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SCIENTOMETRIC PORTRAIT OF NOBEL LAUREATE PIERRE-GILLES DE GENNES

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ABSTRACT

Presents an analysis of 422 papers by the Nobel laureate Pierre-Gilles de Gennes, a French physicist, published during 1956 to 1995 in diverse fields of science such as, magnetism, superconductors, hydrodynamics, polymers, liquid crystals, gels, and glues. The productivity of the scientist peaked in his 40's and his journal preference shows a distinct national bias. Despite the scientist's working with a very large number of collaborators, the percentage of collaborative papers seems to be low i.e. 36%. The receiving of honours and awards seems to attract more collaborators and hike the productivity rate. The scattering of papers over 146 journals does not follow Bradford's law.

Keywords: Scientometrics; Pierre-Gilles de Gennes; Nobel laureate; Bradford's law; Journal preference; Physicists.

INTRODUCTION

Individual scientists including the Nobel laureates are more and more becoming the focus of scientometric studies for quite sometime. An ever-growing stress is recently being laid on scientometrists to publish data on individual scientists rather than gross statistical "macro" data (Schubert and Glanzel, 1992). Some of the studies conducted with individual scientists are as follows. Sinha and Bhatnagar's (1980) focus of study was R.C.Sinha, a renowned plant pathologist of Canada. Derec de Solla Price has been the focus of two different studies. Laitko (1993), dwelling on Price's works showed that they are still relevant. Skalka-Zlatt and Zbikovska-Migon (1993) on the other hand studied the presence of Price's contributions in Polish scientific literature. Other studies centred on cement and concrete chemist, agricultural scientist; a nuclear scientist, chemical engineers and so on (Kalyane and Kalyane, 1993; Sinha and Ulla, 1993; Kademani and Kalyane, 1994; Kalyane and Kalyan, 1994; Kalyane and Devarai, 1994; Peters and Raan, 1994; Kademani and Kalyane, 1995; Kalyane and Samanta, 1995). The present study centres on the contributions of P. G. de Gennes, the French physicist, who won the Nobel Prize for discovering the fact that the methods developed for describing order in simple systems can be generalized in such a way that they can be applied to more complex forms, mainly liquid crystals and polymers. The Swedish Royal Academy of Sciences, while declaring him the winner of Nobel Prize for Physics for the year 1991, called him “the Isaac Newton of our times”, in admiration of his perceptive thinking on the common threads of order and disorder in widely differing physical systems, and for his genius in reducing a broad range of complex phenomenon to a few simple truths. Like Newton, who discovered a set of basic laws explaining the complicated motions of the planets, Professor Gennes is known for his strength in simplifying the view of the world around him. Today because of Gennes it is known that magnets, super-conductors, liquid crystals and polymers all display broadly common traits.

BIOGRAPHICAL SKETCH

Pierre-Gilles de Gennes was born on 24th October, 1932 in Paris, into a family of Protestant elite with a long-standing medical tradition. After formal education he began his career in 1955 as a research engineer at the Centre d’Etudes Nucleaires de Saclay, France. He had the opportunity to work mainly in neutron scattering and magnetism with very famous scientists of the time such as A Abraham and J Friedel. He received his Ph. D. in 1957 and thereafter served briefly as a post-doctoral fellow at the University of California, Berkeley.

As a teacher, he started teaching physics of solids at the Paris-Orsay University in the year 1961. In 1963, he became Assistant Professor at the same university, and soon started Orsay Group on Superconductors. In 1971, he left Paris-Orsay University to join College de France as a professor at the age of thirty-nine. Soon he joined the STRASACOL, a collaborative action programme at Strasbourg, Saclay and the College de France on polymer physics. During his active career he has pioneered a new style of teamwork involving both theoreticians and experimentalists on the one hand, and physicists and chemists on the other to facilitate technological applications of basic research. Since 1976 he is also Director of the School of Physics and Industrial Chemistry, Paris. In 1987, he became Scientific Director of the Rhone-Poulenc Group for Chemophysics and thereafter he occupied the most coveted position of the Director of the Ecole Superieure de Physique et de Chimie Industrielles de la Ville da Paris.

During his long research career spanning more than four decades Gennes has traversed with success an incredibly vast area of science from mathematics to polymers. Given below is a brief resume of his outstanding contributions.

