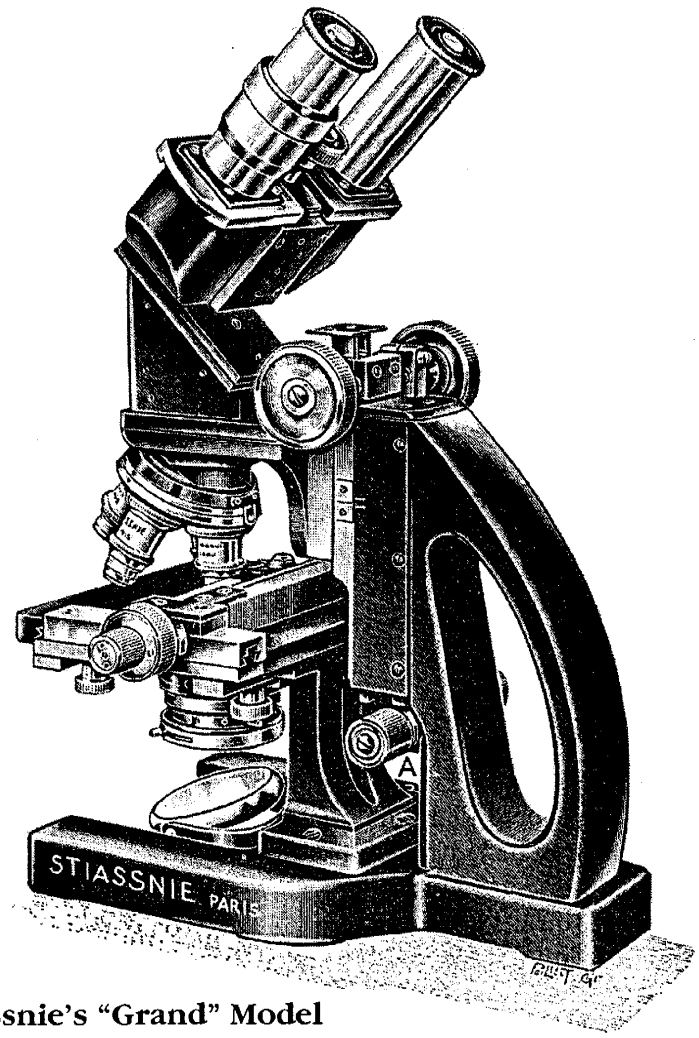
Journal of
THE MICROSCOPICAL SOCIETY OF SOUTHERN CALIFORNIA
Volume 4 Number 9 September 1999

Has Anyone Seen This Microscope?

Allen Bishop



Stiassnie's "Grand" Model

In October, 1983, 1 purchased a copy of *Precis de Microscopie* by M. Langeron who was affiliated with the Station Experimentale de Richelieu in the Department Indre-et-Loire. It is the 6th Edition of this work, copyrighted 1942, thus published under the occupation. In his preface, the author alludes to the "difficult" times under which the present 1340-page volume was put on the market. On the inside back cover a price label indicates that the FF850 price is the "Prix Obligatoire". Over the years, I have mentioned this book to one or two dealers who expressed moderate surprise at its existence; they thought the 5th Edition

of 1934 was the final appearance of Langeron's work. So, if it's rare, I did well (for once); I recall paying $3.00 for it at Acres of Books in Long Beach.

Inside the front cover is an interesting, if confusing property notation. Hand-written is the following: "Given by Mrs. Margaret Estes. 13436 Mystic St., Whittier, Calif.; From Lt. Colonel Doris V. Kleberger, USMC; Headquarters U.S. Marine Corps, Washington, DC." Who gave whom what?

I cannot speak French; I can read it, but it's a woeful struggle. But I can and do enjoy illustrations! And here is the point of my story. The author's main source of graphics are sharp engravings, mostly of instruments from the Maurice Stiassnie firm of Paris. In the English speaking world, European microscopes other than Leitz and Zeiss are not frequently encountered. France made great contributions to microscope history and their instruments are generally extremely well constructed, often revealing design features that appear quirky to non-Gallic minds, yet when appreciated and understood, one can only say, "How very original!"

A total of three stands by Stiassnie are catalogued in Billings, only two of which are illustrated, because two are identical.

Slightly less than a page is devoted to the firm by Bracegirdle. We learn that M. Stiassnie was the "successor to Veirck in 1882", but no light is shed as to when the firm closed. Bracegirdle had access to the company's 1905 catalog, and from the brief synopsis he gives, Stiassnie offered quite a complete line of stands, optics and accessories.

I am quite sure that I bought *Precis* just for the illustration on page 11, figure 8, reproduced here without permission. All one can say is "Now that's original!" I have never seen a microscope resembling this stand, let alone seen one "in the metal and glass". Has anyone seen this microscope? Even a person not well versed

MSSC Journal
Volume 4 Number 9 September 1999
CONTENTS

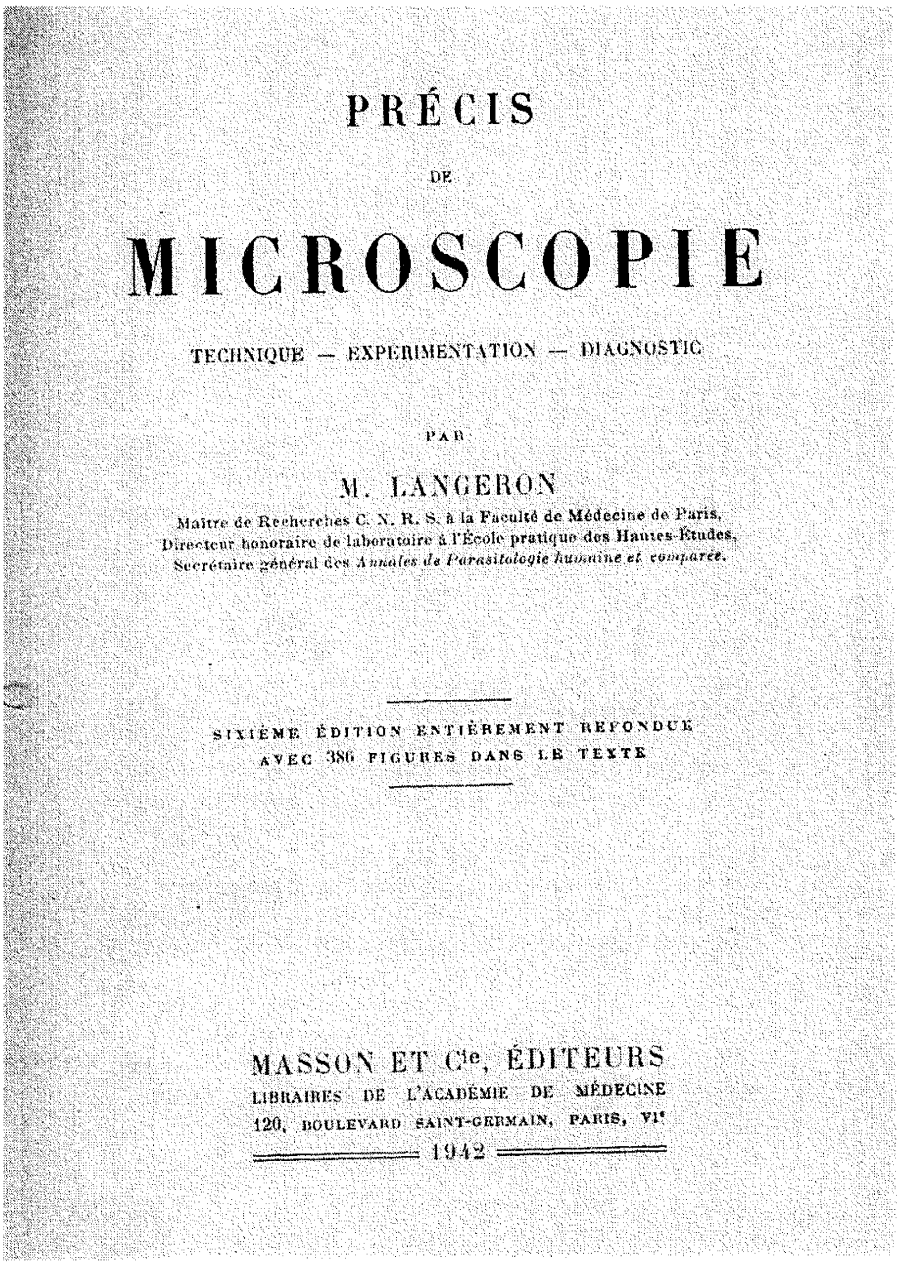
MICROSCOPICAL SOCIETY OF SOUTHERN CALIFORNIA

in 20th Century microscope design would likely not forget it. Described as a "Grand" (large), it appears to me to emanate from the 1920's. In black and chrome it would be impressive, but can you visualize it in gloss black and lacquered brass? Stunning! M. Stiassnie did not want this instrument to be dropped, and he designed a "jug handle" that would do justice to a large pitcher.

Also illustrated are the two monocular tubes that were either optional or perhaps included accessories with these stands. The attachable mechanical stage features concentric controls, a difficult design solution that requires precise adjustment.

The fine focusing mechanism is obviously contained in the forward end of the handle, while equally as obvious is the fact that the stand does not incline.

For your enjoyment and edification, I have included a chart comparing Stiassnie's objectives with those of his contemporaries. Thirteen lenses are listed, against Zeiss (18), B&L (12), and Leitz (20), but Stiassnie offers a 1/18, na 1.30 immersion.



PRÉCIS

DE

MICROSCOPIE

TECHNIQUE — EXPÉRIMENTATION — DIAGNOSTIC

PAR

M. LANGERON

Maître de Recherches C. N. R. S. à la Faculté de Médecine de Paris,
Directeur honoraire de laboratoire à l'École pratique des Hautes-Études,
Secrétaire général des *Annales de Parasitologie humaine et comparée*.

