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PRINCIPAL INVESTIGATOR: V. Craig Jordan, Ph.D.,D.Sc.

CONTRACTING ORGANIZATION: Northwestern University Medical School
Chicago, Illinois 60611

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Chicago, Illinois 60611

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The Robert H. Lurie Cancer Center at Northwestern University is an NCI-funded comprehensive cancer center. The Cancer Center has made significant advances in developing a premier breast cancer program. In September, 1994, the Cancer Center received a four year award from the US ARMY for comprehensive training of graduate students conducting breast cancer relevant research entitled, "Molecular Biology of Breast Neoplasia". This program has successfully trained 12 predoctoral students and 3 postdoctoral fellows, 14 of who are still actively pursuing research careers. Trainees were exposed to the latest developments in breast cancer biology and treatment. Students received laboratory training with senior basic science faculty and clinical investigators provided a translational link. Members of the program participated in a weekly Journal Club and a monthly breast cancer research meeting to augment their research training. The publication record of the trainees is indicative of the success of the Training Grant. The instruction received by the trainees puts them in an ideal position to contribute to advancements in the treatment and prevention of breast cancer.

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Introduction

The Robert H. Lurie Cancer Center has been funded by a cancer center support grant from the National Cancer Institute since 1993. The mission of the Cancer Center is to promote clinical and laboratory research at the Northwestern Medical School and its five affiliated hospitals and in the basic science departments located on the Evanston Campus. The Cancer Center strives for excellence in cancer research, prevention, diagnosis, treatment and rehabilitation, as well as in education of scientists, health professionals and the community. The Cancer Center is dedicated to encourage the rapid application of new technology to patient care. The affiliated hospitals of Northwestern treat a total of more than 5,000 cancer patients per year.

Since 1993, the Lurie Cancer Center has made significant advances in developing a premier Breast Cancer Research Program at Northwestern University. In October, 1993, the Cancer Center recruited V. Craig Jordan, Ph.D., D.Sc. to direct the breast cancer laboratory research program and Monica Morrow, M.D. to direct the clinical breast cancer research program at Northwestern's Lynn Sage Comprehensive Breast Center. Dr. Jordan is an internationally recognized leader in breast cancer research. Dr. Jordan's most important contribution to the field has been in the research and development of the antiestrogen tamoxifen, an important drug used in the treatment of breast cancer. In September 1994, the Cancer Center successfully competed for a grant from the NCI to establish a breast cancer program (NCI 1P20 CA65764). The co-principal investigators of this grant were Drs. Jordan and Morrow. Other breast cancer focused research awards include 6 individual grants from the US Army Breast Cancer Research Program, interactive RO1's from the NCI focused on hormonal and nutritional aspects in breast cancer prevention, an R21 translational research grant in angiogenesis, an RO3 grant to establish the Y-ME support group on the Internet, and Illinois Department of Public Health Cancer Research Grants on breast cancer prevention, early detection and translational research. In August, 1996, the Cancer Center was selected as one of three institutions in the US to receive a four year breast cancer center grant from the US Army (DAMD17-96-2-6013). The title of the grant is "Increasing Access to Modern Multidisciplinary Breast Cancer Care". Principal Investigator is Monica Morrow, M.D.. The award provides funds for eight research projects that address access to breast cancer care by minority women, education of minority women, dietary intervention to reduce cancer risk, methods to increase minority participation in clinical trials and cost effectiveness of new technologies.

BODY

In September 1994, the Cancer Center received funds from the USAMRMC to develop a training program in breast cancer research. In June, 1995, the Cancer Center applied for and received a supplement to the Training Grant through the National Action Plan on Breast Cancer (NAPBC), Public Health Services Office on Women's Health. The award was made to the Cancer Center through the Department of Defense. The Center received funds for three postdoctoral positions, one per year for a period of three years. The Molecular Biology of Breast Neoplasia prepares students and postdoctoral fellows with outstanding research potential for careers in breast cancer biology and biomedical research. This program provides

4 predoctoral and 1 postdoctoral trainees per year with comprehensive training in breast cancer biology, utilizing the powerful tools of molecular biology, genetics and biochemistry to unravel the complex mechanisms of breast neoplasia. .

