959