SIXIÈME ÉDITION ENTIÈREMENT REFONDUE
AVEC 386 FIGURES DANS LE TEXTE

MASSON ET Cie, ÉDITEURS
LIBRAIRES DE L'ACADÉMIE DE MÉDECINE
120, BOULEVARD SAINT-GERMAIN, PARIS, VI[e]
1942

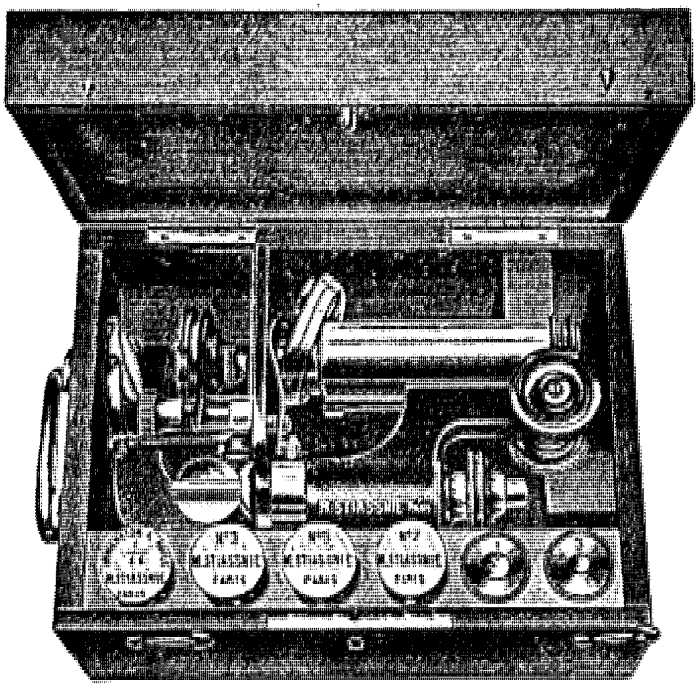
Finally; I couldn't resist, I included some other illustrations from Langeron of other Stiassnie products. Let us know about the whereabouts of these stands and accessories!

Footnotes:

Precis de Microscopie; Langeron, M.; Maitre de Recherches C.N.R.S. a la Faculte de Medicine de Paris, Directeur honoraire de laboratorie a 1'Ecole practique des Hautes-Etudes, Secretaire general des "Annales de Parasitoligie humaine et comparee.
6th Edition; Masson et Cie., Editeurs (Lib. de l'Acad. Med.). Paris. 1942.

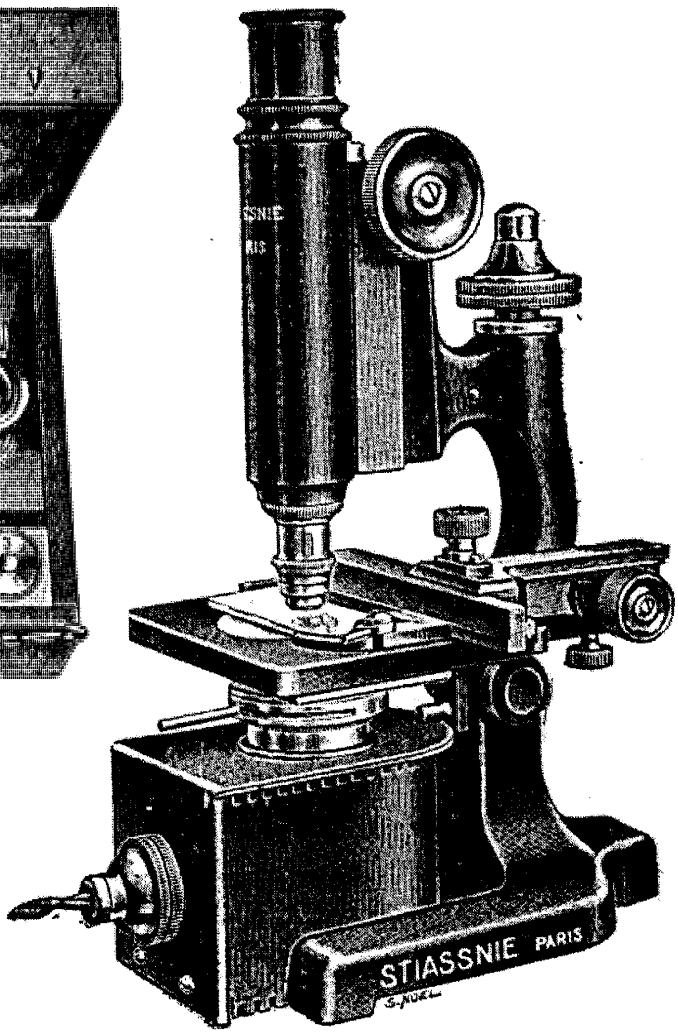
The Billings Microscope Collection; AFIP, Washington, D.C. 2nd Edition, 1974.

Notes on Modern Microscope Manufacturers; Bracegirdle, B. Queckett Microscope Publ. 1996.



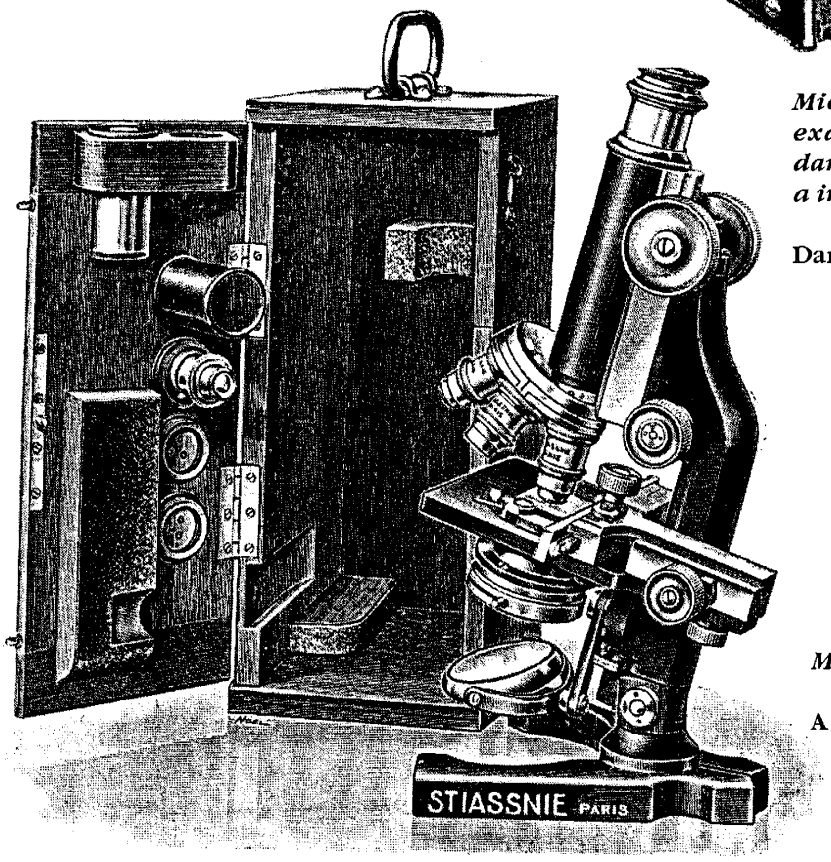
Microscope de voyage de Stiassnie.

A typical traveling stand outfit.



Microscope special Stiassnie pour examens sur fond noir, avec eclairage dans les branches du pied et objectif a immersion 1/10 a iris.

Darkfield setup.



Microscope portatif de Stiassne.

A "portable" microscope.

Table de concordance des objectifs [1].

	Numéro ancien.	a^0	a^1	a^2	a^3	a^4	aa	A	AA
Zeiss (Iéna).	Gross^{t} partiel.	1-1,5	1,5-2	1,2-2,4	2	3	5	6	8	10
	Long. focale.	55	45		50	36	25	23,5	18	15,6
	Ouv. num.							0,17	0,20	0,30
	Dist. frontale.	64/47	33/25	33/7	60	29	19	11	9	7,5
Bausch et Lomb (Rochester N.Y.).	Gross^{t}. propre.		2	2,6		4				10
	Long. focale en mm.		48	40		32				16
	Ouv. num.		0,08	0,08		0,10				0,2
	Dist. front. en mm.		53	43,5		38				2
Leitz (Wetzlar).	Numéro.	0		1*	1		1/6		2	2/5	3
	Gross^{t} propre.	1		2,7	3,2		4,3		6	8	10
	Long. focale en mm.	56		42	40		32		24	20	16
	Ouv. num.	0,05		0,08	0,12		0,15		0,20	0,25	0,3
	Dist. front. en mm.	55		40	34,5		27		16	7,7	5
Stiassnie [1] (Paris).	Numéro.		0	1					2	3	
	Long. focale.		48	42					22	16,5	
	Ouv. num.			0,15					0,17	0,30	
	Dist. frontale.		60	20					9	2,70	

1. Stiassnie Frères, 67, Boulevard Auguste Blanqui, Paris 13e.

	Numéro ancien.	C	D	DD	1/7	E				Apo	F	1/12	Apo	
Zeiss (Iéna).	Gross^{t} partiel.	20	40	40	50	60				90	90	100	120	
	Long. focale.	8,3	4,4	4,4	8,5	2,9				2	2	1,8	1,5	
	Ouv. num.	0,40	0,65	0,85	0,85	0,90				1,30	0,90	1,30	1,30	
	Dist. frontale.	1,6	0,55	0,32	0,40	0,12				0,11	0,09	0,10	0,08	
Bausch et Lomb (Rochester N.Y.).	Gross^{t}. propre.	20 Apo	21	43	45	60				90 Apo	100	97		
	Long. focale en mm.	8,3	8	4	4	3				2	1,8	1,9		
	Ouv. num.	0,65	0,50	0,65	0,85	0,85				1,30	1,30	1,25		
	Dist. front. en mm.	0,60	1,6	0,6	0,3	0,2				0,12	0,13	0,15		
Leitz (Wetzlar).	Numéro.	3b	4	5		6	7	8et 1/10e	9a	10	Apo	1/12	Apo	1/12a	1/16a
	Gross^{t} propre.	14	20	30		45	62	70	85	90	92	100	92	95	114
	Long. focale en mm.	13	9	6		4	3	2,6	2,2	2,1	2	1,8	2	1,95	1,6
	Ouv. num.	0,40	0,45	0,65		0,85	0,85	0,90	0,90	1,20	1,32	1,30	1,40	1,32	1,32
	Dist. front. en mm.	3,2	2	0,75		0,32	0,28	0,25	0,13	0,10	0,11	0,11	0,05	0,11	0,08
Stiassnie [1] (Paris).	Numéro.	4	5		6	7		8				1/12		1/15	1/16	1/18
	Long. focale.	11	5		4	3,2		2,7				1,9		1,8	1,5	1,4
	Ouv. num.	0,35	0,77		0,80	0,85		0,87				1,30		1,30	1,30	1,30
	Dist. frontale.	1,65	0,78		0,57	0,45		0,29				0,30		0,25	0,22	0,16

Table de concordance des oculaires.

Oculaires compensateurs ou périplanatiques.