Table 1 lists the trainees who received funding through this program. The program trained a total of 15, 14 of whom are still in research careers. Eleven trainees are in the final stages of their training programs. The four graduates of the program include: Jennifer Sanders, Ph.D. (currently a postdoctoral fellow at Brigham and Women's Hospital, Boston, MA), Malathy Shanmugam, Ph.D. (currently a postdoctoral fellow at Northwestern), Zehan Chen (currently a senior investigator at Abbott Laboratories) and Ann Buchmann (currently a postdoctoral fellow at Dana Farber Cancer Institute). Larissa Wenning, currently a postdoctoral fellow, recently received notification form the NIH that she is to receive an NRSA beginning in the fall of 1998.

Each year the Cancer Center solicits applications from faculty in the Breast Cancer Program nominating students. Typically, 10 applications are received each year for the predoctoral training and three applications for the single postdoctoral position. The Training Grant advisory committee is responsible for the selection of students. Committee members include: V. Craig Jordan, Ph.D., Steven Rosen, M.D., Director, Lurie Cancer Center, Robin Leikin, Ph.D., Training Grant Administrator; Kathleen Rundell, Ph.D., Professor, Microbiology-Immunology; Janardan Reddy, M.D., Professor, Pathology; and Daniel Linzer, Ph.D., Professor, Biochemistry, Molecular Biology and Cell Biology. Students are selected based upon their academic credentials, the relevance of their research projects to breast cancer and their potential as future academicians in breast cancer research.

Table 1

Predoctoral Students	Principal Investigator	Project
Mairin Anderson	B. Hoffman	Breast cancer imaging techniques
Ann Buchmann	B. Thimmapaya	Retinoblastoma gene in breast cancer cells
Ken Geles	S. Adam	Translocation of nuclear proteins from the cytoplasm to the nucleus
Stephanie Hsu	N. Bouck	Tumor suppressor genes and angiogenesis in breast cancer
Jennifer MacGregor	C. Jordan	The loss of estrogen-responsive breast cancer growth
Sameer Mathur	R. Morimoto	Signal transduction pathways for heat shock protein HSF2
Todd McAdams	W. Miller	Expansion of peripheral blood stem cells from breast cancer patients
Julie McLachlan	O. Bakouche	Effects of estrogens on aged monocytes
Kristi Miller	S. Weitzman	Breast cell morphogenesis

Jennifer Sanders	P. Stern	Effects of estrogens and antiestrogens on bone
Malathy Shanmugam	M. H-Dunn	Protein kinase C delta isoform in human breast cancer
Shiang-Jong Tzeng	D. Linzer	Prolactin receptor expression in the developing mouse fetus

Postdoctoral fellows	Principal Investigator	Project
Sonia Cerda, Ph.D.	S. Weitzman	Oxidative DNA damage repair in breast cancer
Zehan Chen, Ph.D.	C. Jordan	Methylation in down regulation of estrogen receptor in breast cancer cells
Larissa Wenning, Ph.D.	W. Miller	Expansion of hematopoietic progenitors using novel growth factors

Multidisciplinary Approach

The following predoctoral and postdoctoral students have been allocated funds through the Molecular Biology of Breast Neoplasia Training Grant:

S-J Teng

Studies of the Expression of Prolactin Receptors and the Effects of Targeted Disruption of this Receptor Gene during Mouse Embryogenesis

Mr. Teng has studied the developmental pattern of prolactin receptor expression in the mouse. Mice synthesize at least four forms of the receptor. He has found maximum levels of receptor mRNA in mouse embryos at days 8 and 18, but levels decreased between these days to a minimum at day 14, In contrast, levels of placental prolactin receptor mRNA remained constant throughout gestation. On embryonic day 16, the mRNA encoding the long form of prolactin receptor is more abundant in the fetal liver than any of the short receptor form mRNAs, but by day 18 a switch occurs and the mRNA encoding one of the short receptor forms becomes the predominant receptor mRNA in the liver. Expression of prolactin receptor mRNA and protein is abundant throughout the fetus, with particularly high levels in the bone and cartilagenous structures, brain, thymus, pituitary, tongue, and skeletal muscle. The pattern of expression of prolactin receptor in the fetal mouse suggests an important role for the placental lactogens, the major ligands for fetal prolactin receptors in fetal growth and development. Mr. Teng has just published his research in a manuscript entitled, " Prolactin Receptor Expression in the Developing Mouse Embryo" to the journal Molecular Reproduction and Development. Since prolactin is one of the primary regulators of mammary gland development and function, an understanding of the mechanisms of action of the receptors for this hormone is central to understanding the abnormal mammary gland in breast cancer.

