Marjatta Hietala - Aulikki Litzen
marjatta.hietala@uta.fi, aulikki.litzen@uta.fi
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TOWNS AS SEEDBEDS FOR SCIENCE AND FOR INNOVATIONS IN THE 20TH CENTURY EUROPE

Our aim is to analyse attractive and innovative centres, centres of excellence, during the last century. At first we try to outline some factors behind the attraction and innovativeness of cities, especially of towns as science centres or as university towns. In the latter part of our paper special attention is on the research milieus. The first example is based on Marjatta Hietala´s studies on mobility of Finnish scholars at the turn of the 20th century. A deeper analysis concern the careers of Nobel Prize winners in science and attraction of towns based on Aulikki Litzen´s study on Nobel Prize laureates. She offers some explanations for success in location decisions and compares the European experience with the situation in the United States.

Innovativeness

Innovativeness of a society is embedded in the city's traditions. These are the mentality of its people, satisfactory institutions, buildings and support services, such as transport and communication which all belong to so called "hard infrastructure". So called "soft infrastructure consists of various kinds of social networks in the form of informal groups, clubs and common interest networks.[1]

During the last years historians, sociologists and economists, like Peter Hall, Manuel Castells, Richard Florida and Sverker Sörlin have analysed cities as creative and innovative centres. Manuel Castells has emphasized new knowledge-intensive environments where creative synergies arise.[2] Both Castells and Florida emphasize the mobility and the non-hierarchical structure as well as the cultural dimension of a society as prerequisites for innovativeness. In his latest book *Cities and the Creative*

Class Florida explains the success of individual towns with three t: technology, talent/education and tolerance.[3]

Charles Landry describes the "hard infrastructure" as follows: the physical environment and continuity for the development of innovations. On the other hand "soft infrastructure" provides the forum for creative ideas and their initial development, which can also take place within collaborative arrangements such as public private partnerships for harnessing resources. These factors are included in the term "social capital", which covers not only the institutions, that underpin the society, but also "the glue that holds them together" and embraces the relationships and norms that shape the quality and quantity of social interaction in any particular society as well as the role that families and firms play along with gender, democracy and ethnicity. Naturally the norms and values influence the nature of the creative milieu as well as innovations to be adopted.

Swedish researchers Sverker Sörlin and Gunnar Törnqvist uses the term "the social fabric" when emphasizing countless contacts, meetings and social events, cultural and communicative infrastructure.[4] According to Peter Hall innovative environments, cities and places provide opportunities for unexpected meetings between people and different areas of activity.

The foundation and the development of certain research institutes depend not only on local decision making process but on the political climate, and on the activity of different pressure groups and of individual promoters. We assume that development of certain institutes and towns is cyclical, like Joseph Schumpeter has argued, and that the success of institutes and universities is depending on economic resources and human and capital.

When exploring historically the transfer of new information or innovativeness researchers have concluded that this transfer was facilitated by the weak barriers between social classes, the existence of few restrictive practices in working processes, individualism and competition, flexibility, mobility, adaptability. In his book *Cities and Civilization* Pater Hall has argued how important the activity of town has been to

attract e.g. top musicians and skilful composers to Vienna during the 18th and 19th centuries.[5]

Berlin

Marjatta Hietala's earlier studies on Helsinki as an innovative city have shown that the key elements for Finland's and Helsinki´s road to a knowledge-based society have been the high level of education and mobility. These are essential elements in countries with limited capital like Finland. In Finland both the state and the cities have invested in the acquisition of know-how from abroad. Scientists and experts of various fields had to travel in order to keep up with the times. Finland indeed has a long tradition of adopting the most modern know-how, having first-rate linguistic skills and holding on to the goal to be in the forefront of the latest developments.[6]

At the end of 19th century and in the beginning of the 20th century German universities began to attract international students. According to Marjatta Hietala´s study on the mobility and international contacts of Finnish researchers, 459 professors of the University of Helsinki went to Germany in 1860-1960. Before the First World War, Finnish students preferred to study at the universities of Berlin, Munich, Göttingen, Leipzig, Jena, and Marburg, where they stayed 1-2 terms. Usually they moved from one university to another. The popularity of German universities and towns is obvious. Of all study or congress travels/tours (altogether appr. 1500 study tours) completed during 1890-1914 one third (approximately 500 study tours) were made to Germany. From the 1880´s onwards studying in Germany had increased among Finnish scientists and medicine students. Another peak in study tours of Finnish scholars and scientists was from late 1920´s to the end of 1930´s. Finnish German contacts increased because of frequent congresses and of dense networks.[7]

