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WILMOT CANCER CENTER

ECONOMIC IMPACT OF CURRENT & PROPOSED OPERATION

Prepared for:
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SUMMARY

Today the creation, dissemination and application of knowledge – rather than physical transformation – create prosperity for individuals and the community. The James P. Wilmot Cancer Center, part of the University of Rochester Medical Center (URMC), is a major contributor to Rochester's modern economy.

Growing the Economy

The Cancer Center expands the economy in two ways: **First**, by attracting research and clinical trial funding from the federal government, pharmaceutical companies and philanthropic associations (such as the American Cancer Society), the Cancer Center attracts leading researchers (and the purchasing power of their families) to the community.

Second, as the Cancer Center's clinical services continue to improve in quality and reputation, Rochester becomes a magnet for cancer patients living outside the metropolitan area. Increased patient volume enhances the overall ability of URMC to meet the healthcare needs of Rochester area residents, which improves the quality of life in the community.

Economic Impact Could Double

Our analysis suggests that the planned expansion of the facility, coupled with regaining status as a National Cancer Institute-designated cancer center, will roughly double the net impact of the Wilmot Cancer Center on the Rochester economy, adding nearly 1,000 net new jobs to the region and labor income of \$35 million.

In addition, the construction phase of the project will also benefit the local community. Calculated on a single year, full-time

equivalent basis, the facility construction will add an estimated 750 jobs earning about \$30 million.

Economic Impact Summary	Net Impact of Cancer Center in 2003	Impact of Projected Expansion	Construction Period Impact <i>Single year, FTE</i>
Labor Income (in millions - based on 2003 dollars)			
Direct	\$24	\$24	\$23
Indirect	\$3	\$2	\$7
Induced	\$7	\$9	n/a
Total	\$34	\$35	\$30
Employment (FT positions)			
Direct	590	580	550
Indirect	90	60	200
Induced	210	300	n/a
Total	890	940	750

Indirect - Economic activity stimulated by spending of the firm (in this case, the Cancer Center)

Induced - Economic activity stimulated by spending of the firm's employees

The Starting Point: Clinical Care & Research at the Wilmot Cancer Center Revenue from outpatient and inpatient clinical services totaled (less pharmacy) about \$39 million in fiscal 2003, of which CGR estimates \$15 million is net to the Rochester economy.* Research funding is a larger part of the impact picture: Annual spending on all cancer-related research is nearly \$18 million (from total multi-year grants topping \$70 million).

As summarized in the table above, CGR estimates direct, indirect and induced employment attributable to the Wilmot Cancer Center at nearly 900 with earnings of about \$34 million. Outpatient revenue has been growing rapidly in recent years, by 6% from FY2002 to FY2003, then by 16% from FY2003 to

* In cooperation with Cancer Center staff, CGR estimates that this is the value of clinical services likely to be performed outside the local economy if the Wilmot Cancer Center did not exist.

FY2004. Inpatient growth has been less rapid, a result of both a focused effort to treat cancer patients in an outpatient setting and a shortage of beds.

Wilmot Cancer Center Clinical Care Summary: 2003	
Total Inpatient Days	21,778
Average Length of Stay (days)	7.9
Bed Occupancy Rate	95%
Inpatient Net Revenue (million)	\$21.2
Outpatient Infusions/Chemotherapy	13,049
Outpatient Radiation Treatments/Procedures	19,000
Outpatient Net Revenue, Less Direct Pharmacy Cost (million)	\$16.8

Economic Impact of Expansion & NCI Status

The planned expansion will dramatically increase the capacity of the Wilmot Cancer Center to serve patients within the region, reducing the flow of patients to medical facilities in other regions. It will also attract patients to Rochester from surrounding areas, particularly Syracuse and Buffalo. A goal in the Cancer Center Strategic Plan is to re-attain status as a National Cancer Institute (NCI)-designated cancer center, which will drive significant expansion in cancer-related grants between 2004 and 2009.

CGR estimates that the impact of the expansion and NCI initiatives on the Rochester economy will be substantial. CGR estimates that these new initiatives will more than double the net employment in the local economy, bringing the total to about 1,730 positions earning nearly \$70 million every year. Individuals (and their families) earning these salaries will help fund public services and contribute to community life. (See following profile of a recently recruited researcher.)

Additional research investment will also stimulate new marketable ideas. With support from URMC's technology transfer office, invention disclosures will lead to patents, patents will lead to licenses and, in some instances, the innovations will spawn new

businesses in the Rochester area. While modest in comparison with the impacts already mentioned, CGR estimates that technology transfer could stimulate the creation of 75 jobs annually, although it is impossible to speculate on how many of these jobs would be located in Rochester.

ONE RESEARCHER'S \$1 MILLION PLUS (AND COUNTING) IMPACT ON ROCHESTER



As the University of Rochester Medical Center aggressively builds pathways from the laboratory to the physician's office, top research skills are vital to translating knowledge into therapies, procedures or products. Recruiting an established researcher is no small accomplishment for the Cancer Center or, for that matter, the community. And for both, the economic impact can be dramatic.

Craig T. Jordan, Ph.D., was a researcher at the University of Kentucky's Lucille Parker Markey Cancer Center when he caught the eye of Rochester Cancer Center Director Richard Fisher. After completing a PhD at Princeton and post-doctoral studies at MIT, Jordan entered the fast-paced biotechnology industry, earning his private sector spurs at a small start-up, Aastrom Biosciences; the more-established Somatix Therapy Corporation; and industry leader Genentech. He then launched his successful career in academic medical research in Lexington, securing a number of major research grants from leading funders, including the National Institutes of Health, the American Cancer Society, the Department of Defense and the Leukemia & Lymphoma Society. In Jordan, Fisher recognized he'd found a leader who knew both the academic and commercial ends of biotechnology.