Sameer Mathur

Characterization of the Chromosomal 6 HSP70 Locus in Y79 Retinoblastoma Cells

Cellular stresses are associated with activation of the heat shock gene transcription.

There are four known heat shock transcription factors, HSF1-4. Mr. Mathur is studying the signal transduction pathway for the heat shock protein transcription factor HSF2. HSF2 is activated in response to hemin, an inhibitor of proteasome activity. Mr. Mathur tested other inhibitors of proteasome activity for their ability to activate HSF2. Gel mobility shift assays were carried out. Antibodies to HSF2 demonstrated that the DNA binding activity induced by the various proteasome inhibitors was HSF2. Furthermore, HSF2 activation resulted in induction of heat shock protein expression. The induction of heat shock proteins and proteasome activity suggests a role for the heat shock proteins in chaperoning polyubiquitinated proteins. In order to test this hypothesis, immunoprecipitations of hsp70 were performed and the complexes examined for the presence of polyubiquitinated proteins. The results reveal such an interaction between hsp70 and polyubiquitinated proteins. HSF2 is a key regulatory transcription factor for the molecules HSP70 and HSP90, both of which are important regulatory proteins for estrogen, progesterone and glucocorticoid receptors. This has direct relevance to breast cancer because heat shock proteins may regulate the estrogen receptor.

Malathy Shanmugam
Characterization of the Protein Kinase C Delta Isoform in Human Breast Cancer Cell Lines
Ms. Shanmugam has demonstrated that protein kinase delta (PKC δ) is the predominant isoform of PKC in estrogen responsive MCF-7 cells and is absent from estrogen unresponsive MDA-MB human breast cancer cells. She has shown that estrogen's enhancement of proliferation in MCF-7 cells is directly linked to the down regulation of PKC δ mRNA and protein. MDA-MB have reduced levels of PKC δ which may explain in part their more aggressive phenotype. Growth inhibition of MCF-7 estrogen positive cells using phorbol ester leads to PKC δ activation and induction of the cyclin-dependent kinase inhibitor p21Wafl/Cipl. The results suggest that activated PKC delta may signal to initiate/maintain the growth arrest of breast cancer cells. Ms. Shanmugam has recently published her results in the Journal of Biological Chemistry. She completed her Ph.D. training in June, 1997 and is pursuing a postdoctoral position in the field of breast cancer research.

Julie McLachlan
The Effect of Age on the Activation and Cytotoxicity of Human Monocytes
Monocytes isolated from aged individuals (aged monocytes) are greatly deficient in their cytotoxic and tumoricidal abilities when compared to monocytes isolated from young individuals (young monocytes). Ms. McLachlan examined the biochemical, molecular and signal transduction differences between young and aged monocytes by studying the effects of the adrenal androgen dehydroepiandrosterone (DHEA) in immunity. DHEA is the precursor of androgens and estrogens. DHEA and LPS (lipopolysaccharide) at 0.2 ng/ml displayed a synergistic effect on monocyte cytotoxicity against cancerous cell lines, IL-1 secretion, reactive nitrogen intermediate release, complement receptor-1 cell-surface protein, and TNF- α protein to levels comparable with levels obtained using LPS at 1.0 ug/ml. Monocytes stimulated with DHEA alone or with LPS at low concentrations did not display markers of cytotoxicity. DHEA receptor could be measured in monocytes, suggesting that DHEA effects on LPS-stimulated

monocytes are mediated through a receptor-dependent process. Monocytes play a prominent role in host defense against breast cancer through a surveillance mechanism, so breast cancer in the elderly may correlate with a decrease in the efficiency of monocytes to develop a cytotoxic phenotype in elderly. Ms. McLaughlin is the only trainee who did not continue to pursue a career in research.