Berlin became a centre for international activities. It became famous for its university, laboratories and research institutes for bacteriology, pathology, anatomy and ophthalmology. Berlin clinics and laboratories attracted Finnish doctors of medicine for visits and for longer terms. In 1891-1909 altogether 80 study tours were made to Berlin by Finnish professors of medicine German universities like Berlin, Munich, Tübingen, Leipzig, Dresden, and Heidelberg had their strengths. Finnish students of

theology went to Göttingen and Tübingen, students in law studied in Leipzig and Berlin, and students of philosophy in Heidelberg and Leipzig.

Finnish students of medicine and those aiming at specialization in medicine followed the same pattern as other medical students. During the first half of the 19th century Paris was to destination for medical students, but around the middle of the century Vienna came to the fore. The popularity of Vienna was increased by its high standard of medicine and the city's low price level. Vienna, in turn, was partly replaced by Berlin, the clinics of which began to attract foreign students and specialists since the 1880s. Finnish professors and students of medicine became familiar with Berlin clinics and laboratories. Most of them received scholarships from University of Helsinki or from national and private foundation. Some participated in summer courses and some in winter courses, which regularly gathered students from the whole Europe.

Thomas Bonner has analysed the Europe-orientation of Americans surgeons before the First World War. According to his calculations in 1840-1917 the amount of American students at the University of Heidelberg was 1200, of which 268 doctors of medicine.[8] According to Charles Rosenberg altogether 15000 doctors of medicine received their further training in 1840-1917 in German speaking universities, two thirds in Vienna and 3000 in Berlin and not more than 10 percent in other German Universities.[9]

Efficient information might be one factor behind the attractiveness of Berlin and of other German Universities. A special office (Die Akademische Auskunftsstelle an der Königlichen Friedrich Wilhelm-Universität zu Berlin) gave information to students. We know that in 1906 there were 4669 visitors in Berlin and that the office had received altogether 10000 inquiries. Journals like *Berliner Akademische Wochenschrift* and *Berliner Akademische Nachrichten II*, published by the international office of Friedrich Wilhelm Universität in Berlin, and *Akademische Rundschau* published information for students and scholars on lectures, accommodation, cultural events and clubs in the town. Lists of foreign consulates and embassies helped foreign scholars as well.[10]

To conclude Berlin attracted researchers from all over the world especially in medicine. Clinics-system and teaching methods were excellent. In addition the university invested money for dissemination of information through various channels, journals, handbooks and by founding an office for international students. In Germany, especially in Berlin there were many publishing houses which offered services for scientific publications. In addition statistical data on various phenomena was available. That increased the attractiveness of Berlin and other German cities in the eyes of foreign scholars.

Nobel careers and the attractiveness of towns

The following is a part of Aulikki Litzen's ongoing research on the mobility of Nobel Prize winners in science done in the project *Scholars, science, universities, and networks as factors making cities attractive,* directed by Academy Professor Marjatta Hietala. In his recent dissertation on the external aspects of creativity Ola Tufvesson, a Swedish geographer and student of Gunnar Törnqvist, uses the career data of Nobel laureates in a way near to Litzen's.[11] However, while Thufvesson searches creativity in persons' lives and focuses on the meetings of the laureates, Litzen uses the career data, collected independently of Thufvesson's, to find information on career development and mobility of the highly-skilled as such. Additionally, she ranks cities and towns from the point of view of laureate employees, and in some extent explains networks between cities and towns, woven by the movements of the laureates. Litzen has structured the careers of 480 laureate with a full career (from the total 507 laureates in science 1901-2005) to main jobs and counted laureates' coming to new places and the length of their stay in years. The data consists of 1579 main jobs with 569 employees in 285 places in 36 countries. The general time series, 1860-2005, are shorter in some comparisons.