Gennes’s mathematical theories have led to liquid crystal displays. He has been able to show that the progress from order to disorder always takes place at a well-defined temperature and can sometimes take place in leaps, which is called a change of phase at a critical temperature. He further showed that the mathematical description of the changes of phases in the physical systems as different as magnets, superconductors, liquid crystals and polymer solutions can have an astonishingly general value. He thus demonstrated the resemblance between the behaviour of liquid crystals and that of superconductors. His work on the sequencing of simple polymer links which organize themselves in balls or loops, especially with phase changes at critical temperatures, allowed him to envisage and then launch the ultra-quick manufacture of polymer threads with numerous applications.

He also studied porous systems called "soft" systems. The understanding of these processes led him to develop an interest in gels and glues and thin layer phenomenon where molecular "creeping" takes place, which presides over the intimate union of materials that are *a priori* different and "incompatible". These were the "superglues' to which he gave his full attention. The idea behind his action was to look for such a material that can stick on to aircraft or submarine parts in such a way that would make the technique of riveting superfluous, thus simplifying assembling and making the crafts more reliable and safe.

As one of the most distinguished condensed matter theoreticians of the world, he has been involved with an astonishing array of topics leaving a distinctive personal hallmark in all. His contributions have led to lap top computer screens and digital watch displays on the one hand, and on the other opened up a floodgate of developments that have found practical applications in such diverse areas as polymers, lubricants, emulsions, paints, foods, surfactants, magnetic materials, superconductors, plastics, wool and cotton, and synthetics like nylon, polyester and flexiglass.

In the area of polymers he developed the "spaghetti model" to explain how a molten polymer which is more like a tangled mass of spaghetti can flow. Individual polymer molecules could be thought of as tubes. In his "blob model" a certain segment of a chain can move as if it were free. He then came up with the idea of comparing the process of flowing with reptation. The "reptation model" explains the slithering serpentine motion of a polymer chain within a tangle of surrounding polymer chains. He reasoned that the polymers slide past each other along their own tortuous length. That has been the key idea in understanding the dynamics of concentrated polymers both as solutions and melts, and in forming the basis of an entirely new theory of polymer viscosity and density. This work of the scientist opened up the vista for new descriptions of complicated order phenomena in polymers, and equally important, enabled the scientists to determine and control polymer properties to put the material for better practical use. His recent work of "polymer welding" describing how a joint is stronger if the molecules from two sides are tangled together is also of paramount importance.

In 1980, he became interested in surface science, and advanced the understanding of wetting dynamics by explaining as to how liquid droplets spread on smooth and rough substances.

For his outstanding contributions Gennes has received many honours and awards. He has been elected Members of a number of academies and learned bodies such as the French Academy of Science, Dutch Academy of Sciences, Royal Society, American Academy of Arts and Sciences, and National Academy of Sciences.

The awards he has received are: Hollweck Prize from the Joint French-British Physical Society in 1968: Prix Cognac-Jay in 1970; Prix Ampere from the French Academy of Science in 1977; Gold Medal from Centre National de Recherche Scientifique (CNRS), France in 1981; Matteuchi Medal from the Italian Science Academy in 1987; Harvey Prize from Technion Israel in 1988; Polymer Award from American Physics Society as well as American Chemical Society in 1988; Wolf Prize for Physics from Israel in 1990; Lorentz Medal from the Dutch Academy of Arts and Sciences as well as the coveted Nobel Prize for Physics in 1991.

OBJECTIVES

The general assumptions we have made in this study are as follows:

(i) The publication productivity of a scientist which begins in his 20's reaches its culmination in his 30's or 40's and then gradually declines.

(ii)The French being highly nationalistic tends to publish most of their findings in their own journals. 3

(iii) A scientist who works in multi-disciplinary areas is likely to have more collaborative papers as he is unlikely to have the necessary expertise in more than a few areas.

(iv) The prizes and honours a scientist receives increase the visibility of the scientist worldwide and this visibility attracts more fellow scientists towards him as collaborators who raise the productivity of the scientist.

The objective of the study was to test,

(i)the validity of the aforementioned general assumptions, and

(ii)whether the scattering of the publications of the scientist in various journals follow Bradford's law.

METHODOLOGY

The list of papers by the scientist numbering 422 and published during 1956 to 1995 were analyzed yearwise, journal-wise, and authorwise to generate indicators to test the validity of the assumptions given in the objectives.

RESULTS

Decades vs Productivity

The publication activity of the scientist which began in 1956 at the age of 24 continues to date. From Table 1 it may be noted that from 1956 to 1967 the productivity of the scientist varied from 3 to 9 papers averaging 5.3 papers per year. In 1968 the scientist received the Hollweck Prize from the joint French-British Physical Society.