Ann Buchmann
Regulation of Gene Expression by pRb using a Novel Approach
Ms. Buchmann is studying the genes that are transcriptionally controlled by retinoblastoma protein. Specifically, the retinoblastoma tumor suppressor gene product (pRb) controls cell cycle progression from G1 into S. Mutation of pRb or deletion of the Rb gene has been seen in 20-30% of breast cancers. Reintroduction of normal Rb gene into breast cancer cells that have lost Rb function causes the cells to lose their ability to form tumors in nude mice, indicating that loss of pRb contributes to the tumorigenicity of these cells. pRb functions by binding to and regulating the activities of several transcription factors, suggesting that pRb controls the transcription of specific genes. Ms. Buchmann has used adenovirus vectors to overexpress pRb, in the cell lines SAOS (human osteosarcoma) and MCF-10 (breast cancer) in G1 phase of the cell cycle. RNase protection assays indicate that pRb is involved in the transcriptional downregulation of E2F-1, E2F-2, DHFR (dihydrofolate reductase), thymidine kinase, c-myc, PCNA, p107, and cyclin inhibitor p21. pRb has no effect on the transcription of E2F-3, E2F-5, DP-1, DP-2 or cyclin inhibitor p16. These results suggest that pRb controls the transcription of genes involved in G1 to S phase progression. This research complements the research of Dr. Thimmapaya who is developing viral vectors with breast cell specific promoters to deliver suicide genes such as thymidine kinase and cytidine deaminase into breast tissues. She recently completed her Ph.D. (April, 1998) and is pursuing a postdoctoral fellowship at Dana Farber Cancer Institute, Boston, MA.

Stephanie Hsu
Tumor Suppressor Gene Control of Angiogenesis in Glioblastoma Multiforme Cell Lines
Ms. Hsu is looking at the role of tumor suppressors and angiogenesis in human glioblastoma cell lines. The growth of glioblastoma tumors depends on the loss of tumor suppressor genes on chromosome 10 and angiogenesis. When wild type chromosome 10 is transferred into human glioblastoma cell lines, tumor growth is inhibited. This inhibition is due to the loss of angiogenic activity through increased secretion of an inhibitor of angiogenesis, thrombospondin-1. Anti-thrombospondin antibodies completely reverse this inhibition. This work has been extended to patient samples. Normal brain and low grade astrocytomas known to retain chromosome 10 stain strongly for thrombospondin, but 12/13 glioblastomas, which have no chromosome 10, do not stain for thrombospondin. This study suggests that loss of tumor suppressor genes on chromosome 10 contributes to the aggressive phenotype of glioblastomas, in part by releasing constraints on angiogenesis that are normally maintained by thrombospondin. This research is directly related to Dr. Bouck's other research endeavors in breast cancer, where angiogenesis is known to play an important role in the progression of disease. Dr. Bouck has shown that thrombospondin is produced by normal breast epithelial cells, but is lost in breast tumors. Ms. Hsu recently was awarded the Ph.D. degree. Upon completion of her medical training, she will pursue a career in academic research.

Todd McAdams
Improved Substrates and Culture Conditions for the Ex Vivo Expansion of Primitive Hematopoietic Cells
Mr. McAdams is examining optimization of culture pH for improving the expansion of peripheral blood stem cells from breast cancer patients who are undergoing peripheral blood stem cell (PBSC) transplantation. PBSC has the advantage over bone marrow in terms of fewer contaminating tumor cells and for increasing the rate of engraftment/hematopoietic recovery following transplantation. However, PBSC contain tumor cells. Purging methods eliminate rapidly dividing tumor cells, but also eliminate the rapidly dividing committed hematopoietic progenitors. One solution is to use ex vivo methods to expand the PBSC following purging to eliminate tumor cells. Specifically, Mr. McAdams is studying peripheral blood CD34+ cells cultured under a range of pH values from 7.15 to 7.6. Cultures at high pH contained greater numbers of hemoglobin positive and band 3 positive cells, and acquired erythroid differentiation markers sooner than standard and low pH cultures. Flow cytometry using CD71 and CD45RA antigens also indicated that differentiation proceeded faster at high pH and was blocked at an intermediate stage by low pH. Morphological studies confirmed that high pH cultures shifted towards late stage erythroid compartments as compared to low and standard pH cultures. These results have important applications for the ex vivo expansion of erythroid progenitors used in peripheral blood stem cell transplantation.