The points of reference by which Litzen compares the laureate careers and give ranking points to the places are final degree (study), the Nobel Prize work (research), the final job (work), and the length of laureates' presence (person years). Litzen interprets a laureate's presence as evidence for the attractiveness of the place, whether it is the cause or the consequence. The apex of laureate career is the job where he made the discovery that was awarded with Nobel Prize. In some cases, neither the

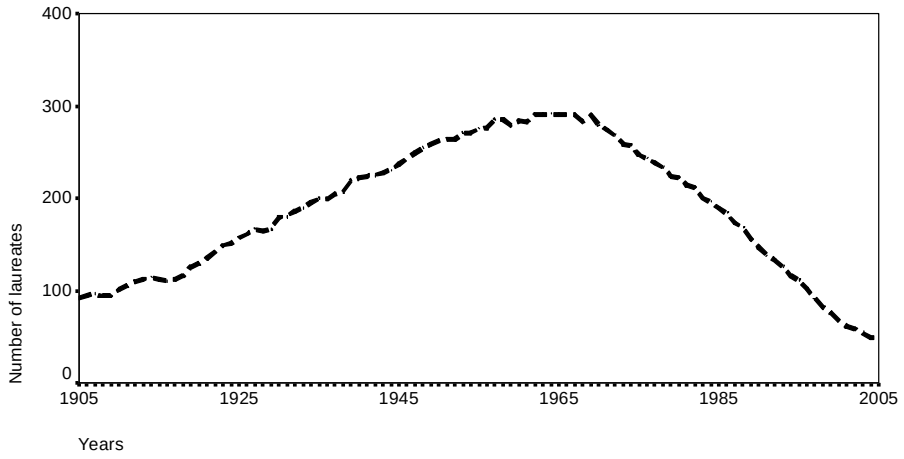
scientist himself nor the scientific community recognizes the achievement's value immediately, and the scientist proceeds to another work place inconspicuously. In other cases, the ground breaking discovery is noticed at once and it makes the scientist a celebrity that is hunted for by faculties, research institutes and companies. In any case, the scene of discovery, the institution and its site, have been favourable to creative work. The vast literature specifying the elements of creativity lists many marks to consider. One mark of creativity of an institution is without doubt the number of laureates, the fact that universities often use when introducing themselves to new students and faculty.

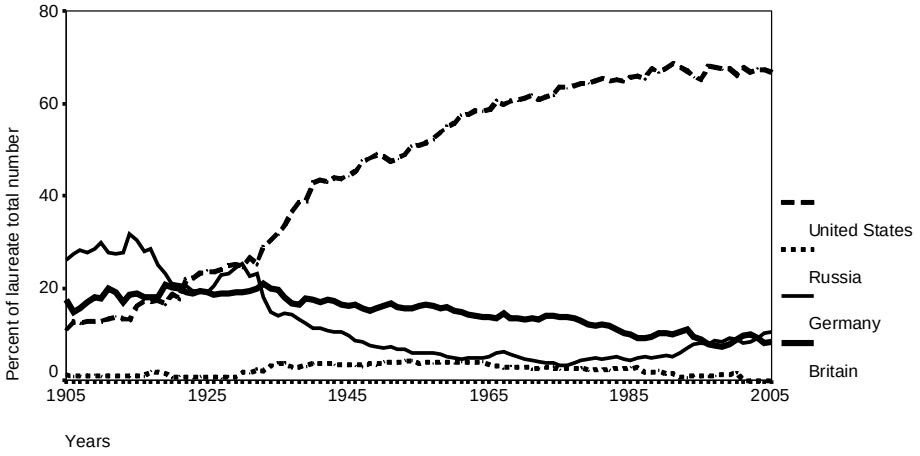
The lists ranking best places for study, research, or work do not differ much from the list based on person years. Six European towns are on the top ten lists: Cambridge, Paris, London, Berlin, Munich, and Zurich.

Figure 1

Laureates in countries

Percent of total number of laureates





Laureates' presence gives a means for comparison of the changing national and international scientific role of countries as well as also of cities and towns. Europe has lost much of its scientific importance to the United States during the 20th century. More than half of the active laureates have been working in the United States from the 1950s, though the drift happened already in the mid 1930s (Figure 1). Germany has suffered most, though the curve shows a slight recovery in the 1980s. Britain has lost less of its weight compared to the situation before the First World War.