Table 1: Publication Productivity of Pierre-Gilles de Gennes Between 1956-1995

Year	Number of Research Paper(s) by Category of Authors											
	I	II	III	IV	V	VI	VII	G	Total	Collaration Coefficient	Age of P.G. de Gennes	Publication Productivity Age
1956	2	1	-	-	-	-	-	-	3	0.33	24	1
1957	2	1	-	-	-	-	-	-	3	0.33	25	2
1958	3	1	-	-	1	-	-	-	5	0.40	26	3
1959	3	-	3	-	-	-	-	-	6	0.50	27	4
1960	1	2	-	-	-	-	-	-	3	0.67	28	5
1961	1	2	-	-	-	-	-	-	3	0.67	29	6
1962	3	-	2	-	-	-	-	-	5	0.40	30	7
1963	2	4	2	1	-	-	-	-	9	0.78	31	8
1964	5	2	-	-	-	-	-	-	7	0.29	32	9
1965	2	4	2	-	-	-	-	-	8	0.75	33	10
1966	4	-	1	-	-	-	-	1	6	0.33	34	11
1967	3	3	-	-	-	-	-	-	6	0.50	35	12
1968	9	2	-	-	-	-	-	-	11	0.18	36	13
1969	11	4	-	-	-	-	-	1	16	0.31	37	14
1970	3	2	1	-	-	-	-	1	7	0.57	38	15
1971	4	1	-	-	-	-	-	-	5	0.20	39	16
1972	9	1	-	-	-	-	-	-	10	0.10	40	17
1973	6	-	-	-	-	1	-	-	7	0.14	41	18
1974	8	1	1	-	-	-	-	-	10	0.20	42	19
1975	9	2	-	-	-	-	1	-	12	0.25	43	20
1976	10	-	-	1	-	-	-	1	11	0.09	44	21
1977	12	5	1	-	-	-	-	1	19	0.37	45	22
1978	8	5	1	1	-	-	1	-	16	0.50	46	23
1979	17	2	1	1	-	-	-	-	21	0.19	47	24
1980	11	-	-	1	-	-	-	-	12	0.08	48	25
1981	11	3	-	-	-	-	-	-	14	0.21	49	26
1982	10	2	1	-	-	-	-	-	13	0.23	50	27
1983	14	6	-	-	-	-	-	-	20	0.30	51	28
1984	11	6	-	-	-	-	-	-	17	0.35	52	29
1985	8	-	-	1	-	-	-	-	9	0.11	53	30
1986	9	10	-	-	-	-	-	-	19	0.53	54	31
1987	11	1	1	-	-	-	-	-	13	0.15	55	32
1988	10	3	-	-	-	-	-	-	13	0.23	56	33
1989	6	1	-	-	-	-	-	-	7	0.14	57	34
1990	6	5	2	-	-	-	-	-	13	0.54	58	35
1991	5	3	1	2	-	-	-	-	11	0.55	59	36
1992	5	5	1	-	-	-	-	-	11	0.55	60	37
1993	3	6	1	2	1	-	-	-	13	0.77	61	38
1994	5	9	1	2	1	-	-	-	18	0.72	62	39
1995	5	2	2	-	1	-	-	-	10	0.50	63	40
Total	267	107	25	12	4	1	2	4	422	0.37		

I = Single authored papers
II = Two athoured papers
III = Three authored papers
IV = Four authored papers
V = Five authored papers
VI = Six authored papers
VII = Seven authored papers
G = Research Group authored papers

The prize not only increased his visibility but also possibly paved the way for the formation of the Orsay Group on superconductors. With this his productivity jumped up from 6 papers in 1967 to 11 papers in 1968 and 16 papers in 1969. Most probably, the formation of the Group provided him much better opportunities and environment for conducting research. However, for reasons not known to us the productivity sharply declined thereafter for two years. In 1970 the scientist received one more prize. Possibly this helped him to become a Professor in 1971 and also a participant of STRASACOL at the age of just 39. Just within two to three years his productivity picked up and continued unabated reaching a maximum number of 21 papers in 1979. In the forty years of his productive life so far Gennes has published 10.55 papers on an average per year. The number by any standard is really impressive.

From Table 1a it can be seen that the scientist published the maximum number of papers in his 40's, followed by papers written in the 50's.

Table 1a: Decadewise Distribution of Papers

Decade	Number of Papers
20's	28
30's	85
40's	135
50's	133
60's	41*

* In 1995 the scientist was 63, as such the decade of 60's is incomplete and does not picture the real productivity.