Jordan's subsequent move to Rochester had an immediate impact in the local community. His artist wife, Donna, also relocated and established a studio with Anderson Alley Artists, a congregation of artists in Rochester's cultural district. Two members of his

Lexington laboratory (plus spouses and a child) also made the trek to Rochester, enthusiastic about the potential offered by URMC's outstanding facility and collegial working environment. Like Donna Jordan, a sculptor, the spouses of Jordan's laboratory team members are also contributors to the community.

At the time of the move in 2003, Jordan was the principal investigator on a number of research grants, and he brought to Rochester about \$850,000 per year in research investment, both direct spending in his laboratory and indirect funding for URMC. Today Jordan's laboratory has 10 researchers, eight of whom are largely dependent on the laboratory for their livelihoods. They include four laboratory technicians, one graduate student, a senior instructor and two physicians. All are married and many have children. While only three re-located to Rochester specifically to work in the laboratory, the long-term impact of URMC's recruitment of Jordan allows eight families to call Rochester home and adds to the purchasing power of two more.

Due to his interest in translational research, Jordan also became deeply involved in the creation of the Translational Research Center, a new URMC institution that works with pharmaceutical companies to improve the success rates of clinical trials. In its first eight months, this center signed contracts worth \$300,000 and is expected to serve as a major inducement for pharmaceutical companies considering the University of Rochester as a clinical trial site. While the Translational Research Center is initially focused on leukemia and lymphoma, its contribution will expand over time. It already employs three persons, including a director, who is the spouse of one of the researchers who relocated from Lexington with Jordan.

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ROLE OF URMC & WILMOT CANCER CENTER IN ROCHESTER ECONOMY

The University of Rochester Medical Center (URMC) and its specialty centers, including the James P. Wilmot Cancer Center, play many roles in the regional economy. Most important, the skilled professionals who staff these centers intervene when that most fundamental element of quality of life, our own health or that of someone close to us, is endangered.

Yet URMC plays other roles, too. As an academic medical center, URMC and the Wilmot Cancer Center are a vital link to research and discovery occurring around the globe, providing the Rochester community with access to the very best health knowledge and treatment in the world, improving both quality and length of life. This is particularly apparent in the case of clinical trials. While few disagree that new drugs and procedures should be rigorously tested before being approved for broad application, individuals with life-threatening diseases can obtain early access to a medical research product if they are under care in an institution, such as the Wilmot Cancer Center, that is involved in extensive clinical trials.

Current Economic Impact of the Cancer Center

The Rochester economy is larger than it would be without the Cancer Center. **First**, the existence of the Cancer Center means that residents requiring sophisticated procedures and treatments stay in Rochester. Revenues associated with their treatment would otherwise flow to distant cities, e.g. New York, Boston, Pittsburgh and Cleveland.

Second, URMC and the Cancer Center attract patients from outside the region, bringing revenue to the community that would have flowed elsewhere. Individuals visiting Rochester from other communities often stay overnight and bring family or friends, thus adding to the revenue of other Rochester businesses.

Third, research programs at URMC and the Cancer Center bring millions of dollars to the community each year from the National Institutes of Health (in the case of the Cancer Center, particularly from the National Cancer Institute or NCI), private foundations and the pharmaceutical industry. These funds support highly trained scientists and technicians who become part of the Greater Rochester community and contribute to the prosperity of other businesses.

This study documents and analyzes the Cancer Center's contribution to the Rochester economy (based on 2003 information) through both its clinical care and research activities. Following this assessment, CGR estimates the economic impact of the Cancer Center's expansion. The focus of the expansion is on clinical care, but it will also enable the institution to increase total research funding, extend its "reach" well beyond the Rochester metropolitan area and achieve designation as a NCI Cancer Center.

CLINICAL CARE AT THE WILMOT CANCER CENTER

The Wilmot Cancer Center provides care on both an inpatient and outpatient basis. Currently, the clinical care facility includes more than 50,000 square feet with 35 examination rooms, 29 infusion chairs, 2 linear accelerators and a radiosurgery accelerator.

A large share of total revenue comes from very complex procedures. Two-thirds of FY2003 inpatient revenue came from procedures whose NYS diagnosis-related group (DRG) was assigned a case mix index (CMI) of 3 or higher; with 45% of total DRGs assigned a CMI of 4 or higher. In FY2004, while inpatient revenue from DRGs with a CMI of 3 or higher fell slightly to

63%, the share of revenue from DRGs with a CMI of 4 or higher rose to 54%.*

Wilmot Cancer Center Clinical Care Summary: 2003	
Total Inpatient Days	21,778
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Bed Occupancy Rate	95%
Inpatient Net Revenue (million)	\$21.2
Outpatient Infusions/Chemotherapy	13,049
Outpatient Radiation Treatments/Procedures	19,000
Outpatient Net Revenue, Less Direct Pharmacy Cost (million)	\$16.8

For purposes of this study, CGR assumed that 45% of inpatient care is unique to the Wilmot Cancer Center and would leave the community were its services not available.

Since cancer treatment nationwide has increasingly shifted to outpatient care, the Wilmot Cancer Center puts great emphasis on outpatient care. A substantial share of outpatient care—particularly in the Cancer Center’s specialty areas—is provided to individuals living at some distance from Rochester. For purposes of this study (and at the recommendation of Cancer Center staff), we assume that one third of total outpatient revenue would leave the community if the Wilmot Cancer Center did not exist.