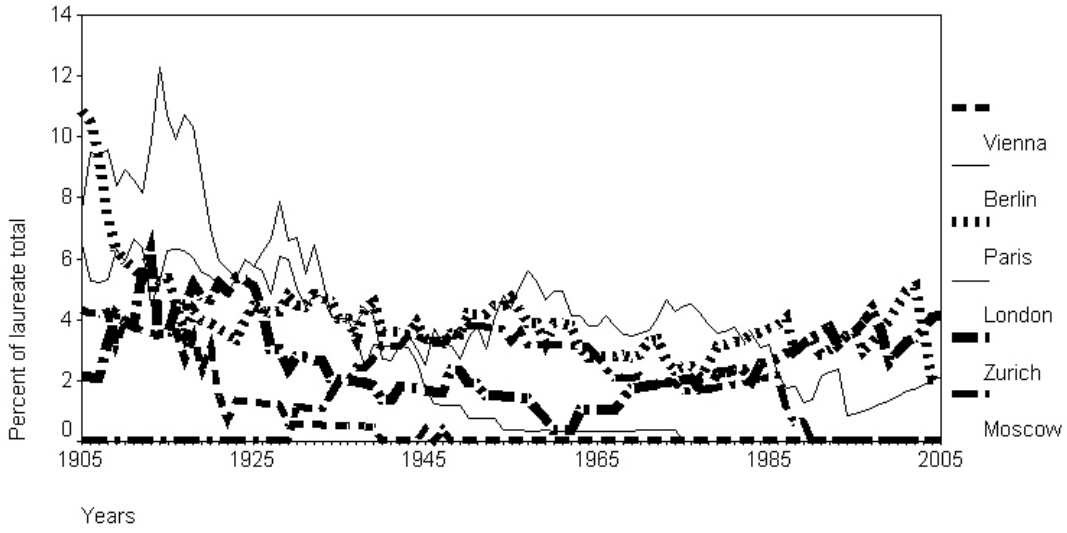
Laureates in cities and university towns

The European capitals of Austria, Germany and Britain were ruling international science centres in the beginning of 20th century (Figures 2 and 3). Vienna's and Berlin's decline started after the First World War and at the end of the Second World War they were finished as important science centres.

Figure 2

European cities as international science centres

Proportion of active laureates



As to the proportion of world laureates, New York overtook the European cities by the early 1930, and in the end of the decade its proportion was about the same as Berlin's had been just before the First World War. Boston, home of Harvard University and Massachusetts Institute of Technology, surpassed New York in the beginning of 1960s (Figure 3).

Figure 3

American cities as international science centres

Proportion of active laureates

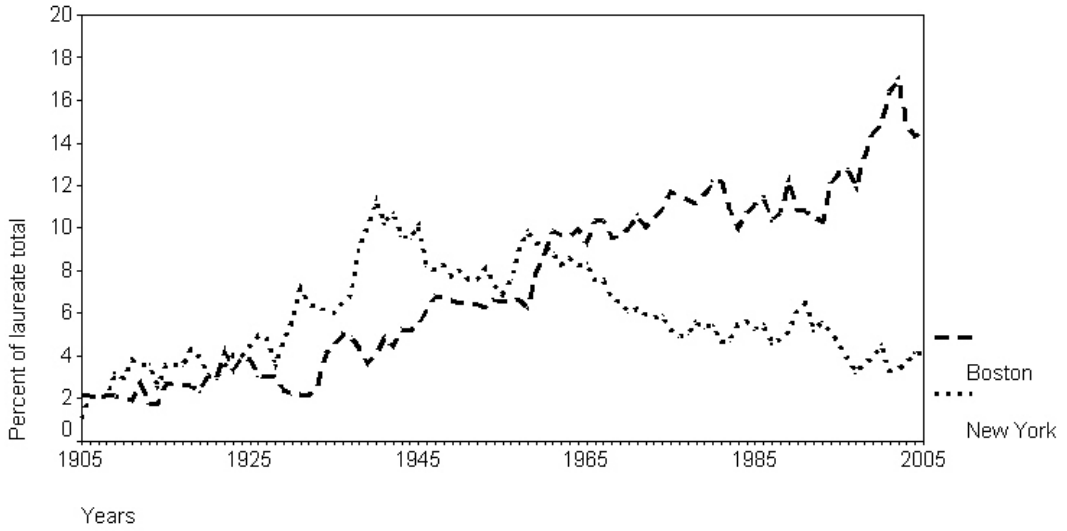
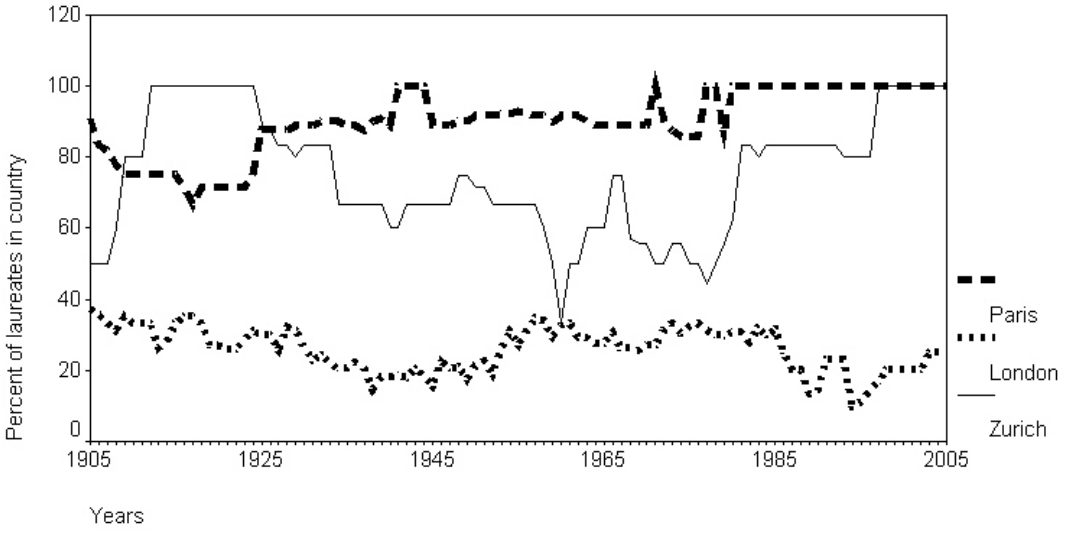