The decade of his 30's was less productive compared to his 40's or 50's. It may be noted that. Gennes received the Hollweck Prize at the age of 36, i.e. the first award of his life in recognition for his contribution and at 39 the Prix Cognac-Jay. Thus, the scientist became recognised only in his late thirties for his contributions and obtained the necessary visibility to forge ahead.

The annual productivity of the scientist in the 40 -year span of his productive life varies from 3 to 21. There has not been a single year when his productivity has dwindled down to zero. Table 1b depicts the total number of papers and the number of years.

Table 1b: Total Number of Papers and the Respective Years

No.of Papers (a)	Years (b)	Total = a x b
3	4	12
5	3	15
6	3	18
7	4	28
8	1	8
9	2	18
10	3	30
11	4	44
12	2	24
13	5	65
14	1	14
16	2	32
17	1	17
18	1	18
19	2	38
20	1	20
21	1	21
	40	422

It is interesting to note that though the number 13 is considered inauspicious by the Europeans, Gennes has published that number of papers in as many as five different years. It also can be noticed that the annual productivity has been 10 or more papers in as many as twenty-five years of his career. Doubtless, it is a great achievement by any standard.

Solo and Collaborative Works

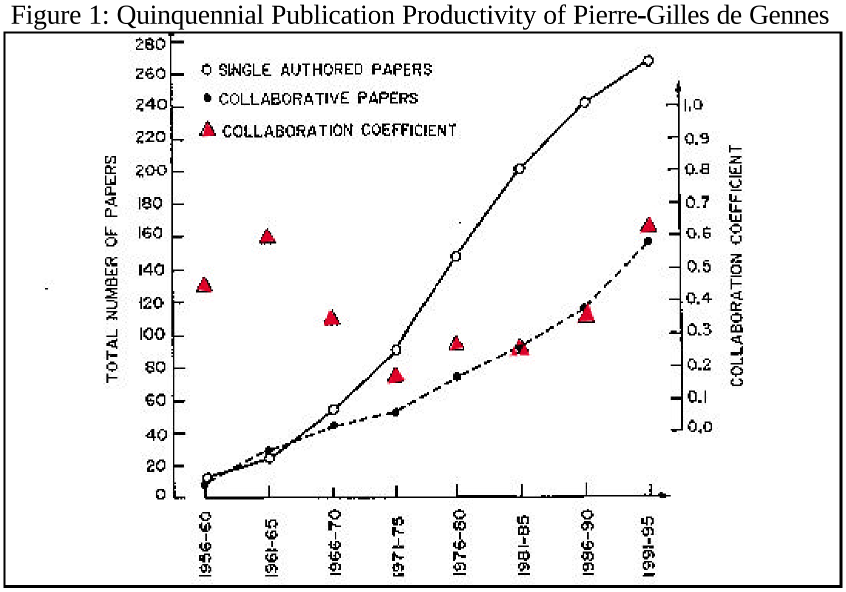
A scientist starts his research work for the first time in his life, usually under someone's guidance. Hence, the initial papers of the scientist are in many cases co-authored with his guide. As the scientist becomes mature and rises in position, he would start to write papers on his own.

At one time in his life by virtue of experience and abilities, the scientist begins to guide students as well as fellow workers. This gives rise to collaborative papers. Multidisciplinary areas of research are also highly fertile grounds for collaborative works.

It is quite surprising that of the first ten papers of his life published during 1956 to 1958 only four papers were contributed in collaboration with others (Table 1). To measure the collaborative research pattern, a simple indicator called *collaboration coefficient* obtained by the formula-number of collaborative works/ number of total works is used. The Table indicates that the highest collaboration coefficient is 0.78 in 1963, followed by 0.77 in 1993, 0.75 in 1965 and so on (Fig. 1).

It may be noted that in 1963, the scientist became Assistant Professor in Orsay, received the Hollwech Prize and

Figure 1: Quinquennial Publication Productivity of Pierre-Gilles de Gennes



soon formed the Orsay Group on Superconductors. This may explain for the highest collaboration coefficients found in 1963 and the third highest in 1965. The collaboration coefficient found to be second highest in 1993 which may be due to his Nobel Prize in 1991 which attracted as many as 14 scientists to work with him.

Table 1 shows that out of 422 papers as many as 267 (63.3%) are single-authored produced without collaboration. This percentage seems to be quite high. Starting from 1976 to 1984 single-handedly the scientist has produced ten or more papers every year except 1978. The contribution of 17 papers in 1979 (highest number of single-authored papers in a year) well compensates for the shortfall in 1978. It may also be noted that the number of two-authored, three-authored, and four-authored papers respectively total 107 (25.4%), 25 (5.9%), and 12 (2.8%). The number of five-, six-, and seven-authored papers totaling respectively 4, 1 and 2 is quite insignificant.