Zehan Chen, Ph.D.
Identification of Genes Related to Estrogen Receptor Independent Proliferation Pathways
Dr. Chen is studying the role of methylation in down regulation of estrogen receptors (ER) in breast cancer cells, testing the hypothesis that methylation of the CpG island is the fundamental mechanism responsible for the loss of ER expression in breast cancer cells. The model for these studies is a cell line C4:2 derived in the Jordan laboratory from an ER positive breast cancer cell line grown long term in estrogen-free medium. The C4:2 has irreversibly lost expression of ER and is no longer hormone responsive. Dr. Chen shows that the ER CpG island in the C4:2 cells remains unmethylated. The loss of the ER in the cell line must be due to other mechanisms rather than methylation. His studies due not rule out that methylation may be an event that occurs subsequent to loss of the ER expression. Dr. Chen recently completed his postdoctoral training to accept a position working in breast cancer research for a pharmaceutical company.

Kristi Miller
The Role of p300 in Breast Morphogenesis
Ms. Miller is studying the role of the transcriptional coactivator p300 in breast cell morphogenesis in vitro. An understanding of the process normal breast cells undertake in morphogenesis should be valuable in understanding breast cancer progression. Since the ability to form structures is lost early in malignant cells, factors controlling morphogenesis may help to explain the mechanisms involved in malignancy. p300 is a nuclear phosphoprotein involved in differentiation. Phosphorylation of p300 is correlated with activation of c-jun transcription. Kristi is attempting to identify regions on the p300 molecule that are linked to breast cell morphogenesis. She will generate mutant vectors for these studies. Kristi has

demonstrated that expression of a mutant p300 protein completely blocks duct formation in vitro.

Jennifer MacGregor
Re-introduction of the Estrogen Receptor (ER) into T47D Breast Cancer Cells to Re-establish the Hormone Responsive Phenotype
Ms. MacGregor is studying the differential effects of estrogen and antiestrogens and their effect on growth and gene regulation in T47:A18 (ER positive) and T47D:C4:2 (ER negative) breast cancer cell lines. These subclones were derived in Dr. Jordan's laboratory from the parent T47D human breast cancer cell line. Ms. MacGregor will determine expression levels and mutational status of the p53 tumor suppressor gene and BRCA1 breast cancer gene in the T47:A18 and T47D:C4:2 cell lines. She will also transiently and stably transfect ER cDNA into the each of the subclones and look at estrogen and antiestrogen responsiveness. Her results should provide important information about the role of the ER in the progression from hormone dependent to hormone independent growth.

Jennifer Sanders
Role of Protein Kinase C (PKC) Isozymes in the Anti-osteoporotic Effects of Estrogen and Antiestrogens
Ms Sanders is studying the effects of estrogen and tamoxifen on bone. Experimental and clinical studies suggest that tamoxifen acts like estrogen on bone, promoting the conservation of bone tissue. Specifically, Ms. Sanders is examining the PKC signal transduction pathway in osteoblasts. PKC isozyme expression was measured in rat osteosarcoma cells treated with estrogen or tamoxifen by Western immunoblotting. Only 3 or 7 day hormone treatment modulated isozyme expression. The observed effect was an increase in PKC- $\beta 1$ expression. This isozyme may play a role in the bone-preserving effects of estrogenic agents. Ms. Sanders has already published some of her research in the Journal of Bone and Mineral Research and her most recent work was published in The Pharmacologist and presented at the Pharmacology '97 Meeting. Ms. Sanders was recently awarded her Ph.D. degree. She is currently a postdoctoral research associate carrying out research in women's health at Brigham and Women's Hospital in Boston, MA.

Sonia Cerda, Ph.D.
Oxidative DNA Damage Repair in Breast Cancer
Dr. Cerda is studying the role of the DNA repair gene, alkyl-N-purine-DNA glycosylase (ANPG), in a variety of human breast cancer cell lines and tissues. MDA-MB 231, MCF 7 and T47D breast cancer cell lines exhibited 3,10 and 14 times higher levels of ANPG mRNA than normal breast epithelium. Analysis of DNA from the cell lines by Southern blot indicated no ANPG amplification. Immunohistochemical staining of fixed tumor cell lines, as determined by intensity of nuclear staining, indicated increased expression of ANPG protein that correlated with the Northern blot data. Levels of ANPG message were also evaluated in 13 breast cancer tissues. Expression of ANPG message was increased 2-24 fold as compared with normal primary breast epithelial cells. These results indicated that ANPG expression is

increased in breast cancer and that up-regulation of this gene may play a functional role in breast carcinogenesis.