RESEARCH AT WILMOT CANCER CENTER

As of August 2004, NCI grants to URMC totaled nearly \$20 million with annualized spending of about \$5 million. A substantial number of additional grants are also cancer-related and are conducted by research physicians affiliated with the Cancer Center. These additional grants (from sources such as the American Cancer Society, the U.S. Department of Defense and

* Patients are assigned to one of hundreds of “diagnosis related groups” (or DRGs) based on diagnoses, procedures, age, sex, and the presence of complications. Each DRG is weighted to reflect the national average hospital resource consumption by patients for that DRG, relative to average hospital resource consumption by all patients. This “case mix index” (CMI) further refines the DRG as an indicator of medical complexity and expected resource use. A higher CMI indicates greater severity.

associations addressing specific cancers) total more than \$50 million with annual spending of about \$13 million.

The Wilmot Cancer Center's Strategic Plan anticipates that total cancer-related research support will increase dramatically during the life of the plan. The Strategic Plan emphasizes cell cycle and cell proliferation research, immunology and hematological malignancies.

NCI Designation

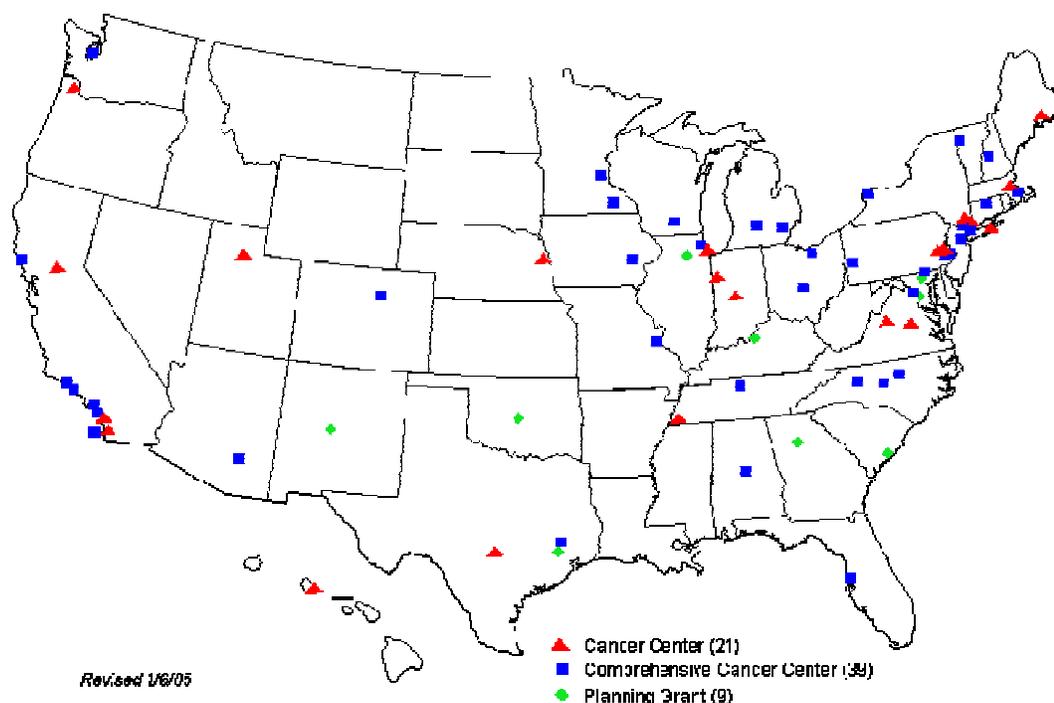
The NCI believes that recent breakthroughs in genetic research and other spheres of medical science have created "unprecedented opportunities" for research into cancer treatment and prevention. For the purpose of improving the quality of this research, NCI provides Cancer Center Support Grants (CCSG) to institutions "that have a critical mass of excellent cancer-relevant scientific research." These grants are intended to facilitate greater coordination among researchers and encourage efforts to translate discovery into treatment.*

An advisory board to the NCI asserts that:

These cancer centers, particularly those deemed comprehensive, are expected to combine the forces of basic, translational, and population cancer research to achieve improved cancer prevention, diagnosis, and treatment. Justification for the Cancer Centers Program has been based on the presumption that clinical progress can only be made by teams of clinicians, clinical investigators, and basic scientists working together to translate information gained at the cellular and molecular level into new therapeutics and diagnostics. Moreover, because cancer is not a single disease, each type of cancer presents distinctive scientific and clinical challenges that require the kind of intensive sub-specialization that a single oncology division or department working in isolation in one location simply cannot provide.**

* National Cancer Institute <http://www3.cancer.gov/cancercenters/>

**National Cancer Advisory Board, *Advancing Translational Cancer Research: A Vision of the Cancer Center and SPORE Programs of the Future*, February 2003. <http://www3.cancer.gov/cancercenters/P30-P50report.pdf>



Characteristics of NCI-Designated Centers

A map of the current NCI-designated centers appears above. The Wilmot Cancer Center at URMU once had NCI designation and is committed to regaining this distinction, intending to become the second NCI-designated center in Upstate New York (in addition to Roswell Park in Buffalo).

The Cancer Center is well on its way to qualifying for this designation. As described by NCI the 6 characteristics of a designated cancer center are as follows:

- ❖ *Facilities dedicated to the conduct of cancer focused research, and to the center's shared resources, administration, and research dissemination should be appropriate and adequate to the task.*
- ❖ *Organizational Capabilities for the conduct of research and the evaluation and planning of center activities should take maximum advantage of the parent institution's capabilities in cancer research.*
- ❖ *Interdisciplinary and Transdisciplinary Collaboration and Coordination: Substantial coordination, interaction, and collaboration among center members*

from a variety of disciplines should enhance and add value to the productivity and quality of research in the center.

- ❖ *Cancer Focus: A defined scientific focus on cancer research should be clear from the center members' grants and contracts, and from the structure and objectives of its programs.*
- ❖ *Institutional Commitment: The center should be recognized as a formal organizational component with sufficient space, positions, and resources to insure organizational stability and fulfill the center's objectives.*
- ❖ *Center Director: The director should be a highly qualified scientist and administrator with leadership experience and institutional authority appropriate to manage the center.*

Potential Impact of NCI Designation

NCI designation confers funding intended to support the infrastructure needed to have an effective cancer research program (as opposed to funding a highly-focused research initiative).