Figure 4

European cities as national science centres

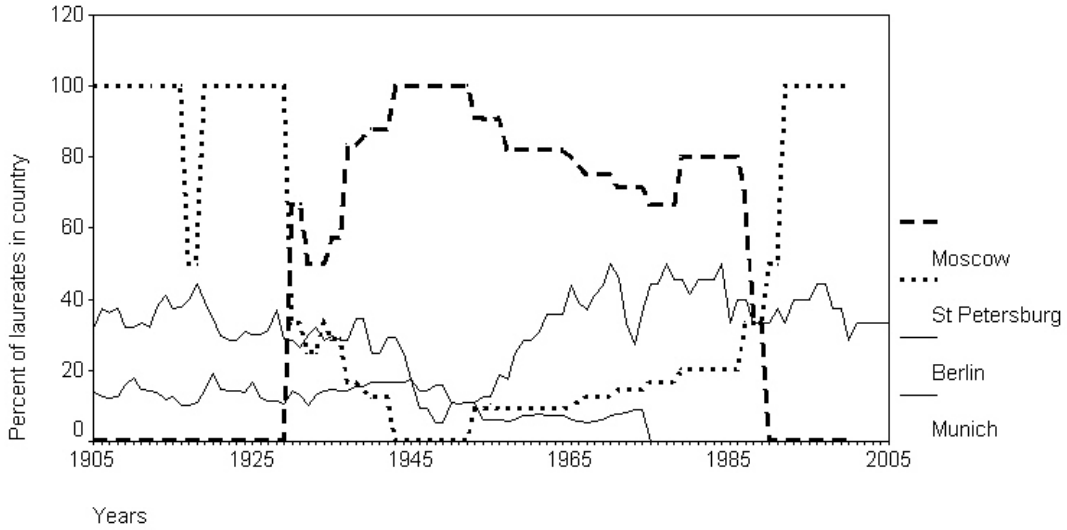
Proportion of laureates in country



London's average proportion of laureates has been around only 25 percent while France and Switzerland have concentrated their talents to one city both (Figure 4). The national importance of Paris is extraordinary: never below 67 percent and with the average of 90 percent laureates. Zurich had some competition by Basel and Geneva in the 1930s-1980s, but has since then had the most laureates in country. Concentration has been the recipe in Soviet Union/Russia and in Germany, too. A little more than a decade after the Soviet government changed the capital from Saint Petersburg to Moscow, in 1934, the Academy of Sciences followed (Figure 5). After the war the laureate density in Moscow started to decline partly because of Saint Petersburg's gradual recovery, but mainly because of the political decisions to establish new science towns and decentralize. In Germany the scientists' move from one city to another was not as abrupt as in Soviet Union, but clear. The old centre of higher education Munich inherited Berlin's role as the capital of German science after the Second World War and Germany's partition. Munich's proportion of laureates doubled in the 1960s (Figure 5), and had been between 30 and 50 percent since. After 1974 no laureates has been working in Berlin.

