

Professional Portfolio

James A. Foster

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1 Introduction and Summary

This document exhibits my collaborative and exploratory, but unified, stance toward research, teaching, and service. It presents evidence that I have built a strong academic career based on solid principles, which form a solid foundation for continued professorial excellence. Section 2 describes the general and specific context of my professional academic life. Section 3 outlines my philosophy and plans. Section 4 summarizes evidence of my performance to date, leaving details to my *curriculum vitae*.

2 Context

2.1 General

Universities exist to produce, disseminate and preserve knowledge. As a professor, I advance this mission with fundamental and applied research, education for myself and my colleagues, and active service in support of the scholarly community. This has been my personal and professional objective for nearly a quarter of a century, and it will remain so for decades to come. The global context for my professional mission is my commitment to Academe as a whole.

For me, research, teaching, and service inextricably combine to support this mission. This portfolio artificially separates these concerns only to make it easier to assess my past contributions and future potential.

2.2 University of Idaho Context

The University of Idaho (UI) is a major research institution, and has been aggressively expanding research during the last decade. So have the College of Engineering (COE) and the Department of Computer Science (CS). Research expectations have been rising. Consequently, my position has increasingly emphasized research.

However, education is also a primary concern at UI in general, and in CS particularly. Since the mid eighties, CS has consistently delivered large numbers of credit hours per faculty member. CS enrollments have been skyrocketing in recent years, even while enrollments university-wide have been declining. So, teaching and advising demands on CS faculty have been increasing. Computer Science changes so rapidly that courses must be entirely redesigned every two or three years, and the course catalog must be constantly in flux. I have been primarily responsible for theoretical courses, but have also been charged with frequent new course development, and helped design our doctoral degree program. I have taught at every level from non-major introduction courses to advanced graduate mathematical training.

CS faculty members are usually expected to teach three to four courses per academic year, with multiple sections of the same course being counted as one course. Exceptions are made for new faculty members or when faculty members buy out their teaching assignment with research funds.

UI and COE encourage but do not require committee service. The Computer Science Department has three standing committees, frequent departmental meetings, and several *ad hoc* committees that administer internal departmental activities. The mission of the computer science department has grown over the last decade to include a considerable research component and a large doctoral degree-granting program. Consequently, service expectations at the departmental level have been somewhat high.

2.3 Position Descriptions

The position description details university expectations regarding the breakdown of faculty effort into research, teaching, and service. Position descriptions are for academic years until 1999 after which they are for calendar years with each semester assigned separately. Table 1 summarizes my position descriptions.

Table 1. Position description summary. Percentage allocation to three categories of activity for each semester in the AY after 1999.

AY	Research	Teaching	Service/Admin/Other
90	25	60	15
91	25	55	20
92	25	55	20
93	30	55	15
94	30	55	15
95	25	55	20
96	25	55	20
97	25	55	20
98	45	30	25
99	45/100	30/0	25/0
00	100/50	0/35	0/15

3 Philosophy and Plans

For me, all professorial activities are social and collaborative. Research engages one in a public conversation with prior generations of scholars and with colleagues, often in different disciplines and always with different perspectives and talents. Teaching is a conversation with tomorrow's colleagues, with the public, and with today's collaborators. Service builds disciplines and shapes academic units, again with conversation and collaboration as the primary activity.

This section presents the philosophy toward research, teaching, and service that has guided and will continue to guide my professorial life. I also present my objectives, which one should consider when assessing my potential future contributions. Finally, I discuss briefly the activities that will meet these objectives.

3.1 Research

Research advances human knowledge and enriches human experience. In my opinion, professorial activities that do not do these things may be valuable, and even scholarly, but they are not research. One must make one's contributions public, through professional presentations, student training, and publication, or they enrich only oneself, making them self-improvement rather than research. I take this view of research, and my obligation to do it, very seriously.

My primary research theme for the last decade has been to identify the extent to which evolutionary processes can be used as engineering design principles. In recent years I have also become interested in using biologically inspired algorithms to analyze biological data.