The median Cancer Center Support Grant (see the Appendix re: P30 Core Grants) going to the “comprehensive” centers designated by NCI was about \$3.8 million in 2003. Total grant funds that flow to NCI-designated centers is also traditionally greater than for non-designated centers (a reflection that the designation is conferred on centers that already have active research programs). Looking only at 2004, total NCI obligations to URMC tallied about \$9 million while the median for all NCI-designated comprehensive and clinical centers (excluding those centers classified as “laboratory/basic”) was about \$26 million. The bottom quartile of the designated group received commitments of \$14 million from NCI in 2004; the second quartile received commitments of \$25 million. A list of all NCI-designated centers, their Cancer Center Support Grants and NCI obligations for 2004 appears in the Appendix.

NCI designation would also improve the Cancer Center's ability to attract clinical revenue and research funding from additional sources, e.g. clinical trial funding from pharmaceutical companies, organizations such as the American Cancer Society and other government funders, particularly the Department of Defense and other arms of the National Institutes of Health.

ESTIMATED ECONOMIC IMPACT

This section of the report discusses how our study assesses economic impact, and then explores both the current impact of the Wilmot Cancer Center on Rochester and the impact of the planned expansion.

“Traded Sector” Impact: Wilmot Cancer Center in 2003

Economic impact analysis is concerned with measuring activities that make the regional economy larger. In a community the size of Rochester, routine medical care would be provided whether URMC existed or not. While routine medical care is critical to any region’s quality of life, regions generally do not engage in trade with their geographic counterparts for these services (e.g., it is very unusual for a Rochester resident to purchase routine medical care from a physician practicing in Buffalo).

More sophisticated medical care, however, *is* “traded” across regions. The Wilmot Cancer Center’s bone marrow/stem cell transplantation practice, for example, does attract patients from well outside the region. Within the 16 NYS counties between Buffalo and Syracuse, the Wilmot Cancer Center is treating nearly 90% of all cases in this subspecialty.

With the Cancer Center’s cooperation, CGR separated revenues that would likely be shifted to other local providers if the Cancer Center did not exist from those revenues that represent earnings for the Rochester economy through “trade” with other regions.

Current Economic Impact of Wilmot Cancer Center

We estimate that the Cancer Center is currently responsible for 600 direct, full-time positions in the economy’s traded sector, with annual earnings of about \$24 million. Secondary impacts—including both the results of medical center spending and the spending of medical center employees—adds another 300 full-time positions earning about \$10 million annually.

Economic Impact of Wilmot Cancer Center: Current & Future					
		Impact of Projected Expansion			Construction-Period Impact
	Net Impact of Cancer Center in 2003	High	Low	Midpoint	<i>Single year, FTE</i>
Labor Income (in millions - based on 2003 dollars)					
Direct	\$24	\$35	\$12	\$24	\$23
Indirect	\$3	\$3	\$2	\$2	\$7
Induced	\$6	\$9	\$9	\$9	n/a
Total	\$34	\$47	\$23	\$35	\$30
Employment (FT positions)					
Direct	590	860	290	580	550
Indirect	90	80	40	60	200
Induced	210	300	300	300	n/a
Total	890	1,240	630	940	750

Visitors to Rochester for Cancer Care

CGR also reviewed Cancer Center data on the residence of individuals coming to Rochester for treatment, both inpatient and outpatient. For these patients, we assumed the following:

- ❖ Patients within the Rochester metropolitan area, if outpatients, will drive to treatment each day. If inpatients, family and friends will not arrange for overnight lodging in Rochester during visits.
- ❖ Outpatients living 80 miles or more from Rochester will stay overnight when scheduled for treatment two days in succession. One family member or friend will accompany the patient.
- ❖ Inpatients living 80 miles or more from Rochester will be accompanied by one family member or friend who will stay in the community for the duration of the inpatient stay (averaging 7.65 days).
- ❖ For both inpatients and outpatients living between 50 and 80 miles distant, we assume that half will spend the night and half will drive back and forth.

- ❖ Of outpatients and family members staying the night, half are assumed to stay at Hope Lodge (associated with the American Cancer Society) at no charge and half in a local hotel.
- ❖ Daily costs assumed for visitors are \$50 for lodging (for those not staying at Hope Lodge), \$20 for food, \$15 for incidentals and \$5 for fuel for inpatients and \$20 per day for outpatients.

These assumptions were developed through discussions with the Cancer Center's Patient Relations Committee, which includes several volunteers who work closely with families. Total annual spending by visitors for both inpatient and outpatient treatment is estimated at about \$120,000.

While this figure is now modest, it will grow rapidly as the Wilmot Cancer Center expands its reach outside the Rochester metropolitan area.

Wilmot Cancer Center Expansion: Annual Impact

The Wilmot Cancer Center Strategic Plan anticipates that clinical and research revenue will grow substantially as a result of the capital construction project and re-attainment of the NCI-cancer center designation.

Clinical Service Expansion

URMC expects that revenue from outpatient clinical services will grow rapidly between 2004 and 2009. For estimating purposes we assume outpatient growth at a compound annual growth rate between 10% and 16%. Inpatient growth is also expected to continue although not at the same pace as outpatient growth as the hospital lacks additional beds. For purposes of this analysis, we assume compound annual growth of inpatient revenue of 3%.

We further assume that 35% of this growth in clinical care services—both inpatient and outpatient—will come from outside the 6-county Rochester Metropolitan Statistical Area, thus adding to the size of the regional economy.