Figure 5

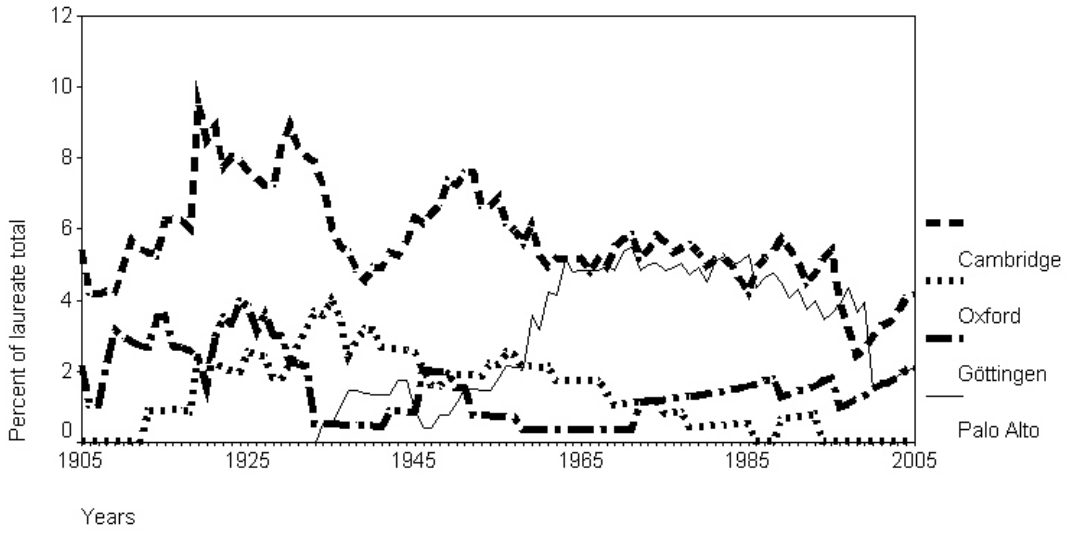
Twin cities Saint Petersburg-Moscow and Berlin-Munich



Of the university towns Cambridge has attracted the most of laureates in Europe (Figure 6) and its portion of them in Britain has been 40 percent in average. The second best university town Oxford has reached 12 percent. Palo Alto, the home of Stanford University, started to compete evenly with Cambridge in the 1960s. In the 1930s when the national socialist atmosphere began to chase out talents, even before the aryanization laws were enforced, Göttingen was hit. Though Göttingen surpassed Oxford in 1960s, it has not fully recovered.

Figure 6

University towns as international science centres



Employer institutions

Cities and university towns can be compared looking at the institutions employing top researchers (Tables 1 and 2). The fact that laureates do not work at some kind of institution does not mean that institutions of the kind do not exist, but it merely demonstrates the local weakness of the field in question. How to categorize research and development institutions is problematic and depends on the view point. From the employee laureate's view point the field of research and the time available for research are most important, not the financing source of the institution or if the institution is for- profit or non-profit. Some long-lived institutions have changed character during times: for-profit company research laboratories have got an independent status with non-profit foundation background, and on the other hand, some non-profit government research laboratories have been reorganized to companies with demand of cost efficiency. Category "Research laboratories" (Table 1 and 2) means non-profit, and for example pharmaceutical laboratories are not included.

The differences of laureate presence in old university towns and cities have at least a partial explanation in the institutional structure that is typical for big cities. City hospitals have been training doctors and nurses traditionally at their own medical schools. Accordingly, laureates specializing in medicine have worked, not in the old university towns, but mainly in London, Paris, Vienna, Berlin, and in the United States in Boston, New York, and Baltimore.

Institutes of technology have also been established in big cities, near to industry, and not in university towns. In Germany engineering was early distributed to various cities of which the most important for laureates have been in Berlin, Munich, Karlsruhe, Aachen, and Hannover. In France Paris and in Britain London have been the only places for engineering laureates. The most popular American institute of technology, Caltech, is an exception in this category, situated as it is in the relatively small Pasadena in California. Originally a local undergraduate college Caltech started to take shape as a technological centre after the foundation of Mount Wilson observatory above Pasadena in 1904. A growing new field, aeronautical research, hastened the

process from the early 1930s. Instead, the second centre for technical laureates, MIT in Boston, and the third, Carnegie-Mellon in Pittsburgh, follow the rule.

Though Berlin offered most jobs to researchers 1860-1919, London had the most versatile institutional structure in the period. Berlin was weaker than London in teaching hospitals and companies, and Paris in companies. Zurich had only the university and the institute of technology, ETH. Berlin was the most versatile city in Europe between the World Wars with strong companies like Siemens. At the same period New York emerged as home of excellent universities, but not of institutes of technology. After the Second World War, London was again the most versatile of European cities.