My research objective for the last few years has been to become one of the world's authorities on genetic programming, which produces computational hardware and software automatically using artificial analogs of natural evolution. In the next decade, my research objectives, which form the context for evaluating my future potential, are to

1. Become one of the world's authorities on biologically inspired computation, and on computationally assisted biology, and
2. Build an internationally respected research and educational program in bioinformatics and evolutionary studies at the University of Idaho

To meet these objectives, I ask fundamental questions about evolutionary computation, and I require analytical results rather than simulations alone whenever possible. I present these results publicly, with both publications and presentations. I also attend the major international meetings, and discuss research ideas frequently with the leaders in my field. Simultaneously, I improve my understanding of related disciplines such as mathematics and biology by discussions with colleagues in those areas and by active collaborations.

3.2 Teaching

Education is a constant cycle of habitual questioning, hypothesizing, investigation, debate, and a return to doubt. It leads us to know and improve our world and ourselves. My teaching assumes that my students are colleagues, that my colleagues are students, and that we actively share both knowledge and questions.

To do this, I encourage discussion and debate, brainstorming and analysis, hands-on projects and public presentation of results. I favor special topics courses and value the multiple perspectives of team taught courses. My syllabi are organized to tell stories, often the story of historical efforts to answer such large questions as "what is computation" or "what can computer scientists learn from biologists". My class projects revolve around asking and answering central questions, with the ultimate objective of asking better questions and finding even better answers. Much of my teaching happens in the lab, directing student research projects.

My teaching objectives are to promote a habit of critical inquiry, discovery, and intellectual sharing with all my colleagues, including students. My specific objectives in the last decade were to: develop and deliver excellent theoretical computer science

courses; to improve the mathematical and experimental rigor in the CS curriculum; and to help develop and deliver an outstanding CS graduate program. In the next decade, my plans are to:

1. Develop and offer the best courses in computational biology and evolutionary computation in the world
2. Implement an education program in bioinformatics and evolutionary studies spanning departments and colleges
3. Increase student participation in first-hand research

To meet these objectives, I will design and teach courses on these topics. I will work closely with colleagues in other disciplines and departments. And I will constantly encourage my colleagues, including students, to pursue knowledge and publicly share their findings.

3.3 Service

College and university committee service is an opportunity to get to know faculty members in other disciplines in order to work together to preserve and create an academic environment consistent with my professional philosophy. Without departmental committee service, growing departments such as CS would quickly stagnate. Professional service provides the peer review and autonomy without which academe would become ingrown and sterile. I consider service both an opportunity and a duty.

I volunteer for committee work when I think I am most likely to make a difference. In the past, my objectives for service have been to: promote scholarship with institutional changes; build a strong CS graduate program; and hire the best possible faculty colleagues. In the future, my plans are to serve on committees that will have a long-term impact on the ability of CS and UI to deliver a high quality research-oriented education and to advance knowledge.

4 Evidence of Performance

This section summarizes evidence of my professional accomplishments in research, teaching, and service. It highlights my dedication to collaboration and public sharing of knowledge. These data provide strong evidence that I will continue to perform the duties of a professor. U. Idaho faculty are required to present these data only since their last promotion. However, I will summarize data from my entire academic career in order to provide the fullest possible picture.

Faculty evaluations are tied to position descriptions. After self evaluation, departmental chairs and college deans rate UI faculty members on a scale from 0 to 3+ in research, teaching, service and administration, advising, and overall. The evaluations have been for calendar years, until recently. The following table summarizes my evaluations. UI does not keep any statistics on average evaluations or on their statistical distribution. However, anecdotal evidence seems to indicate that scores are tightly clustered around a 3-, so that 3's are significantly above average, and 3+'s even more so. My evaluations are consistently very high. Notice also the consistent improvement in all scores over time.