Impact of NCI Designation on Total Research Funding

The impact of NCI designation on total research funding would likely be substantial. For purposes of this study, CGR established an impact range. Total NCI funding to the lowest quartile of NCI-designated "comprehensive" and "clinical" centers is 49%

higher than NCI funding now flowing to URMC; the second quartile receives dramatically more—174% of Rochester’s total. The low end of the range assumes that total cancer-related research would increase at a rate that would bring URMC up to the median of the lowest quartile. The upper end of our range assumes that URMC would achieve the median of the second quartile.*

National Cancer Institute FY2004 Obligations (\$M)	
URMC	\$9.1
NCI-designated Cancer Centers (clinical & comprehensive): Median for grouping	
1 st Quartile	\$13.6
2 nd Quartile	\$24.9
3 rd Quartile	\$33.7
4 th Quartile	\$61.8
Overall	\$25.9

As none of the research funding would be received in Rochester in the absence of the Wilmot Cancer Center, the full value of the increase is counted in the economic impact.

Expansion Could Add 600-1,200 New Jobs

Depending particularly on the Cancer Center’s success at attracting new research dollars, the new initiative will add from 630 to as many as 1,240 new jobs with annual payroll ranging from \$23 million to as much as \$47 million.

One Researcher’s Impact on Rochester

As the University of Rochester Medical Center aggressively builds pathways from the laboratory to the physician’s office, top research skills are vital to translating knowledge into therapies, procedures or products. Recruiting an established researcher is no small accomplishment for the Cancer Center or, for that matter, the community. And for both, the economic impact can be dramatic.

* For purposes of our analysis we assumed that the average duration of an NCI obligation was 4 years.



Craig T. Jordan, Ph.D., was a researcher at the University of Kentucky's Lucille Parker Markey Cancer Center when he caught the eye of Rochester Cancer Center Director Richard Fisher. After completing a PhD at Princeton and post-doctoral studies at MIT, Jordan entered the fast-paced biotechnology industry, earning his private sector spurs at a small start-up, Aastrom Biosciences; the more-established Somatix Therapy Corporation; and industry leader Genentech. He then launched his successful career in academic medical research in Lexington, securing a number of major research grants from leading funders, including the National Institutes of Health, the American Cancer Society, the Department of Defense and the Leukemia & Lymphoma Society. In Jordan, Fisher recognized he'd found a leader who knew both the academic and commercial ends of biotechnology.

Jordan's subsequent move to Rochester had an immediate impact in the local community. His artist wife, Donna, also relocated and established a studio with Anderson Alley Artists, a congregation of artists in Rochester's cultural district. Two members of his Lexington laboratory (plus spouses and a child) also made the trek to Rochester, enthusiastic about the potential offered by URMC's outstanding facility and collegial working environment. Like Donna Jordan, a sculptor, the spouses of Jordan's laboratory team members are also contributors to the community.

At the time of the move in 2003, Jordan was the principal investigator on a number of research grants, and he brought to Rochester about \$850,000 per year in research investment, both direct spending in his laboratory and indirect funding for URMC. Today Jordan's laboratory has 10 researchers, eight of whom are largely dependent on the laboratory for their livelihoods. They include four laboratory technicians, one graduate student, a senior instructor and two physicians. All are married and many have children. While only three re-located to Rochester specifically to work in the laboratory, the long-term impact of URMC's recruitment of Jordan allows eight families to call Rochester home and adds to the purchasing power of two more.

Due to his interest in translational research, Jordan also became deeply involved in the creation of the Translational Research Center, a new URMC institution that works with pharmaceutical companies to improve the success rates of clinical trials. In its first eight months, this center signed contracts worth \$300,000 and is expected to serve as a major inducement for pharmaceutical companies considering the University of Rochester as a clinical trial site. While the Translational Research Center is initially focused on leukemia and lymphoma, its contribution will expand over time. It already employs three persons, including a director, who is the spouse of one of the researchers who relocated from Lexington with Jordan.

Construction of the Cancer Center Expansion

The expanded outpatient facility for the Wilmot Cancer Center is expected to cost \$49 million. We anticipate that the one-time impact of this expenditure will be a direct employment increase of about 550 construction jobs (on a one-year, full-time equivalent basis) with labor income of about \$23 million. Indirect employment (again, the equivalent of one-year, full-time equivalent) will be about 200 with labor income of roughly \$7 million.

Spin-Off Employment from Additional Research Funding

New research spending will bring with it new discoveries. Some of this intellectual property will stimulate commercial development, creating jobs. Employment can be expected at two stages in the process, pre-commercialization R&D and post-commercialization manufacturing, marketing and administration. As these estimates are highly speculative, we have not included them in the more predictable measures of economic impact reported above.

The Massachusetts Institute of Technology (MIT), the University of Pennsylvania (Penn) and others have measured pre-commercialization investments through surveys of firms holding licenses from their institutions. The MIT and Penn studies estimated that each exclusive, active patent license stimulated almost \$1 million per year of induced investment (R&D spending by the licensee to make an idea commercially viable) prior to

bringing a product to market (\$.98 M in the MIT study and \$.93 M in the Penn study). CGR estimated in a prior study* that each license would stimulate employment of 5 to 6 highly-skilled workers during the pre-commercialization phase of development. The location of these jobs depends on the location of the licensee.

Using information collected by the Association of University Technology Managers (AUTM) for 2003, we find that a research “disclosure” (the first step on the road to a patent) was associated with about \$2.3 million in research spending.* Universities reported a paying license or option on a discovery for every \$9 million in spending, although medical research is more likely to generate a license than physical science research. The current economic impact of research at URMC’s Wilmot Cancer Center is about 11 new pre-commercialization jobs each year; this could nearly triple if the research program grows as assumed in this study.