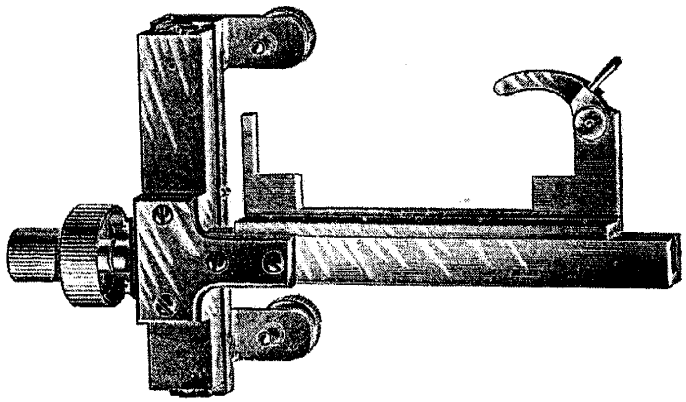
	Coefficient de champ														
Zeiss.	Gross. propre.	23		23		18		13		11		8		6,5	
	Long. focale.	3		5		7		10		15		20		28	
		83		50		36		25		17		12,5		9	
Leitz. (oc. périplanatiques).	Gross. propre.		4	5	6		8	10	12	15		20		25	
	Long. focale.		62,5	50	41,65		31,25	25	20,85	16,65		12,5		10	
Bausch et Lomb	Gross. propre.			5		5		10	12,5	15				25	
	Long. focale.			50		33		25	20	16,7				10	
Stiassnie.	Numéro.		4		6			9	12			18			
	Gross. propre.		4		6			9	12			18			

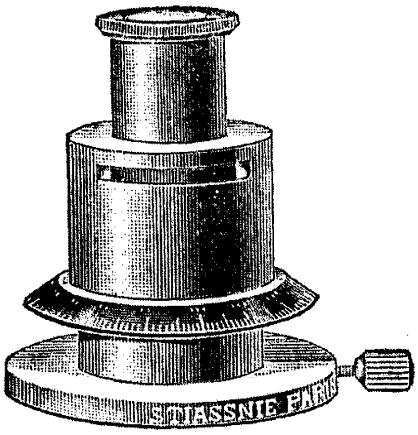
Oculaires de Huyghens.

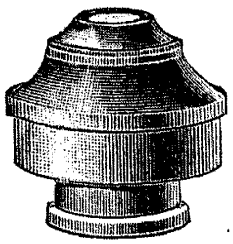
	Coefficient de champ										orthoscopiques	
Zeiss.	Gross. propre.	24	23		18		14		8		13	6,5
	Long. focale.	4	5		7		10		15		17	28
		63	50		36		25		17		15	9
Leitz.	Numéro.			0	1	2		3		4	5	6
	Gross. propre.			4	5	6		8		10	12	16
	Long. focale.			62,5	50	41,65		31,25		25	20,85	15,62
Bausch et Lomb	Gross. propre.				5	6,4		7,5		10	12,5	15
	Long. focale.				50	40		33		25	20	16,7
Stiassnie.	Numéro.				1		2		3			
	Gross. propre.				5		7		9			

Dans cette table de concordance des objectifs, il n'est pas possible de donner les types les plus usuels. Pour le reste, se reporter aux catalogues.

Langeron's objective/eyepiece chart. This is much older than 1942.

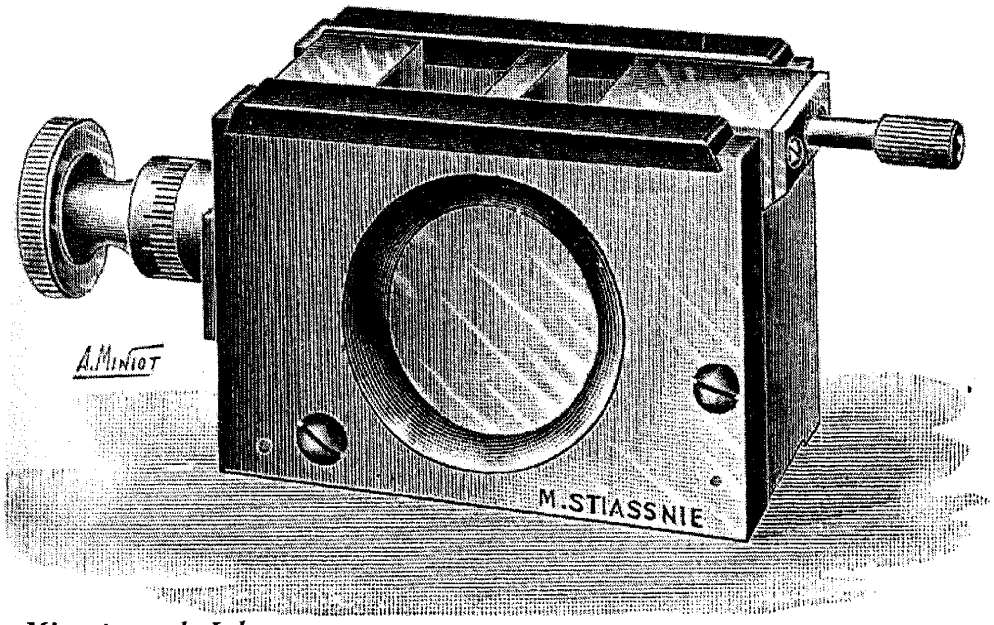






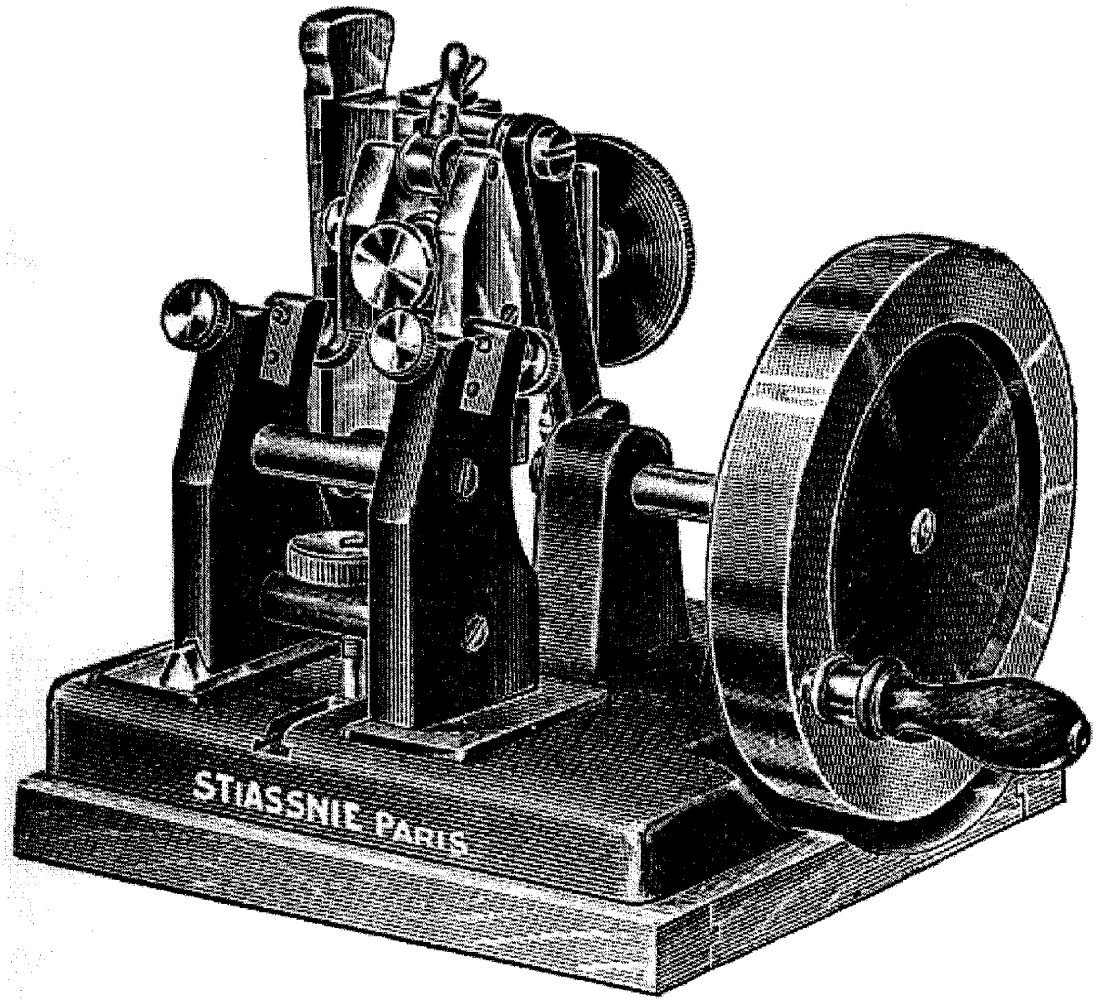
Chariot mobile de Stiassnie, a mouvements rectangulaires et a pignons concentriques pour microscopes a platine carree.

Stiassnie's attachanble X-Y slide carrier.

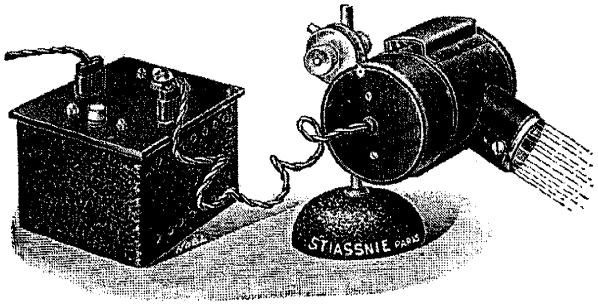


Microtome de Lelong.

A small Lelong type Microtome

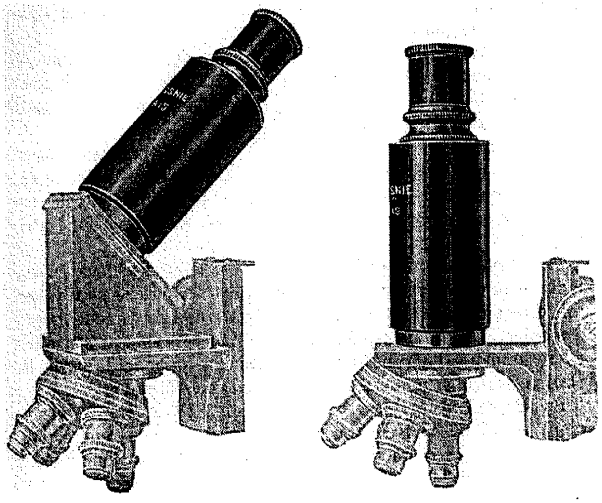


Microtome de Minot, modele de Stiassne. **A Minot microtome offered by Stiassnie.**



Lampe de Stiassnie avec ampoule Phillipps a arc de tungstene dans le vide, donnant une tres forte intensite lumineuse.