Table 2. Summary of faculty evaluation scores. Scores are from 0 to 3+, and evaluations are for calendar year. Numbers in parentheses are Dean scores when they disagree with Chair scores. Shading indicates above average (light gray) and greatly above average (dark gray) scores.

AY	Scores				
	Res.	Teach.	Service	Adv.	Overall
90	3-	3		3	3
91	3-	3		3+	3-
92	3-	3		3	3
93	3-	3		3	3-
94	3-	3+		3	3
95	3	3	3	3	3
96	3+	3+		3	3+
97	3-	3+	3+	3	3
98	3+ (3)	3+ (3)	3/3-	3+	3+
99	3+	3+	2/2	3+	3+

4.1 Research

My research is prolific and influential, as numerous publications and competitive research grants testify. I have also produced several graduate students and engaged many undergraduate researchers.

Publications: I have published in many disciplines, including philosophy, history, political science, biology, mathematics, and even computer science. I have co-authored papers with 5 different undergraduate students, 13 different graduate students and postdocs, 12 different UI faculty members in 5 different departments, and 5 different non-UI academic and industrial colleagues. Table 3 summarizes where my papers have been published.

Table 3. Summary of publications.

<i>Type of publication</i>	<i>Criteria</i>	<i>Num.</i>
Refereed	Review by a panel of peers (usually 3-5), strict publication standard (usually rejection rates over 50%), built-in revision schedule	28
Short refereed	Fully refereed as above, but so short as to be limited in scope	4
Book chapter	Invited or refereed	3
Peer reviewed	Refereed by small panel of peers (less than three), or no	7

	built-in schedule for revision after review and acceptance	
In press or pending		1
In preparation		5
Technical reports	Industrial (9 total): publication-quality documents, refereed internally, but restricted from publication by confidentiality agreements. University (15 total): unrefereed and unreviewed working manuscripts.	24
Total		72

Grants: As primary investigator (PI), co-PI, or project directory (PD) I have had spending authority over \$963,331 (from \$1,416,633 total). This funding came from the following sources:

Table 4. Funding sources and amounts.

Source	Num.	Total
Federal (NSF, NIH, DOD/OST, NSA)	4	\$835,228
State, industry (SBOE, GTE)	2	\$40,000
Internal (URO, Idaho Space Grant Consortium, Idaho EPSCoR, Northeastern Ill. U.)	15	\$63,103
Donations (Science Research Associates)	1	\$25,000
Totals	22	\$963,331

Graduate students: I am currently major professor for 4 MS, and 4 Ph.D. students and have graduated 7 MS students and 1 Ph.D. student. I have served as a committee member for 13 MS students in 6 disciplines and 5 Ph.D. students in 3 disciplines. I have 24 publications with graduate student co-authors.

Undergraduate research: I have directed 21 undergraduate researchers. I have 6 publications with 5 different undergraduate co-authors.

Special Honors: I was awarded a prestigious NIH/NIGMS Senior Fellowship, the only one awarded nationally in 1999. I am also listed in several Who's Who, including the 2000 Outstanding Intellectuals in the 20th Century, which lists only 2000 people worldwide. I have also been invited to five small invitation-only workshops, including three international ones, in my research areas.

4.2 Teaching and Advising

I have won national, university, and departmental teaching awards, including the highest award for teaching excellence at the University of Idaho. My teaching evaluations are consistently among the highest in the university. I have developed many courses and have taught courses at every level and almost every subject in computer science. As chair of the CS Graduate committee, and as assistant chair for graduate studies in CS, I helped

design and implement the CS doctoral degree program and to revise the MS/CS curriculum.

Awards: I have won the following awards for teaching

- *U. of Idaho Teaching Excellence* award (1999). Only three faculty members a year win this award. I have been nominated for this award two times—approximately 20 faculty members are nominated each year, selected by a committee of former award winners.
- Listed in *Lexington Who's Who of American Teachers* (1998 and 1999). Alumni nominate faculty members for this national listing. Only 11 UI faculty were listed in 1998, and fewer than 20% of the listees are listed for multiple years.
- *Alumni Award for Excellence* (1998). Winners of the student alumni excellence awards select faculty for this award, which goes to approximately 20 faculty members per year.
- *ACM Outstanding Teacher* (1995). The graduating class in Computer Science selects winners of this award, which goes to one faculty member per year.