Once licenses begin to pay royalties, the licensee is manufacturing and selling a product. The 2003 AUTM survey reported that each option or license earned about \$120,000 per year for the licensee. A typical royalty rate is about 2%; at this rate, license revenue of \$120,000 would imply revenue of just over \$6 million per license for the licensee. Among pharmaceutical manufacturers in New York State, about \$430,000 in sales is associated with every job (IMPLAN analysis of Bureau of Labor Statistics information). Thus the average paying license is generating about 14 jobs. The variation around these averages, however, is quite large. Many new licenses create little or no employment while others generate very significant job totals. If these relationships hold true for

* CGR Gleason Center for State Policy, *Will New York State Miss the Biotech Train?*
<http://cgr.org/AreasOfImpact/EconomicAnalysis/#article41>

* Our approach was to associate reported disclosures and options/licenses with an average of 3 prior years of research funding. We did not create a model to capture a statistically-valid correlation between spending and subsequent outcomes. These figures, as a result, are illustrative, not predictive.

cancer research conducted at URMC, then the current level of research spending would, on average, stimulate about 28 jobs outside the university; this could reach almost 80 if total cancer research expands.

What share of employment that is stimulated remains in the region? It depends on who holds the licenses, although a 1999 AUTM survey indicated that 82% of licenses were executed with a firm located in the same state as the research institution. Certainly licenses with startup firms are more likely to stimulate local employment; among respondents to the AUTM survey, 13% of licenses and options executed in FY2003 were with startup firms; 52% were with small companies and 35% with large companies. Among hospitals and research institutes, the share of licenses with large firms was greater (51%) and with startups was smaller (7%).

One parameter determining the success rate is the quality and quantity of resources devoted to the technology transfer process by the university. URMC, as part of the Strategic Plan the institution put in place in 1996, has made a substantial investment in technology transfer, suggesting that URMC's success rate may be above average for comparable institutions.

	Current Level of Cancer Research	Projected Cancer Research: Low Estimate	Projected Cancer Research: High Estimate
Expected Invention Disclosures	8	11	21
Expected Paying Licenses	2	3	5
Expected Pre-commercialization Employment	11	16	30
Expected Production Employment	28	42	77

APPENDIX

2003 Grants to NCI-Designated Cancer Centers (P30 Core Grants)

State	Institution	Type of Center	(\$1,000)	Rank
Alabama	University of Alabama at Birmingham	Comprehensive	\$ 5,124	13
Arizona	University of Arizona	Comprehensive	\$ 3,750	24
California	University of California San Francisco	Comprehensive	\$ 7,771	5
California	University of Southern California	Comprehensive	\$ 5,916	8
California	University of California Los Angeles	Comprehensive	\$ 4,487	18
California	University of California San Diego	Comprehensive	\$ 3,978	21
California	Burnham Institute	Lab/Basic	\$ 3,044	31
California	Salk Institute for Biological Sciences	Lab/Basic	\$ 2,689	34
California	University of California Irvine	Comprehensive	\$ 2,617	37
California	Beckman Research Institute	Comprehensive	\$ 2,371	42
California	University of California Davis	Clinical	\$ 1,296	57
Colorado	University of Colorado Health Sciences Center	Comprehensive	\$ 3,659	26
Connecticut	Yale University	Comprehensive	\$ 1,039	60
District of Columbia	Georgetown University	Comprehensive	\$ 2,908	32
Florida	University of South Florida	Comprehensive	\$ 2,285	43
Hawaii	University of Hawaii at Manoa	Clinical	\$ 1,964	46
Illinois	Northwestern University	Comprehensive	\$ 4,690	17
Illinois	University of Chicago	Clinical	\$ 4,116	19
Indiana	Indiana University - Purdue University at Indianapolis	Clinical	\$ 1,362	55
Indiana	Purdue University West Lafayette	Lab/Basic	\$ 1,139	59
Iowa	University of Iowa	Comprehensive	\$ 1,559	50
Maine	Jackson Laboratory	Lab/Basic	\$ 2,572	38
Maryland	Johns Hopkins University	Comprehensive	\$ 5,924	7
Massachusetts	Dana-Farber Cancer Institute	Comprehensive	\$ 10,287	1
Massachusetts	Massachusetts Institute of Technology	Lab/Basic	\$ 2,482	40
Michigan	University of Michigan at Ann Arbor	Comprehensive	\$ 5,055	14
Michigan	Barbara Ann Karmanos Cancer Institute/Wayne State University	Comprehensive	\$ 730	61
Minnesota	University of Minnesota Twin Cities	Comprehensive	\$ 3,253	29
Minnesota	Mayo Foundation Clinic	Comprehensive	\$ 3,112	30
Missouri	Washington University	Clinical	\$ 1,385	54
Nebraska	University of Nebraska Medical Center	Clinical	\$ 1,532	51
New Hampshire	Dartmouth College	Comprehensive	\$ 1,871	47
New Jersey	Robert Wood Johnson Medical School	Comprehensive	\$ 2,679	35
New York	Memorial Sloan-Kettering Institute for Cancer Research	Comprehensive	\$ 9,233	3
New York	Albert Einstein College of Medicine/Yeshiva University	Clinical	\$ 3,756	23
New York	Cold Spring Harbor Laboratory	LaboratoryLab/Basic	\$ 3,742	25
New York	Roswell Park Cancer Institute Corp	Comprehensive	\$ 3,583	27
New York	American Health Foundation	Lab/Basic	\$ 2,633	36
New York	Kaplan Cancer Center/NYU	Clinical	\$ 2,502	39
New York	Columbia University Health Sciences	Comprehensive	\$ 1,768	48
North Carolina	Duke University	Comprehensive	\$ 5,840	9
North Carolina	University of North Carolina Chapel Hill	Comprehensive	\$ 5,296	12
North Carolina	Wake Forest University	Comprehensive	\$ 1,483	53
Ohio	Case Western Reserve University	Comprehensive	\$ 3,949	22
Ohio	Ohio State University	Comprehensive	\$ 2,761	33
Oregon	Oregon Health & Science University	Clinical	\$ 1,228	58
Pennsylvania	Fox Chase Cancer Center	Comprehensive	\$ 7,730	6
Pennsylvania	University of Pennsylvania	Comprehensive	\$ 5,394	10
Pennsylvania	Thomas Jefferson University	Clinical	\$ 4,909	15
Pennsylvania	University of Pittsburgh at Pittsburgh	Comprehensive	\$ 4,063	20
Pennsylvania	Wistar Institute of Anatomy and Biology	Lab/Basic	\$ 2,466	41
Tennessee	St. Jude Children's Research Hospital	Clinical	\$ 4,849	16
Tennessee	Vanderbilt University	Comprehensive	\$ 3,264	28
Texas	University of Texas M.D. Anderson Cancer Center	Comprehensive	\$ 9,026	4
Texas	San Antonio Cancer Institute	Clinical	\$ 1,754	49
Utah	Huntsman Cancer Institute/University of Utah	Clinical	\$ 1,497	52
Vermont	University of Vermont & St. Agric College	Comprehensive	\$ 1,304	56
Virginia	Medical College of Virginia/Virginia Commonwealth University	Clinical	\$ 2,262	44
Virginia	University of Virginia Charlottesville	Clinical	\$ 2,056	45
Washington	Fred Hutchinson Cancer Research Center	Comprehensive	\$ 9,653	2
Wisconsin	University of Wisconsin Madison	Comprehensive	\$ 5,378	11
Total P30 Core Grants			\$ 222,025	