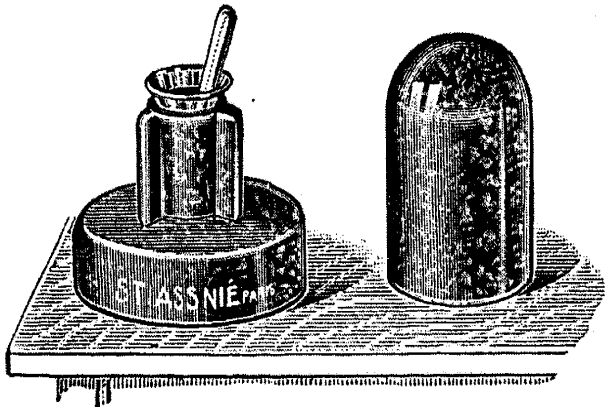
High intensity illuminator.



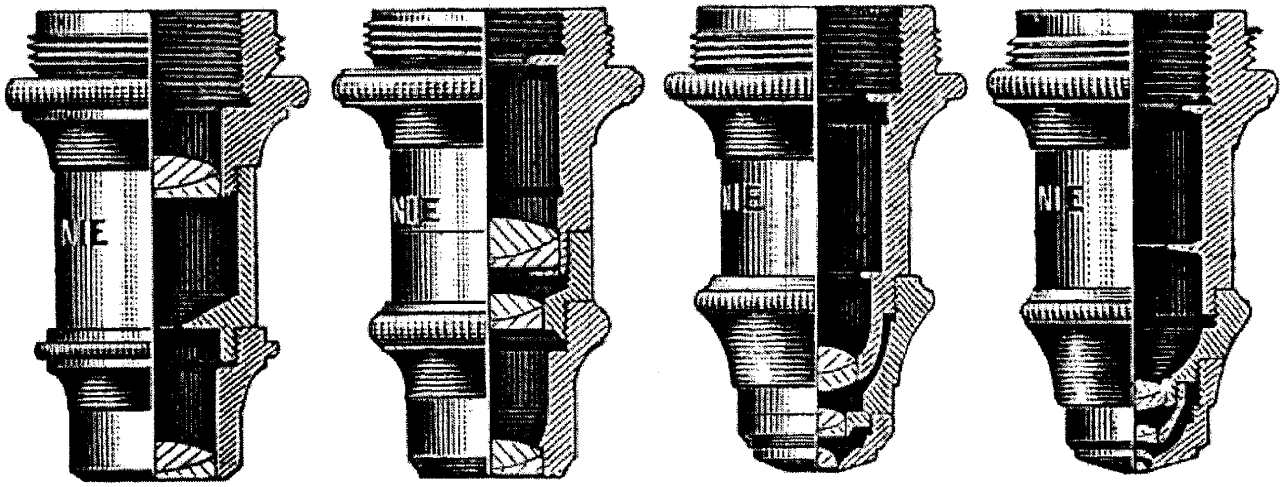
Tube monoculaire incline interchangeable avec le dispositif binoculaire incline du grand microscope binoculaire de Stiassnie.

Tube monocualire droit interchangeable ave le dispositif binoculaire ou monoculaire incline du grand microscope binoculaire de Stiassnie.

Vertical and inclined tubes for the Grand Modele



Immersion oil bottle by Stiassne.



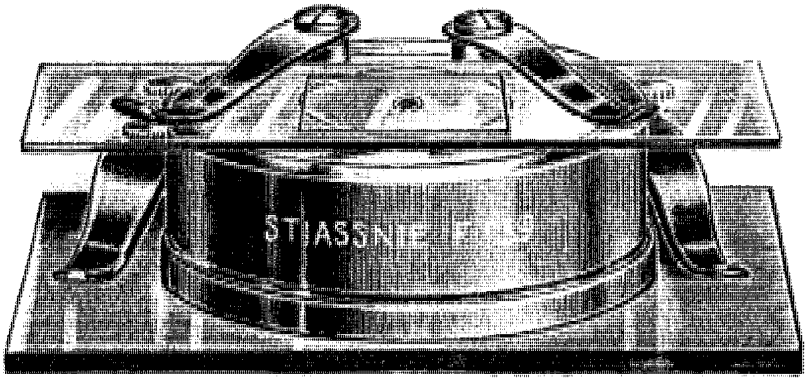
Objectif faible (n° 2) de Stiassnie

Objectif moyen (n° 4) de Stiassnie

Objectif fort (n°6) de Stiassnie

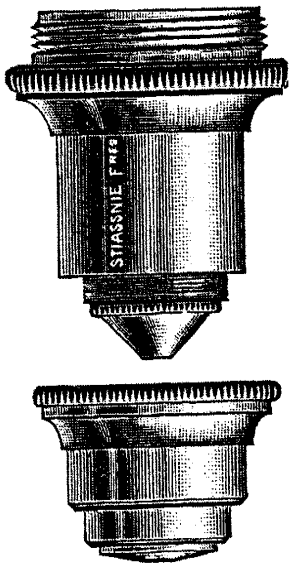
Objectif a immersion (1/15) de Stiassnie.

Stiassnie objectives in section.

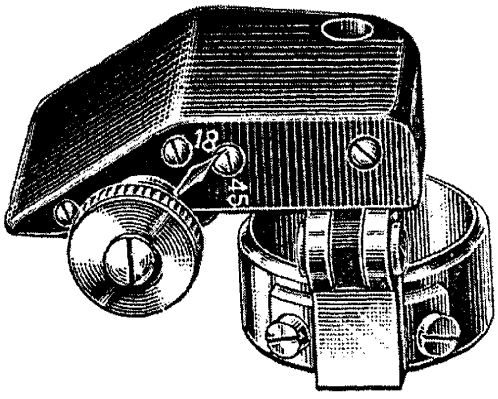


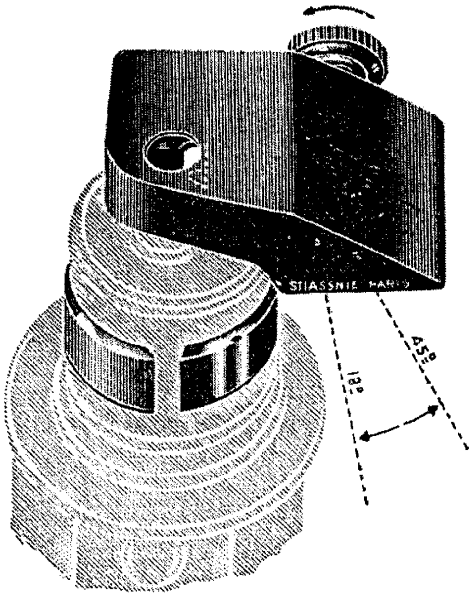
Condensateur torique a plateau de Stiassnie

Toric condensor that is placed on a stage.



Immersion objective with darkfield stop inserted.





Drawing Prism

Marvin Minsky
Inventor of the Confocal Scanning Microscope

MIT Media Lab and MIT AI Lab
Toshiba Professor of Media Arts and Sciences
Professor of E.E. and C.S., M.I.T
minsky@media.mit.edu
http://www.ai.mit.edu/people/minsky/minsky.html

Marvin Minsky has made many contributions to AI, cognitive psychology, mathematics, computational linguistics, robotics, and optics. In recent years he has worked chiefly on imparting to machines the human capacity for commonsense reasoning. His conception of human intellectual structure and function is presented in The Society of Mind (1987), which is also the title of the course he teaches at MIT.
He received the BA and PhD in mathematics at Harvard and Princeton. In 1951 he built the SNARC, the first neural network simulator. His other inventions include mechanical hands and other robotic devices, the confocal scanning microscope, the "Muse" synthesizer for musical variations (with E. Fredkin), and the first LOGO "turtle" (with S. Papert). A member of the NAS, NAE and Argentine NAS, he has received the ACM Turing Award, the MIT Killian Award, the Japan Prize, the IJCAI Research Excellence Award, and the Rank Prize.

Editor's Note. The following is the remarkable story of the invention of the confocal microscope by Marvin Minsky. This account was published in *Scanning* vol. 10 pp 128-138, 1988. It appears in many places on the web including Marvin Minsky's home page : http://www.ai.mit.edu/people/minsky/minsky.html

Although we microscopists may be most interested in his confocal scanning microscope, Minsky's home page contains many more examples of his creative mind and even lists his particular mentors and others who influenced him. Minsky's is such an inspiring web site that it will undoubtedly influence young scientists of the future.

And now for the microscope.

Memoir on Inventing the Confocal Scanning Microscope

Marvin Minsky

Published in *Scanning*, vol.10 pp128-138, 1988

This is what I remember about inventing the confocal scanning microscope in 1955. It happened while I was making a transition between two other theoretical preoccupations and I have never thought back to that period until Alan Boyde suggested writing this memoir. When I read the following account, the plot seems more coherent now than it ever did in those times of the past. Perhaps, though, those activities which seemed to me the most spontaneous were actually those which unconsciously were managed the most methodically. The story actually begins in childhood, for my father was an ophthalmologist and our home was simply [full] of lenses, prisms, and diaphragms. I took all his instruments apart, and he quietly put them together again. Later, when I was an undergraduate at Harvard in the class of 1950, there were new wonders every day. I studied mathematics with Andrew Gleason, neurophysiology with John Welsh, neuroanatomy with Marcus Singer, psychology with George Miller, and classical mechanics with Herbert Goldstein. But perhaps the most amazing experience of all was in a laboratory course wherein a student had to reproduce great physics experiments of the past. To ink a zone plate onto glass and see it focus on a screen; to watch a central fringe emerge as