Gennes has worked with as many as 104 other scientists resulting in 155 papers (Table 2, Figure 2). The maximum collaborative activity is found with F. Broachard-Wyart (43 papers), followed by E. Raphael (10 papers), P. Mincus (9 papers), J.F. Joany (9 papers), and J. Matricon (7 papers) and others. All other collaborators have produced five papers or less. As many as 73 scientists have produced only one paper in collaboration with Gennes.

Journal Preference

Table 3 shows that Gennes has published his 422 papers in as many as 146 journals (Fig 3). As can be expected, the largest number of papers totaling 108 were placed in *C. R. Acad. Sci*, a French journal, followed by *J. Physique* (34 papers), another French journal. The fourth journal, i.e. *J Physique - Lett* accounting for 15 papers is also a French journal. This is definitely an indication of national bias, which may be seen in scientists from many other countries of the world. However, it has been observed that scientists from developing countries tend to publish their best papers in the journals of developed countries. For example, an analysis of the contributions by 441 fellows of the Indian National Science Academy shows that 65.6% of their best contributions appeared in foreign (non-Indian) journals. The authors of the study was of the opinion that 'the general practice seems to be that any result or discovery is first communicated to a foreign journal' (Krishnan, 1987). Three other journals in which Gennes has published more than ten papers are *Phys Lett* (18 papers), *J Chem Phys* (13 papers), and *Solid State Comm* (13 papers) all of which are in English.

The highly widespread field of research of the scientist is clearly discernible from the titles of journals (Table 3) which belong to such varied fields as physics, chemical physics, solid state physics, hydrodynamics, macromolecules, colloid science, magnetism, chemistry, crystallography, and condensed matter.

Table 2: Productivity of Authors in the Research Group of Pierre-Gilles de Gennes

		Authorship in Following Authored paper(s)								Period
No.	**Researcher(s)**	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**Total**	**FPY-LPY**
1	de Gennes P.G.	267	107	25	12	4	1	2	418	1956-1995
2	Harpin A.	-	1	-	-	1	-	-	2	1956-1986
3	Friedel	-	4	1	-	-	-	-	5	1957-1969
4	Ericson M.	-	-	-	-	1	-	-	1	1958-1958
5	Jacrot B	-	-	-	-	1	-	-	1	1958-1958
6	Meriel P	-	-	-	-	1	-	-	1	1958-1958
7	Kittel C.	-	-	1	-	-	-	-	1	1959-1959
8	Portis A.M.	-	-	1	-	-	-	-	1	1959-1959
9	Lafore P.	-	-	2	-	-	-	-	2	1959-1959
10	Millot J.P.	-	-	2	-	-	-	-	2	1959-1959
11	Villaib J	-	1	-	-	-	-	-	1	1960-1960
12	Hartmann F.	-	2	1	1	-	-	-	4	1961-1962
13	Matricon J.	-	2	5	-	-	-	-	7	1962-1965
14	Caroll C.	-	-	5	-	-	-	-	5	1962-1966
15	Saint James D.	-	3	1	-	-	-	-	4	1962-1963
16	Sarma G.	-	3	-	-	-	1	1	5	1963-1975
17	Pincus P.	-	6	1	2	-	-	-	9	1963-1992
18	Winter J.M.	-	-	-	1	-	-	-	1	1963-1963
19	Tinkham M.	-	1	-	-	-	-	-	1	1964-1964
20	Mauro S.	-	1	-	-	-	-	-	1	1965-1965
21	Nozieres P.	-	1	-	-	-	-	-	1	1965-1965
22	Hurult J.P.	-	1	-	-	-	-	-	1	1965-1965
23	Cyrot M.	-	-	1	-	-	-	-	1	1966-1966
24	Dobrosav-lyevic L.	-	1	-	-	-	-	-	1	1967-1967
25	Dubois-Violette E.	-	2	1	-	-	-	-	3	1967-1975
26	Barisic S.	-	1	-	-	-	-	-	1	1968-1968
27	Jannink G.	-	1	-	1	-	-	2	4	1968-1980
28	Deutscher G.	-	1	-	-	-	-	-	1	1969-1969
29	Papoular M.	-	1	-	-	-	-	-	1	1969-1969
30	Brochard-Wyart F.	-	28	6	7	2	-	-	43	1970-1995
31	Parodi P.	-	-	1	-	-	-	-	1	1970-1970
32	Kleman M.	-	1	-	-	-	-	-	1	1971-1971
33	de Seze L.	-	-	-	-	-	1	-	1	1973-1973
34	Bidaux R.	-	-	-	-	-	1	-	1	1973-1973
35	Boccara N.	-	-	-	-	-	1	-	1	1973-1973
36	Parodi O.	-	-	-	-	-	1	-	1	1973-1973
37	Rainer D.	-	1	1	-	-	-	-	2	1974-1974
38	Ambegaokar V.	-	-	2	-	-	-	-	2	1974-1974
39	Daod M.	-	2	-	-	-	-	2	4	1975-1979
40	Cotton J.P.	-	-	-	-	-	-	2	2	1975-1978
41	Farnoux B.	-	-	-	-	-	-	2	2	1975-1978
42	Banoit H.	-	-	-	-	-	-	1	1	1975-1975
43	Velasco R.M.	-	-	1	1	-	-	-	2	1976-1977
44	Pfeuty P.	-	-	1	-	-	-	-	1	1977-1977
45	Daoudi S.	-	1	-	-	-	-	-	1	1978-1978
46	Houches Les	-	1	-	-	-	-	-	1	1978-1978
47	Fisher M.	-	1	-	-	-	-	-	1	1978-1978
48	Guyon E.	-	1	-	-	-	-	-	1	1978-1978