Courses: I have taught 15 different courses at U. Idaho (not including courses with arranged credits such as 499, 500, 501, 502, 600, and counting similar course with different numbers, such as special topics 404/504, as one course). I have developed 8 new courses and completely revised 3 syllabi. These courses included a university core courses for non-majors; 5 lower division undergraduate courses; 7 upper division undergraduate courses; and 7 graduate courses.

I also taught several sections of 6 different classes at Northeastern Illinois University before coming to U. Idaho.

Evaluations:

UI conducts teaching evaluations for each undergraduate course (course numbers 100 to 499) and, optionally, for graduate courses. Each student ranks faculty members from 0 to 4, with 4 being the highest. From Fall 1990 to Spring 1992, the evaluation instrument asked only about the “quality of instruction”. From Fall 1992 through Fall 2000 it asked several questions, and I present the average score for these questions.

The following tables summarize my teaching evaluations. They do not report small directed studies, seminars, or special topics courses (such as 204, 501, 502, 499, 500, and 600). “na” indicates that evaluation scores are not available for that class.

These data differ from those reported by the department in the following ways. Since some students do not evaluation forms, class enrollments reported here are higher than the number of respondents in the departmental data. Some classes are cross-listed, and my data average all sections. In Spring 1994, my evaluation for the cross listed CS 495 is higher than the departmental numbers, which omit the mathematics section.

Notice that my average student evaluations are usually (all but twice) much higher than UI averages, and considerably higher than College of Engineering averages.

Table 5. Summary of teaching evaluations (Fall 1990—Spring 1992). University and college averages are not available.

Term	F 90		Sp 91		F 91	Sp 92		
Course	213	490	113	4/504	4/504	204	495	360
Enrollment	38	31	23	8	9	6	52	21
My Scores	2.95	3.39	2.79	3.25	3.17	3.40	3.04	na

Table 6. Summary of teaching evaluations (Fall 1992—Spring 1995). University and college averages are not available.

Term	F 92		Sp 93	F 93	Sp 94		F 94		Sp 95	
Course	113	490	590	4/504	495	590	490	596	590	4/504
Enrollment	20	48	12	20	43	9	52	8	8	16
My Average	3.40	3.11	na	3.71	3.64	3.70	3.37	3.32	3.56	3.58

Table 7. Teaching evaluation summary (Fall 1995—Spring 1997). Cross-listed grad/upper division courses report upper division average scores. University and college averages are not available before Fall 1996. Shading indicates above average (light gray) and greatly above UI average (dark gray) scores.

Term	F 95	Sp 96		F 96		Sp 97	
Course	4/504	590	495	490	101	4/504	590
Enrollment	43	8	48	51	50	12	16
My Average	3.58	3.90	3.36	3.52	3.12	3.69	3.57
College Avg	No data			3.12	3.02	3.10	3.46
University Avg	No data			3.18	3.22	3.12	3.18

Table 8. Teaching evaluation summary (Fall 1997--current). Cross-listed grad/upper division courses report upper division average scores. I was on sabbatical from Fall 99 to Spring 00 and so taught no courses. Shading indicates above average (light gray) and greatly above UI average (dark gray) scores.

Term	F 97		Sp 98		F 98	Sp 99		F 00	
Course	113	4/596	4/572	495	4/572	499	590	490	4/504
Enrollment	21	24	23	45	30	9	19	52	17
My Average	3.75	3.48	3.63	3.53	3.60	3.89	3.40	No Data	
College Avg	2.96	3.20	3.16	3.16	3.12	3.14	3.46	No Data	
University Avg	3.22	3.22	3.24	3.24	3.22	3.26	3.46	No Data	

Curriculum Development: I have developed 8 new courses and completely revised 3. I was also chair of the graduate committee that designed a new graduate curriculum, and helped institute a doctoral degree program in our department.