Minsky - continued on page 189

Member Profile
Brian J. Ford

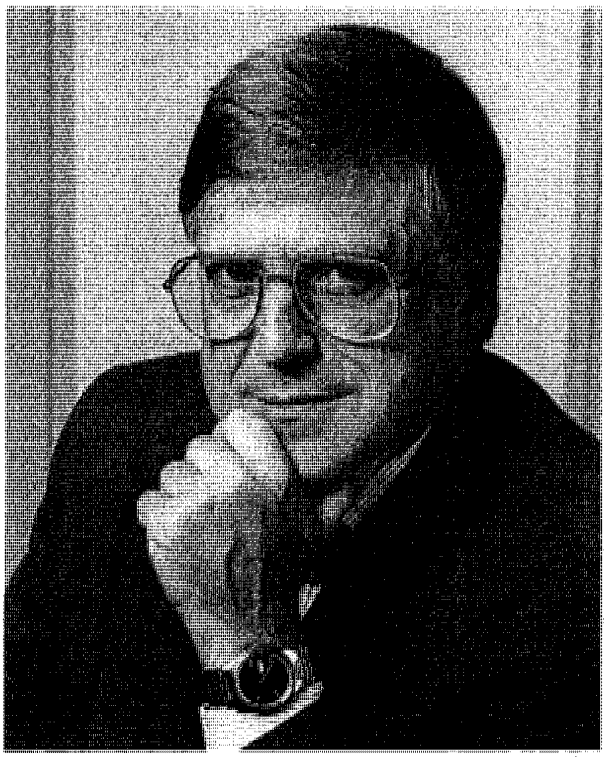
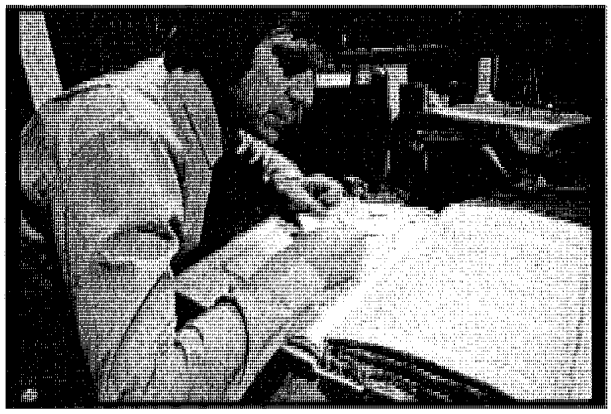
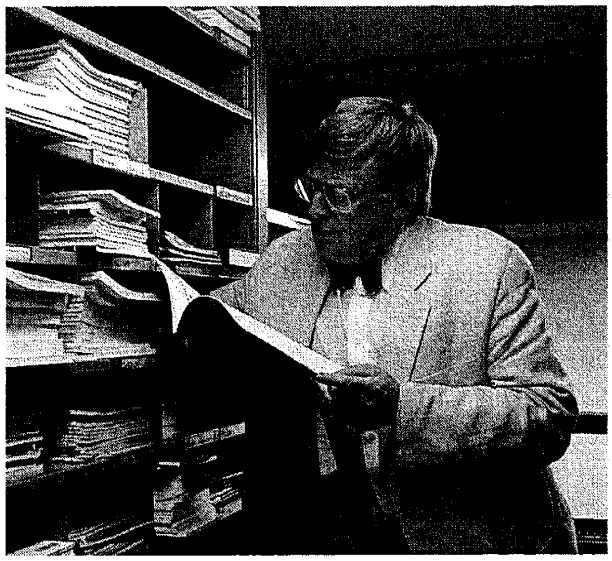


Photo by Joe Barabe.

Photo taken at the McCrone Research Institute in Chicago as Brian Ford was awarded the inaugural Dr. August Kohler medal by the State Microscopical Society of Illinois.



At the moment of discovering Leeuwenhoek's specimens in the vaults of the Royal Society.



In the Cambridge University Library

Brian was always fascinated by science. The earliest pictures of him as an infant show him examining flowers and drawing steam trains. He used to collect specimens of sand, butterflies, and pressed plants from an early age, and first looked through a microscope when he was nine years old. His father William, an engineer, used to purchase a Stilton cheese each Christmas, and when the young Brian showed his father the cheese mites on the surface, that cheese was placed in the garden in the rain where the birds ate it. After seeing those little organisms, Brian's father never ate Stilton again. As a boy, Brian lived in a large house in North London. It had an orchard and extensive grounds, and had battlements at one end. He used to study wild life and even mapped the district by hand at the age of ten.

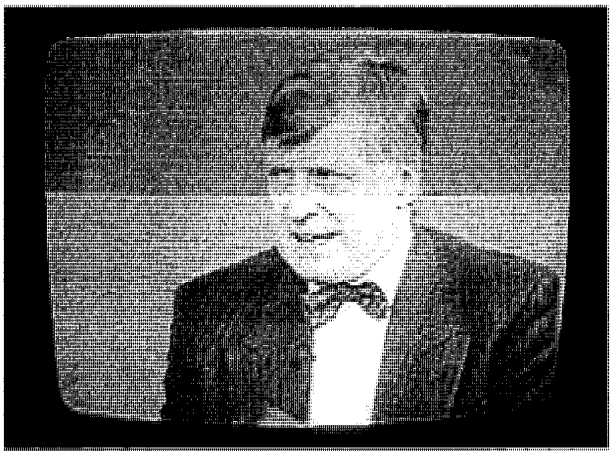
At the King's School, Peterborough, Brian had A. G. Lowndes as his science tutor. As a young man, Lowndes had taught Sir Peter Medawar. Since then, he had worked as a research zoologist at the Marine Biological Research laboratory in Plymouth, and took a sabbatical at King's to act as a science tutor. When he offered to give Brian science tuition, his father protested that education cost enough already, but Lowndes said he did not propose to charge anything. It was this tuition that introduced Brian to microbiology, and also to the name of Leeuwenhoek. By the time he was sixteen, Brian was building micrographic cameras from wood and metal, and some of the pictures he took with those basic cameras have since been published. The *Van Nostrand Scientific Encyclopedia*, for example, has included some of his teenage pictures for over thirty years.

Brian and wife, Jan in a pub in Grantchester near Cambridge

When the family moved to Cardiff, Brian soon became acquainted with the science departments at Cardiff University. He was collecting cultures of bacteria by this time, and developing enthusiasms for rock and roll. With two brothers Geoff and Dave Edmunds he used to play rock keyboards, and performed in London and the provinces and on television. In fact, his first TV appearance at the age of 22 was not as a biologist, but as a pianist. Brian played Albert Ammons "Shout for Joy', a great piano blues number, in a series presented by the popular singer Donald Peers. Among the other people who appeared in the program was a young singer named Tom Jones, also making his first-ever television appearance. Dave Edmunds is now based in Los Angeles and produced many of the rock greats, including Roy Orbison and the Everly brothers. Brian had a particular interest in cryptogams at the time, amassing a fine collection of ferns and being cited as an authority on locations in the standard texts. Instead of immediately going to university, Brian took a post at the Medical Research Council (MRC) 'the most junior position you can imagine' as he now says, working under Professor Scott Thompson. He did work on bacterial sensitivity and frog physiology and studied histopathology. He now has huge collections of preparations of human tissue specimens that he has prepared over the years. At the same time, he began his studies of blood coagulation. Brian's discovery of the penderocyte in clotting blood was heralded in the medical press and in the newspapers as an epoch-making discovery, and it featured (opposite a picture sent back from the lunar surface) as one of the year's leading discoveries in the 1968 International Yearbook of Science.

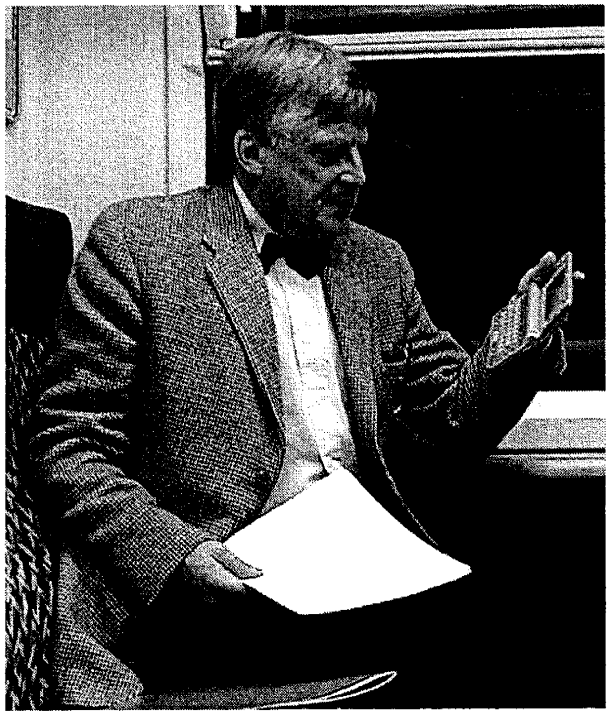
Brian did not want to go to university, believing it to be cause of too much conformity in science. He believed that real science was basically a rebellious occupation, while the schools and universities simply encouraged students to conform. Instead, while he was at the MRC he also took on a commission to write a weekly newspaper column on science. Thus he became a newspaper columnist by the time he was twenty.

However, Brian was meeting still more of the university people through his work at the MRC and decided on the spur of the moment that he would go to university, after all. It was only a few days before the first day of the semester, and everyone said it wasn't possible to start at such short notice. Brian had made up his mind, however, and went personally to see the Director of Education about getting a grant, and also to the University where they found him a place at the last minute. Brian's family was displeased at his decision to study biology, rather than engineering, which may explain why he received no parental support for his studies. Instead, he was writing his weekly newspaper column and performing in his own 'Rhythm and Blues Spot' at a night-club twice a week. Soon he was writing larger feature articles on special topics, and

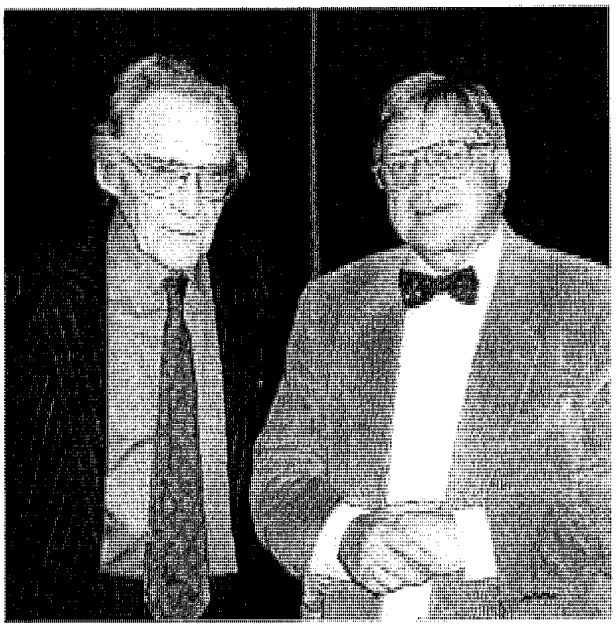


On Sky News television, October 1999.