FY04 NCI Grant Obligations and Grant Totals: Top 100

Institution	Rank	\$ Obligated	# of Grants	NCI Designation
UNIVERSITY OF TEXAS MD ANDERSON CAN CTR	1	\$107,187	235	Comprehensive
FRED HUTCHINSON CANCER RESEARCH CENTER	2	\$82,200	127	Comprehensive
JOHNS HOPKINS UNIVERSITY	3	\$82,134	155	Comprehensive
UNIVERSITY OF PENNSYLVANIA	4	\$75,695	173	Comprehensive
DANA-FARBER CANCER INSTITUTE	5	\$75,202	125	Comprehensive
UNIVERSITY OF CALIFORNIA SAN FRANCISCO	6	\$67,151	149	Comprehensive
SLOAN-KETTERING INSTITUTE FOR CANCER RES	7	\$61,802	117	Comprehensive
DUKE UNIVERSITY	8	\$58,906	132	Comprehensive
UNIVERSITY OF MICHIGAN AT ANN ARBOR	9	\$56,307	124	Comprehensive
MAYO CLINIC COLL OF MEDICINE, ROCHESTER	10	\$53,940	99	Comprehensive
VANDERBILT UNIVERSITY	11	\$53,687	122	Comprehensive
UNIVERSITY OF PITTSBURGH AT PITTSBURGH	12	\$48,185	120	Comprehensive
UNIVERSITY OF SOUTHERN CALIFORNIA	13	\$42,817	67	Comprehensive
MASSACHUSETTS GENERAL HOSPITAL	14	\$41,905	97	none
UNIVERSITY OF NORTH CAROLINA CHAPEL HILL	15	\$41,679	123	Comprehensive
UNIVERSITY OF CALIFORNIA LOS ANGELES	16	\$41,523	105	Comprehensive
AMERICAN COLLEGE OF RADIOLOGY	17	\$41,003	6	none
NATIONAL CHILDHOOD CANCER FOUNDATION	18	\$40,988	4	none
WASHINGTON UNIVERSITY	19	\$38,099	90	Clinical
UNIVERSITY OF ARIZONA	20	\$37,803	74	Comprehensive
STANFORD UNIVERSITY	21	\$35,761	90	none
OHIO STATE UNIVERSITY	22	\$35,617	101	Comprehensive
BAYLOR COLLEGE OF MEDICINE	23	\$35,477	97	none
UNIVERSITY OF CHICAGO	24	\$35,289	68	Clinical
BRIGHAM AND WOMEN'S HOSPITAL	25	\$34,720	61	none
UNIVERSITY OF ALABAMA AT BIRMINGHAM	26	\$34,506	79	Comprehensive
UNIVERSITY OF WISCONSIN MADISON	27	\$33,867	91	Comprehensive
UNIVERSITY OF CALIFORNIA SAN DIEGO	28	\$33,535	85	Comprehensive
ROSWELL PARK CANCER INSTITUTE CORP	29	\$33,338	77	Comprehensive
UNIVERSITY OF WASHINGTON	30	\$31,418	91	Clinical
CANCER THERAPY AND RESEARCH CENTER	31	\$30,568	6	none
YESHIVA UNIVERSITY	32	\$28,257	62	Clinical
FOX CHASE CANCER CENTER	33	\$27,546	57	Comprehensive
CASE WESTERN RESERVE UNIVERSITY	34	\$26,373	78	Comprehensive
ST. JUDE CHILDREN'S RESEARCH HOSPITAL	35	\$25,357	52	Clinical
COLUMBIA UNIVERSITY HEALTH SCIENCES	36	\$25,180	71	Comprehensive
NORTHWESTERN UNIVERSITY	37	\$24,983	71	Comprehensive
SCRIPPS RESEARCH INSTITUTE	38	\$24,248	61	none
UNIVERSITY OF MINNESOTA TWIN CITIES	39	\$24,035	73	Comprehensive
DARTMOUTH COLLEGE	40	\$23,795	52	Comprehensive
THOMAS JEFFERSON UNIVERSITY	41	\$23,076	47	Clinical
YALE UNIVERSITY	42	\$22,812	75	Comprehensive
BETH ISRAEL DEACONESS MEDICAL CENTER	43	\$21,273	60	none
NSABP FOUNDATION, INC.	44	\$21,222	3	none
NEW YORK UNIVERSITY SCHOOL OF MEDICINE	45	\$20,916	62	Clinical
GEORGETOWN UNIVERSITY	46	\$20,824	60	Comprehensive
BURNHAM INSTITUTE	47	\$20,713	35	Lab/Basic
CITY OF HOPE/BECKMAN RESEARCH INSTITUTE	48	\$20,499	40	Comprehensive
UNIVERSITY OF COLORADO HLTH SCIENCES CTR	49	\$20,247	58	Comprehensive
MASSACHUSETTS INSTITUTE OF TECHNOLOGY	50	\$19,413	33	Lab/Basic

FY04 NCI Grant Obligations and Grant Totals: Top 100 (cont.)