Mairin Anderson
Optical imaging of breast tumors holds great promise of offering a safe, effective, noninvasive and inexpensive imaging modality. Optical contrast agents that absorb at the appropriate wavelength enhance and sharpen the images. Most importantly, compounds which localize in neoplastic tissue highlight the tumors. Earlier attempts to prepare such agents have focused on porphyrins, which accumulate in tumor tissue, but do not absorb adequately at the long wavelengths necessary for imaging. Ms. Anderson proposes to synthesize tetraazaporphyrins, a synthetically accessible type of porphyrinic macrocycle which has the optical characteristics necessary for imaging. Solubility and absorption spectra will be optimized by modifications to the periphery of the macrocycle to generate potential candidates for contrast agents in optical imaging of breast tumors.

Ken Geles
The transport of proteins and RNA across the nuclear envelope depends on the cooperation of both cytoplasmic and nuclear factors. The import of proteins through the nuclear pore complex requires three cytosolic factors: the nuclear localization sequence (NLS) receptor, p97 and Ran/TC4. Multiple NLS receptor homologues have been identified in mammalian cells. Analysis of NLS receptors in leukocyte and lymphocyte cell lines indicate that NLS receptor may play a role in carcinogenesis. Further support for NLS receptor's role in carcinogenesis has been obtained from BRCA1 subcellular localization experiments. BRCA1 can directly bind to the NLS receptor, but BRCA1 remains in the cytoplasm when transfected into breast cancer cells despite identification of two functional NLS's. In contrast, BRCA1 accumulates in the nucleus of non-breast cancer cells, suggesting that there may be a defect in the nuclear import pathway of breast cancer cells. Mr. Geles has chosen the nematode C. elegans as a model to study the function and developmental regulation of NLS receptors in vivo.

Larissa Wenning, Ph.D.
Recent studies indicate that high-dose therapy in conjunction with peripheral blood stem cell transplantation results in higher response rates than conventional chemotherapy for treatment of metastatic breast cancer. The presence of tumor cells in the peripheral blood necessitates the use of purging techniques to eliminate the tumor cells prior to transplantation. However, the agents used to eliminate tumor cells also eliminate rapidly dividing hematopoietic progenitors, thus increasing the mortality due to delayed expansion of peripheral blood stem cells. One potential solution to this problem is the use of cytokine assisted ex vivo expansion of peripheral blood stem cells following purging to eliminate tumor cells. Dr. Wenning is studying the cytokine stem cell factor (SCF) to determine its effects on growth and differentiation of hematopoietic cells in stroma free culture. Mathematical modeling techniques will also be used to determine which hematopoietic processes are affected by SCF. Dr. Wenning has received an individual NRSA, National Research Service Award, from the NIH to support her research in Dr. Miller's laboratory beginning in the fall of 1998.

Program components

Dr. Jordan has established the Breast Cancer Journal Club to bring together the members of the Breast Cancer Training Program on a weekly basis to discuss relevant journal articles and areas of research. Training grant students participate and present at the journal club meetings. Students present a selected breast cancer topic from the basic and clinical literature and Dr. Jordan leads a discussion revolving around the topic. The journal club regularly attracts 10-15 graduate, postdoctoral and faculty participants in addition to the four predoctoral students and one postdoctoral fellow.

In addition to the Journal Club, Dr. Jordan also conducts a monthly breast cancer research meeting to bring together clinicians and basic scientists on both the Evanston and Chicago campuses of Northwestern. At the meetings faculty review progress on their research. Examples of research presented include: Ann Thor, M.D., Professor, Department of Pathology, Evanston Hospital, described her research on molecular markers in breast cancer. Dr. Thor is trying to correlate changes in markers with specific chemotherapy treatment regimens. One example of such a marker is Her B-2. Peter Gann, M.D. and Linda Van Horn, Ph.D., presented their research on diet and hormone levels in the prevention of breast cancer; Robert Chatterton, Ph.D., presented his research on measurement of hormone levels in breast fluid using highly sensitive fluorescent assays.