With old friend Joe Brown, rock and country musician on German TV.



Working with PalmTop on the train.



With friend of 30 years, Sir John Maddox, distinguished former editor of *Nature* with whom he has chaired many meetings.

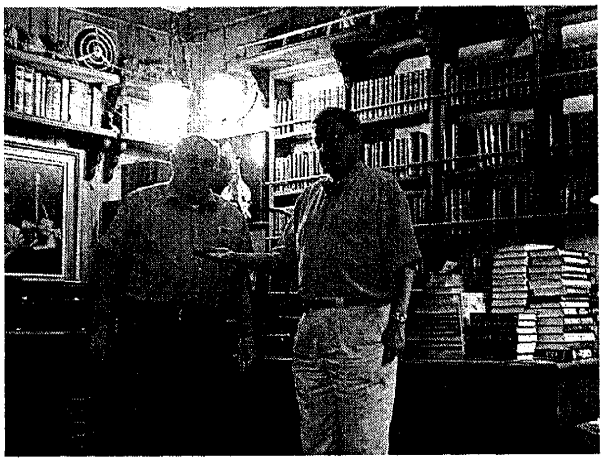
was invited to contribute to radio programs explaining his views on science. Brian wrote many pioneering articles on topics like genetic modification and environmental conservation while he was still in his twenties, and when such subjects were highly unfashionable. Brian always spent a lot of time at the seaside, and prepared a detailed floral and structural map of Sully Island. He was also commissioned to carry out an ecological survey when in his early twenties, anticipating developments of subsequent decades. Brian made many enduring friends at university but he did not really care for the need to conform to what he felt were 'old-fashioned' scientific ideas, and to learn by rote. One of his semesters was devoted to the phycomycete fungi, but Brian had already learned about those in his teens and was keen to do research. In the end, he left without graduating to set up a private laboratory of his own, and by the time his friends were graduating, he was already popular on radio and television and publishing many articles on science. While still in his twenties, he gave vent to his dissatisfaction in our understanding of the role of bacteria, not by protesting, but more positively, by writing a textbook *Microbiology and Food*. It became a best seller and was widely cited in the United States as a source of new ideas. From his private laboratory, he did research for the university, including polarimetry on plastics, methods of breeding locusts, and the microscopy of algal reproduction. At this time, he was elected a Fellow of the Royal Microscopical Society.

Brian and Jan last week discussing Brian's monthly magazine column with Peter Boizot, the proprieter, at Kettner's restauarant in Soho, a former haunt of Oscar Wilde.

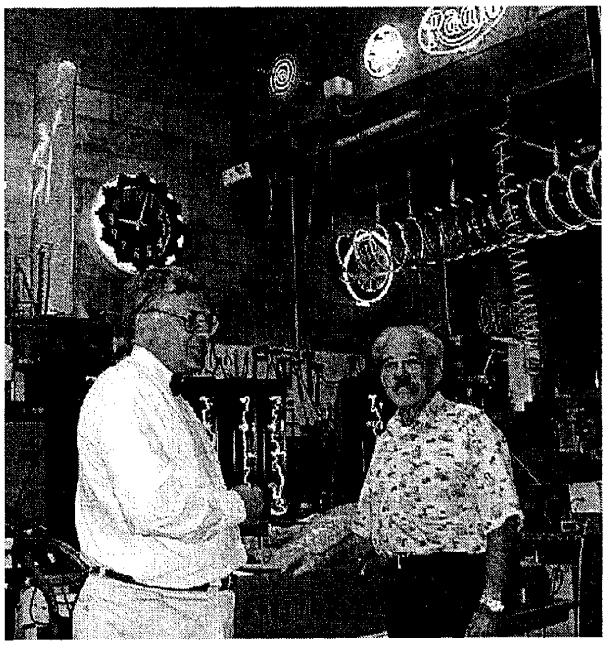
The research on blood brought Brian to the Royal Society in London for the first time, and still in his twenties, he lectured in their meeting room in Burlington House, Piccadilly, on blood coagulation mechanisms at a symposium organized by the British Microcirculation Society. Since then, he has been a regular visitor to the Royal Society, recently as after-dinner speaker at functions for Stephen Jay Gould and also for the former editor of *New Scientist*. Brian has known many of their Presidents, and it was during the presidency of Sir Andrew Huxley that Brian was invited to consult the original Leeuwenhoek letters. His momentous discovery of the original specimens after more than 300 years is one of the most important developments in the study of the history of the microscope.

Brian continued to conjure up major new theories, proposing that life on earth began as prebiotic molecules in outer space, a theory that has remained popular at Cardiff ever since, and advancing the idea that we can best study multicellular organisms by examining the cells of which they are composed. In *Microbiology and Food,* he first wrote of 'mankind as microbe', and the idea is central to his recent book *Genes, the Fight for Life*. The British publication *Laboratory News* recently wrote that this was 'a wonderful book'. Also in his twenties, Brian began diplomatic work that was to prove highly influential. He traveled widely in Europe, for example he was in Czechoslovakia when the Russians invaded in 1968 and photographs taken in East Germany show him in earnest debate with the Russian officers. Brian soon came to the attention of the East German authorities, and he negotiated the publication of a supplement in *The Times of London* under the heading of the German Democratic Republic. Official approval for this was obtained from the British government, and this was the first document in the bibliography of détente. Subsequently, the East German authorities opened their wartime archives to him, and Brian was also allowed to read the top-security files from the Allied invasions of scientific institutes at the end of World War II. The result was his very first book, *German Secret Weapons*, which soon became a classic. This book has been in print ever since it was first published more than thirty years ago. Brian analyzed voice patterns, and his research on speech was published and used by the British government when drawing up laws on the use of tape-recorded evidence. More recently still, Brian's views on the

Examining a microscope with Stuart Warter at his home in California.



With Ken Gregory at home in his Library in Long Beach



With Larry Albright in his Venice, CA laboratory

Dinner with some members of the MSSC. L to R. Brian Ford, Ken Gregory, Maurice Greeson, Gary Legel, Jim Solliday, Mrs.Stuart Warter, Stuart Warter.

spread of BSE were quoted by the British Labour Party, and this report is still on their web site. Brian has also prepared scientific reports for the European Union in Brussels, and is currently editing a book on the History of the Institute of Biology in London. Another of his diplomatic projects was the introduction of biohazard legislation around the world. During his work with the MRC, Brian had been concerned about the lack of safety regulations covering the handling of dangerous bacteria. He published a paper in *Nature* and another in the *New Law Journal*, setting out his requirements for legal controls. The ideas were widely quoted in America and Britain (for instance, there was a leading article and a large interview with Brian published in *The Times*). As a result of his campaigning, his proposals have been made into laws around the world. He also succeeded in having the sale of opiate-containing medicines banned in Britain. Brian's work on head lice, published in the medical journals, resulted in better control of outbreaks and the louse page on his web site is very popular with surfers. Brian worked on the mucous coating of Spirogyra, on the chromosomes of Scilla (of which he took particularly beautiful micrographs) and on the hibernation of aquatic protozoa including Spirostomum. His beautifully colored studies of snowflakes appeared in references works at the time, and he used one to make his first personal Christmas card. The family greetings cards Brian's many friends receive each Christmas have continued ever since. Brian continued to play rhythm and blues throughout his twenties, and his enthusiasm for the arts led him to launch the first course on science and technology for art students. His twice-weekly lectures are still remembered by the students, many of whom went on to become successful artists and designers.

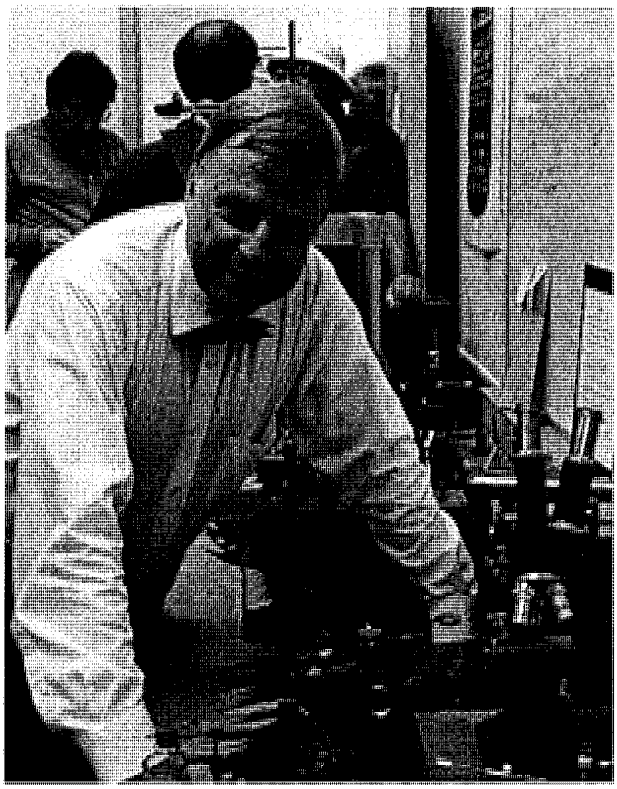
It was also in his twenties that Brian was first invited to lecture to the annual Inter Micro meetings, orga-

With MSSC Members on the wharf at Seal Beach, CA. L. to R. Ken Gregory, LarryAlbright, Brian Ford, Jim Solliday, Stuart Warter, Mrs. Stuart Warter, Maurice Greeson.