Table 1

Laureate jobs in cities by institution category and starting time

Time	City	Research institutes	Universities	Teaching hospitals	Institutes of technology4	Companies	Other	Total
1860-1918								
	Zurich		7		8			15
	Vienna	1	6	4				11
	London	3	5	4	1	3		16
	Berlin	16	13		2		6	37
	Munich		11		1			12
	Paris	8	6	4	3		1	22
	S.Petersburg	1	1	1				3
	New York	3	2	1				6
	Boston		2	2				4
	Total	32	53	16	15	3	7	126
1919-1945								
	Zurich		1		5			6
	Vienna		2	1			1	4
	London	5	4	1	2		1	13
	Berlin	9	3	4	2	4	1	23
	Munich		7		1			8
	Paris	10	4	1			2	17

	Rome		5				5
	Moscow	8	1				9
	S.Petersburg	3					3
	New York	8	16	7		3	1	35
	Boston		10	12				22
	Total	43	53	26	10	7	6	145
1946-2005								
	Zurich		1		4	2		7
	London	11	9	2	6	3	1	32
	Berlin	2						2
	Munich	10	3		5			18
	Paris	16	6	1			1	24
	Rome	2	2				3	7
	Moscow	4						4
	S.Petersburg	1						1
	New York	15	20	5	1			41
	Boston	3	25	15	19	2		64
	Total	61	41	8	16	5	5	200

Other: Government offices, schools, private consultancy or research.

Research institute jobs give one possibility to compare the big cities and university towns. In France, the strength of Paris has all the time based on research institutes. In Germany, Kaiser Wilhelm Society's, from 1948 Max Planck Society's, research institutes were first concentrated in Berlin. The life continued normal a few years longer at society's private institutes while the national socialist aryanization policy from 1933 paralyzed the universities where employees were civil servants. Still, statistically Berlin has attracted more laureate level researchers than other German towns. After the war Max Planck Society moved several old Kaiser Wilhelm institutes and also the society's headquarters to Munich. Two laureates of the 1930s, Werner Heisenberg and Adolf Butenandt, had a key role in this development that changed not only Munich proper but also other places in Bavaria to high-technology centres. In the outskirts of Munich two important centres were built from the 1960s on: Garching for physical sciences and Martinsried for bio-sciences.

Independent research institutes financed either privately or by public money, began to flourish in the university neighbourhood only after the First World War. In Germany Göttingen benefited from the institute transfers from Berlin after the war but soon lost some of them to Munich. Heidelberg was more fortunate. Its vanguard expertise in medical research, done at Kaiser Wilhelm institutes, not at hospitals, from 1920s has been strengthened by new establishments, especially the international European Molecular Biology Laboratory 1974. In Britain, independent research institutes became numerous in Cambridge from 1950s. Special importance has had Medical Research Council as financier with public money. Of the American university towns Princeton, Berkeley (University of California Berkeley), Pasadena (Caltech), Palo Alto (Stanford), and La Jolla (University of California San Diego) la Jolla and Princeton has excelled in research institutes around, while Palo Alto has offered more company jobs for laureates. In Europe the only laureate company in university milieu has been the predecessor of the later Deutsche Bergin AG (coal and oil chemistry) that Friedrich Bergius founded and directed from Heidelberg from 1919.

Table 2

Laureate jobs in university towns by institution category and starting time

Time	Town	Research institute	University	Teaching hospital	Institute of technology	Company	Total
1860-1918							
	Cambridge		15				15
	Oxford		2				2
	Göttingen		9				9
	Heidelberg		5			1	6
	Princeton		1				1
	Berkeley		2				2
	Total		34			1	35
1919-1945							
	Cambridge	1	30				31
	Oxford		12				12
	Göttingen		7				7
	Heidelberg	6	2				8
	Princeton	1	4				5
	Berkeley		9				9
	Pasadena				8		8
	Palo Alto		4				4
	Total	8	68		8		84
1946-2005							
	Cambridge	12	20				32
	Oxford		8				8
	Göttingen	5	1				6
	Heidelberg	4	3				7
	Princeton	6	11			1	18
	Berkeley	1	14				15
	Pasadena	1			17		18
	La Jolla	12	7			1	20
	Palo Alto		23	1		3	27
	Total	41	87	1	17	5	151

Laureate brain drain

The attractiveness of cities and their institutions for a person varies according to the stage of career. Some places are best for study, some for research, and some offer best benefits for an employee preparing for retirement. My supposition has been that laureates give priority to research possibilities over other things when leaving their university town, when leaving the place where they have made their best research, and also in most occasions when deciding where to retire.