Institution	Rank	\$ Obligated	# of Grants	NCI Designation
MOUNT SINAI SCHOOL OF MEDICINE OF NYU	51	\$19,350	62	none
HARVARD UNIVERSITY (SCH OF PUBLIC HLTH)	52	\$18,624	37	none
UNIVERSITY OF CALIFORNIA IRVINE	53	\$18,426	55	Comprehensive
HARVARD UNIVERSITY (MEDICAL SCHOOL)	54	\$18,031	40	none
H. LEE MOFFITT CANCER CTR & RESEARCH INS	55	\$17,422	51	none
UNIVERSITY OF VIRGINIA CHARLOTTESVILLE	56	\$16,745	64	Clinical
EMORY UNIVERSITY	57	\$15,873	51	none
UNIVERSITY OF CALIFORNIA DAVIS	58	\$15,703	45	Clinical
UNIVERSITY OF ILLINOIS AT CHICAGO	59	\$15,290	41	none
UNIVERSITY OF UTAH	60	\$14,791	40	Clinical
UNIVERSITY OF IOWA	61	\$14,380	41	Comprehensive
UNIVERSITY OF HAWAII AT MANOA	62	\$14,281	23	Clinical
UNIVERSITY OF TEXAS SW MED CTR/DALLAS	63	\$13,985	35	none
WAYNE STATE UNIVERSITY	64	\$13,616	54	Comprehensive
FRONTIER SCIENCE & TECH RESEARCH FDN,INC	65	\$13,457	4	none
COLD SPRING HARBOR LABORATORY	66	\$13,297	22	Lab/Basic
UNIV OF MED/DENT NJ-R W JOHNSON MED SCH	67	\$13,281	46	Comprehensive
WISTAR INSTITUTE	68	\$12,889	29	Lab/Basic
UNIV OF MASSACHUSETTS MED SCH WORCESTER	69	\$12,727	40	none
VIRGINIA COMMONWEALTH UNIVERSITY	70	\$12,201	38	Clinical
JOHN WAYNE CANCER INSTITUTE	71	\$12,162	5	none
GYNECOLOGY ONCOLOGY GROUP	72	\$11,944	1	none
OREGON HEALTH & SCIENCE UNIVERSITY	73	\$11,710	47	Clinical
CLEVELAND CLINIC LERNER COL/MED-CWRU	74	\$11,327	39	none
UNIVERSITY OF MARYLAND BALT PROF SCHOOL	75	\$10,945	46	none
UNIVERSITY OF CINCINNATI	76	\$10,798	32	none
UNIVERSITY OF CALIF-LAWRENC BERKELEY LAB	77	\$10,593	19	none
WAKE FOREST UNIVERSITY HEALTH SCIENCES	78	\$10,414	41	Comprehensive
WEILL MEDICAL COLLEGE OF CORNELL UNIV	79	\$10,336	30	none
U.S. PHS PUBLIC ADVISORY GROUPS	80	\$10,240	18	none
SALK INSTITUTE FOR BIOLOGICAL STUDIES	81	\$10,040	16	Lab/Basic
INDIANA UNIV-PURDUE UNIV AT INDIANAPOLIS	82	\$9,962	33	Clinical
STATE UNIVERSITY NEW YORK STONY BROOK	83	\$9,565	31	none
UNIVERSITY OF VERMONT & ST AGRIC COLLEGE	84	\$9,404	19	Comprehensive
PENNSYLVANIA STATE UNIV HERSHEY MED CTR	85	\$9,199	30	none
UNIVERSITY OF ROCHESTER	86	\$9,125	29	none
UNIVERSITY OF NEBRASKA MEDICAL CENTER	87	\$9,074	33	Clinical
CHILDREN'S HOSPITAL OF PHILADELPHIA	88	\$8,892	23	none
UNIVERSITY OF ARKANSAS MED SCIS LTL ROCK	89	\$8,784	22	none
CHILDREN'S HOSPITAL (BOSTON)	90	\$8,775	23	none
MEDICAL UNIVERSITY OF SOUTH CAROLINA	91	\$8,710	41	none
UNIVERSITY OF KENTUCKY	92	\$8,545	31	none
BOSTON UNIVERSITY MEDICAL CAMPUS	93	\$8,504	30	none
CENTER FOR HEALTH STUDIES	94	\$8,448	11	none
UNIVERSITY OF SOUTH FLORIDA	95	\$8,009	26	Comprehensive
BROWN UNIVERSITY	96	\$7,908	14	none
UNIVERSITY OF MIAMI-MEDICAL	97	\$7,707	37	none
UNIVERSITY OF TEXAS MEDICAL BR GALVESTON	98	\$7,486	28	none
PRINCETON UNIVERSITY	99	\$7,476	15	none
INSTITUTE FOR CANCER PREVENTION	100	\$7,359	14	Lab/Basic
Total (Top 100)		\$ 2,550,888	5,742	
Total (All Recipient Institutions)		\$ 3,115,412	7,774	

Source: National Cancer Institute, National Institutes of Health