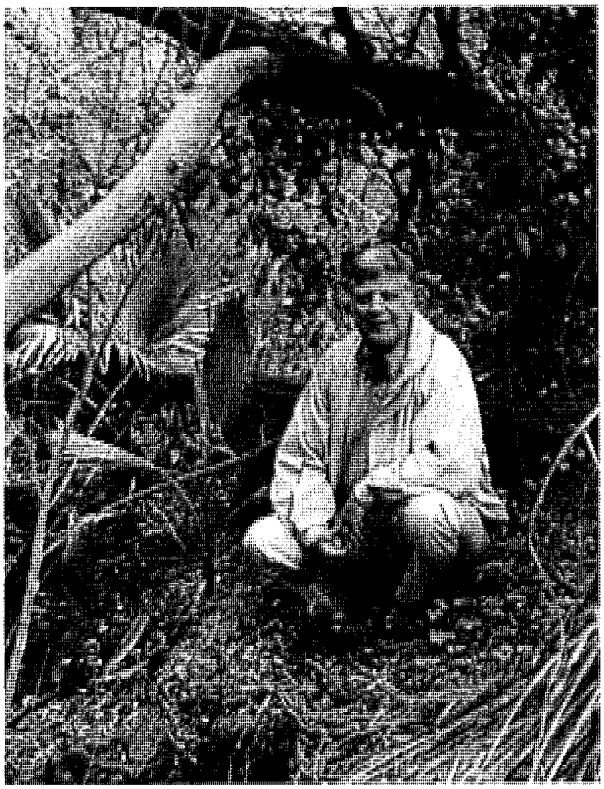
nized each year by the McCrone Research Institute. For some 15 years, he has given an annual keynote lecture in Chicago, now known as 'An Evening with Brian', and widely regarded as one of the annual highlights of the microscopists' calendar. Brian has lectured round the world for the British Council, and now speaks frequently across the United States. He has prepared diplomatic reports, provided forensic reports for the courts, and has published on the problems graduates face in working in science. As a problem solver, he has worked in many areas. Those that have featured on television include 'divine' visions, forged photographs and the cause of the slippage of coal slurry at Aberfan. He evolved methods of recovering nitrate from water using microbial recycling, and published a new method of re-scheduling air flights that provide an answer to jet-lag. He showed that the reason plants drop their leaves is not just to protect themselves in winter, but it is also their way of shedding waste materials. They concentrate materials like heavy metals in their leaves and then shed them, as a way of purifying the system. Brian argued that this offered a mechanism of cleansing polluted soils, and published the idea in a number of lectures and papers, including one in *Nature*. The idea took off, and there are now hundreds of organizations around the world using his idea to recover soils that are contaminated by heavy metals.

The shape of modern science has been influenced by Brian, partly through his political activities but also through his hard work on voluntary committees. He has been a Councillor at bodies including the Linnean Society of London and the Institute of Biology. At the Linnean he is in charge of the microscopes, as Honorary Surveyor of Scientific Instruments, and at the Institute he is compiling their official history for publication in 2000. He was also the first British President of the European Union of Science Journalists Associations, Brussels, and Chairman of the Science and Technical Authors Committee in London. Currently he chairs several charitable Trusts, and is on the Council of several bodies at Cambridge University.

Few people, apart from Brian, were surprised when he was elected a Fellow of his University, Cardiff. This is the greatest honor they can bestow. He has also served as a member of the University Court for years. Currently he is teaching on-line at the Open University in England, where he holds the first Royal Literary Fund Fellowship in Scientific Authorship. The European Space Agency recently asked him to design a microscope to go into space, and he has now produced the prototype design which is currently under construction at Brunel University. It is due to go into orbit in a year's time. Brian's research has been reported and reviewed in *Nature, New Scientist* and the *British Medical Journal.* He is one of the few people whose work has been reported in *Scientific American*, whose books have been reviewed there, and who has contributed to the pages of that world-renowned journal. Many of Brian's ideas have changed the way we look at science. His book *The Revealing lens, Mankind and the Microscope* was the first best-selling book that discussed the microscope and its place in society. Brian's pioneering ideas on the role of microorganisms were popularised in *Microbe Power* (1976), which remains in print in editions ranging from the USA to Japan. This was one of the first books on modern science to seize the imagination of the public, as well as the world of science, around the world. Meanwhile, his critical studies of the direction of modern science were published in *Nonscience* (1971) and *Cult of the Expert* (1982), both books being translated and published overseas. He has traveled widely in Europe, North Africa and the



With microscopes at the MSSC October Meeting



Hillside in Mandeville Canyon on the Albright Estate.

Middle East, India, Indonesia, Singapore and Thailand, Australia, New Zealand, Scandinavia, the Caribbean and the Pacific Islands, and is a regular visitor to North America where he lectures coast to coast.

He has delivered keynote addresses at meetings worldwide, from King's College, Cambridge to the University of Hobart, Tasmania. His broadcasts resulted in nomination for the Prix Italia by the BBC, and he gained their highest-ever Audience Reaction Index for one of his two-hour science programs. He has worked on films (advising Val Guest, producer of 20,000 Suspects) and produced and directed *The Fund,* a film on cancer research. His books have been published in about 100 editions around the world, and they include general works (e.g. *101 Questions about Science*) and volumes written for children (e.g. his *First Encyclopedia of Science*, which sold 70,000 copies in a month). He pioneered his concept of a holistic approach to science in a leading article for *Nature* more than twenty years ago, and his interdisciplinary research has always included the presentation of science to the public through radio and television.

Within the last year he has carried out an extensive lecture schedule, including a millennium lecture to the Society for the Application of Research at Cambridge University. Brian is featured again this year in the BBC highly intellectual show 'Round Britain Quiz', where he partners lady Antonia Fraser, and he had two new books published. *Genes, the Fight for Life* (Cassells) spells out his theory that multicellular organisms are rich in the behaviour of the single cells of which they are comprised. *Sensitive Souls* - due out under a different title in the United States during the year 2000 - argues that all life has a language, if only we took the trouble to decipher it. The microorganisms about which he is so passionate play starring roles in both books. He continues to find time to appear widely on radio and TV, often commenting on the progress of mad cow disease. Brian's book on that subject has become the standard reference work in London and Brussels, yet it was researched and written in just six and a half days. Work began on 3 April 1996, and by 29 April printed and bound copies were going out to the shops. This set an all-time record in scientific publishing, and nobody is surprised to see Brian appearing on the title page of the *Guinness Book of World Records 2000*. He advises them on accuracy, notably in science and medicine. Brian's current trips have taken him to the United States (twice), across the South of France, then to Amsterdam and Leiden, Netherlands. He is part of the small group who have changed the modern world, and Brian numbers people like Stephen Jay Gould, Sir David Attenborough, Lyn Margulis and Dame Miriam Rothschild among his friends. Yet Brian is above all a family man, and has been devoted to raising six children. He and his wife Jan live in an eighteenth century thatched farm-house in the Cambridgeshire countryside. The range of visitors has been amazing - not only knights and lords, but with many California scientists among them.

Minsky - continued from page 181

the lengths of two paths become the same; to measure those lengths to the millionth part with nothing but mirrors and beams of light - I had never seen any things so strange.For graduate studies I moved to Princeton to study more mathematics and biology, and wrote a theoretical thesis on connectionistic learning machines - that is, on networks of devices based on what little was known about nerve cells. As long as I can remember, I was entranced by all kinds of machinery — and, early in my college years, tried to find out how the great machines that we call brains managed to feel and learn and think. I studied everything available about the physiology, anatomy, and embryology of the nervous system. But there simply were too many gaps; nothing was known about how brains learn. Nevertheless, it occurred to me, you might be able to figure that out - if only you knew how those brain cells were connected to each other. Then you could attempt some of what is now called "reverse engineering" - to guess what those circuit's components do from knowing both what the circuits do and how their parts are connected. But I was horrified to learn that even those connection schemes had never been properly mapped at all. To be sure, a good deal was known about the [shapes] of certain types of nerve cells, because of the miraculous way in which the Golgi treatment tends to pick out a few neurons and then stain all the fibres that extend from them. But this permits you to visualize only one cell at a time, whereas to obtain the required wiring diagram you need to make visible [all] the cells in a three dimensional region.And here was a critical obstacle: the tissue of the central nervous system is solidly packed with interwoven parts of cells. Consequently, if you succeed in staining all of them, you simply can't see anything. This is not merely a problem of opacity because, if you put enough light in, some will come out. The serious problem is scattering. Unless you can confine each view to a thin enough plane,nothing comes out but a meaningless blur. Too little signal compared to the noise: the problem kept frustrating me. After completing that doctoral thesis, I had the great fortune to be invited to become a Junior Fellow at Harvard. That three-year membership in the Harvard Society of Fellows carries unique privileges; there is no obligation to have students, responsibilities, or supervisors, and all doors to the university are opened; one is bound only by a simple oath to seek whatever seems the truth. This freedom was just what I needed then because I was making a change in course. With the instruments of the time so weak, there seemed little chance to understand brains, at least at the microscopic level. So,during those years I began to imagine another approach. Perhaps we could work the other way; begin with the large-scale things minds do and try to break those processes down into smaller and smaller ingredients. Perhaps such studies could help us to guess more about the low-level processes that might be found in brains. Then, perhaps we could combine what we learned from both "top down" and "bottom up" points of view - and eventually close in on the problem from two directions.In the course of time, that new top down approach did indeed become productive; it soon assumed the fanciful name,Artificial Intelligence. But that is a different story, and the only part that is relevant here was what happened to me in that interlude. I now felt that while it might take decades to learn enough more about the brain, Artificial Intelligence could be tackled straight away - but my ideas about doing this were not yet quite mature enough. So (it seems to me in retrospect) while those ideas were incubating I had to keep my hands busy and solving that problem of scattered light became my conscious obsession. Edward Purcell, a Senior Fellow of the Society of Fellows, obtained for me a workroom in the Lyman laboratory of Physics, with a window facing Harvard Yard and permission to use whatever shops and equipment I might need. (That room had once been Theodore Lyman's office. Under an old sheet of shelf paper I found a bit of diffraction grating that had likely been ruled, I was awed to think, by the master spectroscopist himself.) One day it occurred tome that the way to avoid all that scattered light was to never allow any unnecessary light to enter in the first place.An ideal microscope would examine each point of the specimen and measure the amount of light scattered or absorbed by that point. But if we try to make many such measurements at the same time then every focal image point will be clouded by aberrant rays of scattered light deflected points of the specimen that are not the point you're looking at. Most of those extra rays would be gone if we could illuminate only one specimen point at a time. There is no way to eliminate every possible such ray, because of multiple scattering, but it is easy to remove all rays not initially aimed at the focal point; just use a second microscope (instead of a condenser lens) to image a pinhole aperture on a single point of the specimen. This reduces the amount of light in the specimen by orders of magnitude without reducing the focal brightness at all. Still, some of the initially focused light will be scattered by out- of-focus specimen points onto other points in the image plane. But we can reject those rays, as well, by placing a second pinhole aperture in the image plane that lies beyond the exit side of the objective lens. We end up with an elegant, symmetrical geometry: a pinhole and an objective lens on each side of the specimen. (We could also employ a reflected light scheme by placing a single lens and pinhole on only one side of the specimen - and using a half-silvered mirror to separate the entering and exiting rays.) This brings an extra premium because the diffraction patterns of both pinhole apertures are multiplied coherently: the central peak is sharpened and the resolution