Table 3

Laureate balance 1860-2005

Town	Degrees	Nobel researches	Left after Nobel research	Final jobs	Final jobs-degrees	Final jobs-Nobel research
Zurich	12	10	-2	11	-1	1
Berlin	18	13	-8	10	-8	-3
Munich	16	10	-2	15	-1	5
Göttingen	13	7	-3	6	-7	-1
Heidelberg	2	3	-2	8	6	5
Tübingen	2	2	-2	1	-1	-1
London	15	13	-3	23	8	10
Cambridge	43	32	-12	23	-20	-9
Oxford	13	6	-1	9	-4	3
Paris	20	22	-2	25	5	3
St.Petersburg	4	3	-1	2	-2	-1
Moscow	7	9	-1	9	2	0
New York	26	32	-16	27	1	-5
Boston	38	37	-12	33	-5	-4
Berkeley	13	9	-1	12	-1	3
Pasadena	10	8	-2	12	2	4
Palo Alto	2	7	-3	13	11	6

Long-term comparison of cities and smaller university towns according to the numbers of final degrees and of final jobs show positive balance in Europe for London, Paris, Heidelberg, and Moscow (Table 3). Balance for research attractiveness, comparison according to numbers of final jobs and Nobel researches, is

best for London but positive also for Oxford, Paris, Heidelberg, Munich, and Zurich. Of the American cities and towns that belong to the top of ranking lists the Californian Palo Alto (Stanford University) has the best balance.

The three best cities and university towns for Nobel research, Cambridge, Boston, and New York, display negative research balance. Though it does not show in statistics for laureate jobs (Table 2), Cambridge has worked from the 1970s to resolve the export problem and offer more jobs to highly qualified researchers. Inspired by the example of Stanford, Cambridge Science Park is a major project that follows and tries to attract science based companies to town.

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[1] Landry, Charles, The Creative City, A Toolkit for Urban Innovators, (Earthscan Publications), London 2000, 87-90.
[2] Castells, Manuel, The Information Age: Economy, Society and Culture (Blackwell), Oxford 1996-1998.
[3] Florida, Richard Cities and the Creative Class,(Routledge), New York – London, 2005, 37-39.
[4] Sörlin, Sverker, Cultivating the Places of Knowledge, Studies in Philosophy and Education 21:377-388, 2002, pp.377-388. Sverker Sörlin, Science and Mational Mobilisation in Sweden, University and nation. The University and the Making of the Nation in Northern Europe in the 19th and 20th Centuries, ed. by Märtha Norrback and Kristiina Ranki, Studia Historica 53, Finnish Historical Society, Helsinki 1996, S.31-41.

[5] Hall, ibid. p.159-200.

[6] Marjatta Bell & Marjatta Hietala, *Helsinki - The Innovative City. Historical Perspectives*, Finnish Literature Society Editions 857, Finnish Literature Society & City of Helsinki Urban Facts, Jyväskylä 2002.
[7] Hietala, Marjatta, *The development of international contacts in the 20th century, Research in Finland – A History*, ed. Päiviö Tommila Aura Korppi-Tommola (eds.), Helsinki University Press 2006, 131-146.
[8] Bonner, *American Doctors and German Universities, A Chapter in International Intellectual Relations 1870-1914*. University of Nebraska Press, 1963, S. 34-3.
[9] Rosenberg, Charles, *The Care of Strangers. The Rise of American Hospital System*, New York 1987.
[10] *Berliner Akademische Wochenschrift*, I. Jg 1906/1907; *Berliner Akademische Nachrichten* II. Jahrgang 1907-1908 hrsg. von Professor Dr. Wilhelm Paszkowski, (Leiter der Akademischen Auskunftstelle an der Königlichen Friedrich-Wilhelms-Universität zu Berlin). Neue Folge der Berliner Akademischen Wochenschrift, Berlin 1908. *Akademische Rundschau. Zeitsschrift für das gesamte Hochschulwesen und die akademischen Berufstände*, hrsg. von Wilhelm Baum und Friedrich Schultze. I Jg 1913.
[11] Ola Thufvesson, *Kreativitetens yttre villkor.* Meddelanden från Lunds universitets geografiska institution. Avahandlingar CLXI. 2006.