Cont'd Table 2

49	Adam M.	-	-	1	-	-	-	-	1	1978-1978
50	Pieranski P.	-	-	1	-	-	-	-	1	1978-1978
51	Wall F.T.	-	-	-	1	-	-	-	1	1978-1978
52	Seitz W.A.	-	-	-	1	-	-	-	1	1978-1978
53	Chin J.C.	-	-	-	1	-	-	-	1	1978-1978
54	Boue F.	-	-	-	-	-	-	1	1	1978-1978
55	Nierlich N.	-	-	-	-	-	-	1	1	1978-1978
56	Joanny J.F.	-	7	1	1	-	-	-	9	1979-1987
57	Leibler L.	-	-	1	-	2	-	-	3	1979-1994
58	Hauffmann J.D.	-	-	-	1	-	-	-	1	1979-1979
59	di Marzio E.	-	-	-	1	-	-	-	1	1979-1979
60	Guttman C.M.	-	-	-	1	-	-	-	1	1979-1979
61	Hayter J.	-	-	-	1	-	-	-	1	1980-1980
62	Rinaudo M.	-	1	-	-	-	-	-	1	1981-1981
63	Veyssie M.	-	1	-	-	-	-	-	1	1981-1981
64	Taupin C.	-	1	-	-	-	-	-	1	1982-1982
65	Leger L.	-	1	-	1	-	-	-	2	1982-1995
66	Jouffroy J.	-	-	1	-	-	-	-	1	1982-1982
67	Levinson P.	-	-	2	-	-	-	-	2	1982-1990
68	Hervet H.	-	2	1	2	-	-	-	5	1983-1994
69	Charmet J.C.	-	1	-	-	-	-	-	1	1983-1983
70	Legait B.	-	1	-	-	-	-	-	1	1984-1984
71	Andelman D.	-	1	-	1	-	-	-	2	1985-1988
72	Lincel Lesione	-	2	-	-	-	-	-	2	1986-1990
73	Auvray L.	-	1	-	-	-	-	-	1	1986-1986
74	Tabor M.	-	1	-	-	-	-	-	1	1986-1986
75	Halperin A.	-	1	-	-	-	-	-	1	1986-1986
76	dechelles Lois	-	1	-	-	-	-	-	1	1986-1986
77	Shanahan M.E.R.	-	1	-	-	-	-	-	1	1986-1986
78	Seguin-Trembley A.M.	-	-	1	-	-	-	-	1	1987-1987
79	Raphael E.	-	10	-	-	-	-	-	10	1989-1995
80	Troian S.	-	1	1	-	-	-	-	2	1990-1990
81	Cazabat A.M.	-	1	-	-	-	-	-	1	1990-1990
82	Xin H.	-	-	1	-	-	-	-	1	1990-1990
83	Jeon S.I.	-	-	-	1	-	-	-	1	1991-1991
84	Lee J.H.	-	-	-	1	-	-	-	1	1991-1991
85	Andrade J.D.	-	-	-	1	-	-	-	1	1991-1991
86	di Meglio J.M.	-	-	-	1	-	-	-	1	1991-1991
87	Querre D.	-	-	-	1	-	-	-	1	1991-1991
88	Rubenstein M.	-	-	-	-	1	-	-	1	1993-1993
89	Williams D.R.M.	-	1	-	-	-	-	-	1	1993-1993
90	Ji H.	-	1	-	-	-	-	-	1	1993-1993
91	Authelin J.R.	-	-	1	-	-	-	-	1	1993-1993
92	Ajdari A.	-	-	1	-	3	-	-	4	1993-1995
93	Dvolaitzky M.	-	-	-	1	-	-	-	1	1993-1993
94	Guedeau M.A.	-	-	-	1	-	-	-	1	1993-1993
95	Jullien L.	-	-	-	1	-	-	-	1	1993-1993
96	Wagner M.	-	-	-	1	-	-	-	1	1993-1993
97	Cohen-Added J.P.	-	1	-	-	-	-	-	1	1994-1994
98	Brown H.	-	-	1	-	-	-	-	1	1994-1994
99	Marciano Y.	-	-	-	1	-	-	-	1	1994-1994
100	Redon C.	-	-	-	1	-	-	-	1	1994-1994