is increased. (One can think of the lenses on both sides of the microscope combining, in effect, to form a single, larger lens, thus increasing the difference in light pathlengths for point-pairs in the object plane.)The price of single-point illumination is being able to measure only one point at a time. This is why a confocal microscope must scan the specimen, point by point and that can take a long time because we must add all the time intervals it takes to collect enough light to measure each image point. That amount of time could be reduced by using a brighter light - but there were no lasers in those days. I began by using a carbon arc, the brightest source available. Maintaining this was such a chore that I had to replace it by a second best source: zirconium arcs, though less intense, were a great deal more dependable. The output was measured with a low noise photomultiplier circuit that Francis Pipkin helped me design. Finally, the image was reconstructed on the screen of a military surplus long-persistence radar scope. The image remained visible for about ten seconds, which was also how long it took to make each scan.The most serious design problem was choosing between moving the specimen or moving the beam. So far as I know, all modern confocal microscopes use moving mirrors or scanning disks. At first it seemed more elegant to deflect a weightless beam of light than to move a massive specimen. But daunted by the problem of maintaining the three-dimensional alignment of two tiny moving apertures, I decided that it would be easier to keep the optics fixed and move the stage. I also was reluctant to use the single-lens reflected light scheme because of wanting to "see" the image right away! (Not only would dark field be inherently dimmer, but there would also be the fourfold brightness loss that beam splitters always bring.)The modern machines do use the single-objective reflected light scheme. A more patient scientist would have accepted longer exposure times and assembled the pictures as photographs - which would have produced permanent records rather than transient subjective impressions. In retrospect it occurs to me that this concern for real-time speed may have been what delayed the use of this scheme for almost thirty years. I demonstrated the confocal microscope to many visitors, but they never seemed very much impressed with what they saw on that radar screen. Only later did I realize that it is not enough for an instrument merely to have a high resolving power; one must also make the image 'look' sharp. Perhaps the human brain requires a certain degree of foveal compression in order to engage its foremost visual abilities. In any case, I should have used film - or at least have installed a smaller screen! In any case, once I decided to move the stage, this was not hard to accomplish. The specimen was mounted between two cover slips and attached to a flexible platform that was supported by two strips of spring metal. A simple magnetic solenoid flexed the platform vertically with a 60 hertz sinusoidally waveform, while a similar device deflected the platform horizontally with a much slower, sawtooth waveform. The same electric signals (with some blanking and some corrections in phase) also scanned the image onto the screen. Thus the stage-moving system was little more complex than an orthogonal pair of tuning forks. The optical system was not hard to align and proved able to resolve points closer than a micrometer apart, using 45x objectives in air. I never got around to using oil immersion for fear that it would restrict the depth to which different focal planes could be examined, and because the viscosity might constrain the size of scan or tear apart the specimen.There is also a theoretical advantage to moving the stage rather than the beam: the lenses of such a system need to be corrected only for the family of rays that intersect the optical axis at a single focal point. In principle, that could lead to better lens designs because such systems need no corrections at all for lateral aberrations. In practice, however, for visible light, opticians can already make wide field lenses that approach theoretical perfection. (This was another thing about optics I had always found astonishing: the mathematical way in which the radial symmetry of a lens causes odd order terms of series expansions to cancel out, so that you can obtain sixth order accuracy by making only two kinds of corrections, of second and fourth order. It almost seems too good to be true that such simple combinations of spherical surfaces - the very shapes that are the easiest to fabricate - can transform entire four dimensional families of rays in such orderly ways.) However, the advantages of combining stage scanning with paraxial optics could still turn out to be indispensable, for example, for microscopes in the X-ray domain for which refractive lenses and half-silvered mirrors may never turn out to be feasible.In constructing the actual prototype, the electronic aspects seemed easy enough because, a few years earlier, I had already built a learning machine (to simulate those neuronal nets) - and that system contained several hundred vacuum tube circuits. But the world of machining was new to me. Constructing an optical instrument was to live in a world where the critical issue of each day was how to clamp some bar of steel to the baseplate of a milling machine, what sort of cutter and speed to use, and how to keep the workpiece cool. I became obsessed with finding ways to reduce the thermal expansion under the wheel of a grinding machine; no matter how flat a surface seemed, I'd find new bumps the following day. (Perhaps I was haunted by Lyman's ghost.) By the time the prototype was complete, I understood how the principles of kinematic design had made most of that precision unnecessary. I could have saved months. Still, the machine shop experience was not wasted. A decade later, it helped me to build a singularly versatile robotic arm and hand.Scanning is far more practical today because we can use computers to transform and enhance the images. In those days computers were just becoming

available and my friend Russell Kirsch was already doing some of the first experiments on image analysis. He persuaded me to try some experiments, using the SEAC computer at the Bureau of Standards. However, that early machine's memory was too small for those images, and we did not yet have adequate devices for digitizing the signals. Subsequently years, both Kirsch and I continued to pursue those same ideas - of closing in on the vision problem by combining bottom-up concepts of feature extraction with top-down theories about the syntactic and semantic structures of images. Eventually, Kirsch applied those techniques to "parsing" pictures of actual cells, while I pursued the subject of making computers recognize more commonplace sorts of things. I should mention that I was also working with George Field (who also helped with the microscope design) on how to use computers to enhance astronomical images. Such schemes later became practical but at that time they, too, were defeated by the cost of memory. I returned to physical optics only once more, in the middle 1960s, in building computer controlled scanners for our mechanical robotics project and in studying the feasibility of using somewhat similar systems in conjunction with radiation therapy.I also pursued another dream - of a microscope, not optical, but entirely mechanical. Perhaps there were structures that could not be seen - because they could not be selectively stained. What for example, served to hold the nucleus away from the walls of a cell? Perhaps there was a scaffolding of invisible fibres that one might recognize by plucking them - and then measure the strain, or see other things move. I examined the various micromanipulators that already existed but, finding none that seemed suitable, I designed one which I hoped to use in conjunction with my new microscope. Again the Society of Fellows came to my aid, this time in the person of Carroll Williams, who invited me to build it in his laboratory. The new micromanipulator was extremely simple: I mounted the voice coils of three loudspeakers at right angles and connected them with stiff wires to a diagonally mounted needle probe. The needle could be moved in any spatial direction, simply by changing the current in the three coils. The only hard part was replacing the coil suspensions with materials free from mechanical hysteresis. The resulting probe could be swiftly moved with precision better than 100 nanometers, over a range of more than a millimeter. (This sensitivity was at first limited by power supply noise. This was solved by using batteries.) To control the probe, my childhood classmate Edward Feder, who was now also working in Williams' laboratory, constructed a three-dimensional electrical joystick by attaching three conductive sheets to the sides of a tank of salt water. Everyone seemed to like this instrument, so we left it around in the laboratory, but it was never actually put to use, and I have no idea what became of it. I had planned to measure the infinitesimal forces by applying very high frequency vibrations to a microelectrode mounted on the probe and correlating the waveforms against the needle deflections as observed through the scanning microscope. I never got around to this because, by 1956, AI was already on the march. This is what I remember now, and it may not all be accurate. I've never had much conscious sense of making careful, long range plans, but have simply worked from day to day without keeping notes or schedules, or writing down the things I did. I never published anything about that earliest learning machine, or about the micromanipulator, or even about that robot arm. In the case of the scanning microscope, it was fortunate that my brother in law, Morton Amster, not only liked the instrument but also happened to be a patent attorney. Otherwise I might have never documented it at all. The learning machine and the micromanipulator disappeared long ago but, only today, while writing this, I managed to find the microscope, encrusted with thirty years of rust. I cleaned it up, took this photograph, and started to write an appropriate caption - but then found the right thing in a carbon copy of a letter to Amster dated November 18, 1955.

Editorial Note

The photograph and letter to Amster do not appear on the Web, at least I could not find them. They can presumably be found in the original publication, *Scanning*. It would also be interesting to look up the original patent for more insight into Minsky's thoughts at the time regarding the future applications of his invention.

As further enticement to look at Minsky's web site, the list at the right are the wide range of Minsky's publications that you will find there. Also, there is a list of those people who were influences, others who were mentors and science fiction writer friends, some of whom he never met.

Some Publications

* Alien Intelligence (html)
* Causal Diversity (txt, html)
* Why People Think Computers Can't (text)
* Music Interview with Otto Laske (text)
* Matter, Mind and Models (text, html)
* Music, Mind, and Meaning (html)
* Symbolic vs. Connectionist (text)
* Alienable Rights (html)
* Afterword to *True Names* (html)
* Inventing the Confocal Microscope (text)
* Negative Expertise (text)
* Jokes and Cognition (text)
* Introduction to *LogoWorks* (html)
* More *Turing Option* chapters (text)
* Will Robots Inherit the Earth? (text, html)
* The Society of Mind CD-ROM

December Schedule

The Christmas Party will replace the regular 3rd Wednesday meeting. NO MEETING AT CROSSROADS IN DECEMBER.

However, the regular workshop will be held on Saturday, the fourth of December at the Meadows' home.

Course in Basic General Optics for Microscopy

Alan deHaas, our expert in the use and understanding of the microscope, has offered to present a non-mathematical course on the optics of the microscope. Alan has prepared a course outline that would require about 13 hours to cover the included material. One thought is that this could be presented one hour at a time whenever would be most convenient for the participants. One suggestion is that each course hour be presented starting at 6 PM before the regular Wednesday meetings. Those wishing to attend would come early for the course. This would not require a separate meeting night and could use a classroom in the school with a white board for instruction. If you are interested, think about what you want to learn and when you want to do it..

Ed.

MSSC Christmas Party

Sunday, December 12
hors d'oeuvres at 3 PM dinner at 5 PM
Marj and Ernie Meadows
707 Greentree Road
Pacific Palisades, Ca 90272
Tel. 310-459-4788

Marj and Ernie Meadows have again most generously offered to host the MSSC Christmas party at their beautiful home in Rustic Canyon. A superb full turkey dinner, with all possible trimmings, will again be catered by Barbara Black, Steve Craig's daughter.

The warmth and beauty of the Meadows' home with the treasures of Ernie's design and manufacture, the ambience of the garden under the sycamores and the good fellowship will make this a special evening to be long remembered by all who attend.

Please bring a dessert to share and, if you wish, wine or other alcoholic beverage for yourself. The cost is $14 per person. Make your check out to Beverly Black and mail it to Steve Craig at 3455 Meier St. Los Angeles, CA 90066. Please respond early so Beverly can plan accordingly.

Directions: Take Brooktree off of Sunset. First right onto Greentree. Go to end of Greentree and park. #707 is the first home on the right up a short narrow wooded lane at the end of Greentree.