Students also attend numerous seminars and journal clubs throughout the year that have direct relevance to breast cancer. These include the Tumor Cell Biology Seminar Series, Cell and Molecular Biology Seminars, Molecular Endocrinology Seminars and the new Cancer Center mini-symposia. During the last two years the Lurie Cancer Center has sponsored the visit of several leading breast cancer research specialists, such as Judah Folkman, M.D., Marc Lippman, M.D, Barry Gehm, Ph.D. and Marco Gottardis, Ph.D..

Publications

The success of the Lurie Cancer Center Breast Cancer Training Grant is exemplified by the numerous publications by the students as a direct result of their funding by the Molecular Biology of Breast Neoplasia Training Grant.

Trainee	# of Papers/Abstracts Submitted for Publication
S-J Teng	1
Sameer Mathur	1
Malathy Shanmugam	3
Julie McLachlan	1
Ann Buchmann	1
Stephanie Hsu	3
Todd McAdams	3
Zehan Chen, Ph.D.	4
Kristi Miller	1
Jennifer MacGregor	8

Jennifer Sanders	2
Sonia Cerda, Ph.D.	3
Mairin Anderson	1
Larissa Wenning	0
Kenneth Geles	3

Publications

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Conclusions

The Robert H. Lurie Cancer Center has established an outstanding program in breast cancer at Northwestern University. A critical component of this program is the US Department of Defense Training Grant "Molecular Biology of Breast Neoplasia". The training grant provides an exceptional environment to promote and advance the research potential of committed individuals. The program has enabled 12 predoctoral students and 3 postdoctoral fellows to be exposed to a solid foundation in breast cancer research. The productivity of the students is significant as assessed by research publications. The program attracted a significant applicant pool each year. Students were selected based upon their academic credentials, letters of recommendation from their faculty sponsors, and the relevance of their research to breast cancer. Hopefully, the program has trained investigators to actively contribute to breast cancer related problems in their future research endeavors.

APPENDIX MATERIAL

MOLECULAR BIOLOGY OF BREAST NEOPLASIA

Robin Goldman Leikin, Ph.D. and V. Craig Jordan, Ph.D.

Robert H. Lurie Cancer Center
Northwestern University

The Robert H. Lurie Cancer Center at Northwestern University is an NCI-funded cancer center. The Cancer Center has made significant advances in developing a premier breast cancer program. In September 1994, the Cancer Center received a four year award from the US ARMY for training of graduate students conducting breast cancer relevant research entitled, "Molecular Biology of Breast Neoplasia". This program provides students with comprehensive training in breast cancer biology, utilizing the powerful tools of molecular biology, genetics and biochemistry to unravel the complex mechanisms of breast neoplasia. The program enables four students per year to be supported for their degree with senior basic science faculty on a topic relevant to breast cancer research and to be exposed to clinical investigators who provide a translational link. In June 1995, the Cancer Center applied for and received a supplement to the Training Grant through the National Action Plan on Breast Cancer (NAPBC), Public Health Services Office on Women's Health. The award funds three postdoctoral positions, one per year for a period of three years.

Each year the Cancer Center solicits applications from faculty in the Breast Cancer Program nominating students. Typically, 10 applications are received each year for the predoctoral training and three applications for the single postdoctoral position. The Training Grant advisory committee is responsible for the selection of students. Students are selected based upon their academic credentials, letters of recommendation from their faculty sponsors and the relevance of their research to breast cancer.

Keywords: Training, Breast Neoplasia, Molecular Biology, Translational, Cell Growth

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Northwestern University
Robert H. Lurie Comprehensive Cancer Center
Breast Cancer Research Program

Future dates of talks:

May 11	Dr. Thor Breast Cancer Research Projects on the Evanston Campus
June 15	Dr. Gann and Dr. Van Horn
July 27	Dr. Chatterton
August 17	Dr. Klein
Sept.21	Dr. Gapstur

All talks will be held in the Vanderwicken Library, 8th flr of the Olson Pavilion.
Talks start at **2:00pm.**
Refreshments will be served.