Pedagogical Innovation: I have team-taught courses with four different faculty members, published two articles on pedagogical innovations, and taught an experimental course that was later added to the permanent curriculum. I have offered 17 courses on videotape for distance education students since 1991, and six of my eight graduate students are distance education students, including two doctoral students. My courses have been web-assisted since 1994, and so were among the first in the world to use the web.

Advising: The following table reports the number of undergraduate students for which I have been an academic advisor at UI. See section 4.1 for research advising of graduate and undergraduate students. These are typical loads in CS, but are higher than recommended by the Computer Science Accreditation Board (CSAB).

Table 9. Number of undergraduate advisees at UI. Note that 99-00 was a sabbatical year.

AY	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01
Num	0	22	25	28	30	32	32	35	24	0	24

4.3 Service

I have served on several university, college, and departmental committees, often in very important capacities at critical times. My professional service includes international refereeing for journals and conferences, student guidance at a national level, and chairing sessions at international meetings.

Local: I have chaired three departmental committees, and served on 6. This includes 8 years on the Graduate Program committee, which designed our current graduate curriculum and implemented our doctoral program. I was Assistant Chair for graduate studies for two years. I have also served the largest student group in computer science, the student chapter of the ACM, as faculty advisor for 8 years and as programming team coach for 9 years.

I have served on three college committees, including a critical search committee for our first external chair and the college tenure and promotions committee.

Professional:

- I am on the editorial board for the *Journal of Genetic Programming and Evolvable Hardware*, the major journal in my field, and have been since it was established.
- I referee for several journals in computer science, mathematics, engineering, and biology.
- I have been on program committees for almost every major international conference and workshop in my field.

- I have been a session chair at every major conference in my field that I have attended.
- I have been a judge and panel member at the annual Graduate Student Workshop of the GECCO conference each year that this workshop has existed.

5 Summary

The University of Idaho expects a high level of achievement from faculty members who are to be promoted to full professor. My personal philosophy also requires high levels of achievement in every aspect of the academic profession: research, teaching, and service. I am proud to have been able to fulfill these expectations, while working with excellent faculty and student colleagues. I fully intend to continue this level of accomplishment, or to surpass it, during the next decade.

6 Appendix: Sample publications

I have included three papers representative of my more recent work, and indicative of the sort of work I will be pursuing in the future:

1. Clough, Foster, Barnett, Wichman, (1996) “Computer simulations of transposable element evolution: random template and strict master models,” *J. Mol. Evol.*, 42:52—58.

This paper presents simulation work in collaboration with a biologist (Wichman) and an undergraduate student (Clough). We developed the first computer simulation of DNA sequence evolution in the presence of two error sources, and used this model to test hypotheses about the modes of replication for transposable elements. This is an example of cross-disciplinary collaborations.

2. Soule and Foster. Limiting code growth in genetic programming. *J. Evolutionary Computation*, 6:4, 293—310, 1998.

This is an example of research on a fundamental limitation of genetic programming, my main research area. We present evidence for three reasons why evolved programs grow larger in a way uncorrelated to their solution quality, one of which is novel. This is an example of an undesirable inherent side effect of evolutionary design. We also present practical guidelines for overcoming this problem.

3. Masner, Cavalieri, Frenzel, and Foster. Size versus robustness in evolved sorting networks: is bigger better? *Proc. NASA/DoD Workshop on Evolvable Hardware (EH)*, IEEE Press, pp. 81—90, 2000.

This paper presents and quantifies the degree to which evolutionary design of computational hardware, sorting networks in this case, builds circuits that gracefully tolerate local gate failures. This paper applies bitwise stability, a novel metric for robustness developed in my research group. This is an example of a desirable inherent side effect of evolutionary design.