Figure 2: Publication Productivity of Pierre-Gilles de Gennes

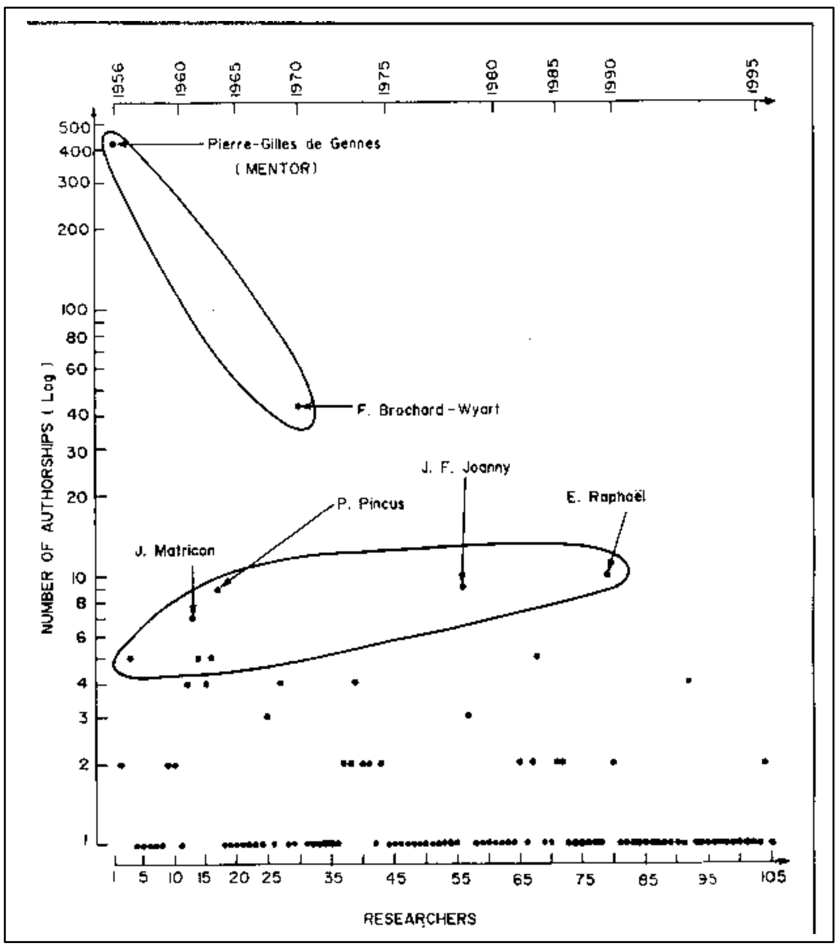


Table 3: Journal Preferance of P.G. de Gennes

Rank	Channels of Communication	Communication		Period
		No	Cumulative	FPY-LPY
1	C.R. Acad. Sci.	108	108	1956-1995
2	Physique (Fr)	34	142	1962-1989
3	Phys. Lett.	18	160	1963-1974
4	Physique - Lett. (Fr)	15	175	1974-1985
5	J. Chem. Phys.	13	188	1968-1989
6	Solid State Comm.	13	201	1963-1972
7	Macromolecules	9	210	1975-1993
8	Europhysics Lett.	8	218	1986-1993
9	Physics	7	225	1959-1991
10	Langmuir	6	231	1990-1994
11	J. Phys. Chem. Solids	5	236	1958-1960
12	J. Polymer Sci.	5	241	1977-1979
13	Recherche (Fr)	5	246	1974-1981
14	Comments Solid State Phys	4	250	1968-1971
15	J. Colloid Interface Sci.	4	254	1976-1991
16	J. Phys.	4	258	1979-1986
17	J. Phys. Rad.	4	262	1956-1962
18	Physico-Chemical Hydrodynamics	4	266	1981-1985
19	Phys. Rev.	4	270	1959-1974
20	Rev. Mod. Phys.	4	274	1964-1992
21	J. Phys. Chem.	4	278	1984-1994
22	Adv. Colloid Interface Sci	3	281	1987-1992
23	C.R. Colloque National Magne'tisme (Fr)	3	284	1957-1957
24	Faraday Discussions Royal Soc. Chem.	3	287	1978-1979
25	Macromol Chem. Macromol Symp.	3	290	1990-1994
26	Physics	3	293	1964-1967
27	A paraitre an J. de Physique (Fr)	2	295	1986-1994
28	Colloid Polym Sci.	2	297	1986-1993
29	J, de Chimie Physique	2	299	1977-1979
30	Mol. Cryst. & Liquid Cryst.	2	301	1969-1973
31	Nobel	2	303	1973-1973
32	Phys.Cond. Matter	2	305	1963-1964
33	Phys. Kond. Mat.	2	307	1965-1970
34	Physics Today	2	309	1983-1987
35	Radiation Physics Chemistry	2	311	1983-1983
36-146	Others with only one article in each	111	422	1958-1995

The scattering of articles in various journals does not follow Bradford's law as can be seen from Table 4.

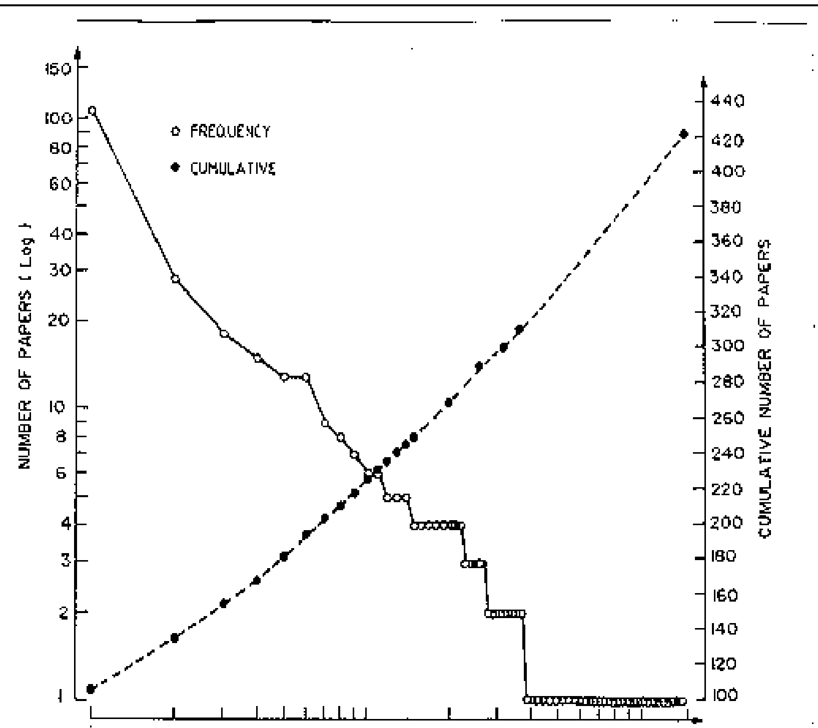
Table 4: Scattering of Papers in Journals

Zone	No. of Papers	No.of Journals (observed value)	No. of Journals (calculated value)
1st	142	2	2
2nd	142	21	21
3rd	138	123	221

CONCLUSION

The assumptions we made are found to be more or less correct. The productivity of the scientist peaked in his 40's. A predominant national bias is observed in his journal preference. As the scientist has worked in diverse fields and his papers were published in about 150 journals it was expected that the scattering of papers might follow Bradford's law, which was not the case, maybe because

Figure 3: Bradford - Zipf bibliograph on Publications of Pierre-Gilles de Gennes



CHANNELS OF COMMUNICATION (log)

of the national bias of journal preference. Even though the scientist has worked with more than one hundred collaborators, the percentage of collaborative work is found to be rather low, i.e. 36%. In 1963, when the scientist received his first award, there was a rise in the number of collaborators as well as papers. The same phenomenon was observed after he was awarded the Nobel Prize. This pattern indicates that the honours and awards a scientist receives attract more collaborators and hike his productivity. More studies will be necessary to substantiate this view.

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