ENTRANCE INTO THE ACADEMIC CAREER*

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This paper examines the initial academic placement of 239 male, Ph.D. biochemists. Position in the academic stratification system, according to the normative structure of science proposed by Merton, should be allocated universalistically on the basis of a scientist's contribution to the body of scientific knowledge. Our analyses, however, show that after controlling for the effects of doctoral origins and the prestige of the mentor, preemployment productivity has an insignificant effect on the prestige of the scientist's first academic position. This basic finding is elaborated by examining the effects of postdoctoral fellowships, additional characteristics of the doctoral department, and the academic rank of the position obtained. In no instance does preemployment productivity affect the prestige of the first job. The universalistic nature of the scientific stratification system is assessed by comparing those factors which determine job allocation to those which predict scientific productivity later in the career. It is found that prestige of a scientist's first teaching position is least influenced by those factors which are most predictive of future productivity and most influenced by those factors which are likely to involve ascriptive processes.

One of the most persistent findings in the study of stratification in science is the substantial correlation between the prestige of the university department which currently employs a scientist and the prestige of his doctoral department (Caplow and McGee, 1958:225; Berelson, 1960:127; Crane, 1965; Hargens and Hagstrom, 1967; Hagstrom and Hargens, 1968; Cole and Cole, 1973:98). This relationship suggests two alternative interpretations. First, the correlation may be evidence for the operation of ascriptive or particularistic hiring patterns. This would be true to the extent that the prestige of a student's doctoral department aids him in obtaining a prestigious academic appointment, independently of his demonstrated ability. Second, the prestige of a student's doctoral department may be associated with factors indicating his ability as a scientist, and hence the correlation between doctoral prestige and the prestige of the hiring department would reflect the universalistic allocation of rewards in the scientific community.

Evidence for these alternative explanations is mixed. When both doctoral prestige and measures of scientific productivity are introduced into analyses predicting current prestige, the effect of doctoral prestige is somewhat reduced (Hargens and Hagstrom, 1967; Cole and Cole, 1973:98). Nevertheless, the effect of doctoral prestige remains significant and approximately equal to (or greater than) the effect of productivity. This result suggests *at least* a partial departure from the norm of universalism in science which requires that "scientific careers be open to talent" and that "recognition and esteem accrue to those who have best fulfilled their roles, to those who have made original contributions to the body of scientific knowledge" (Merton, 1973:272, 293). Indeed, on the basis of her findings, Crane (1970:961) concluded: "It could be argued that despite the system's normative commitment to universalistic criteria, they are not utilized in practice." In short, past studies do not support the contention that academic position is allocated exclusively, or even largely, on the basis of scientific productivity.

This lack of correspondence between scientific productivity and academic position is not simply a temporary inequity

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soon to be corrected by later mobility, but has lasting consequences for the individual scientist. Hagstrom and Hargens (1968) report a correlation of .68 between the prestige of first and current positions (which may be the same) for scientists in four fields. Even when they exclude those scientists who received their degrees less than 25 years earlier, the correlation was over .65. Moreover, for every subgroup studied the prestige of the first job was a much better predictor of the prestige of the current job than was the current number of publications. It should be noted, however, that these high correlations are partly a consequence of the fact that many scientists remain in the same department for most of their careers. For those who do change jobs, the correlations are much lower (Allison, 1976:207; Long, 1978). Nonetheless, given the immobility of many scientists, where a scientist ends up depends largely on where he starts, as Caplow and McGee (1958:225) have suggested.

The initial misallocation of position may be not only unfair to individual scientists, but also potentially damaging to scientific progress. As Zuckerman (1970:246) has suggested, regardless of the mechanism by which the first academic job is allocated, being located at a university with superior resources and stimulating colleagues should give the young scientist a significant boost in his career. Many of the rewards associated with prestigious departments are also prerequisites for future productivity (cf. Cartter, 1966; Brown, 1967; Clark et al., 1976). And indeed, Long (1978) has shown that departmental location has a major impact on a scientist's future productivity. Consequently, to the extent that prestigious position and valuable resources are allocated to those not best able to utilize them, overall scientific productivity may be reduced.

It now appears that earlier studies have *overestimated* the effects of productivity on the prestige of current affiliation. Hence, the violation of the norm of universalism may be more serious than previously thought. The problem arises from the fact that these studies (with the exception of Crane, 1965) measured departmental prestige and individual productivity at the same point in time, raising the possibility that it is the prestige of the department (or its correlates) that affects productivity rather than the reverse. With longitudinal data, Long (1978) has presented evidence for just this possibility. In this paper we extend those results by showing that the prestige of a scientist's first teaching position is least influenced by those factors which are most predictive of future research productivity and most influenced by those factors which are likely to involve ascriptive processes.

Before turning to the data, let us briefly consider how the first job might be allocated. It is worth remembering that academic jobs are not allocated by some master decision maker, but by a market mechanism in which departments compete for the most desirable candidates. The process occurs in three stages: candidates decide which jobs to apply for, departments choose candidates for the vacancies, and candidates choose among the offers they receive. Since the candidates themselves play such a large role in the final outcome, it would be misleading to interpret observed correlations between departmental and doctoral prestige as indicative only of *departments'* preferences and procedures (Cole and Cole, 1973:97). Nevertheless, most new Ph.D.s stress the importance of prestige or its correlates in choosing jobs (Brown, 1967), and we will not take this as problematic.

Assuming, then, that prestigious departments have a competitive advantage in recruiting new faculty, the question becomes which characteristics of students provide them with a competitive advantage over others? Suppose that departments recruited new Ph.D.s in a completely universalistic fashion. If universalism means choosing those candidates who have made the greatest scientific research contributions, then we would expect the number and estimated quality of predoctoral research publications to be major criteria. But new doctorates have not had much time to demonstrate their ability through publications. The evaluation of those publications is further complicated by the fact that many of the predoctoral publications are coauthored with the dissertation supervisor or other faculty members who may have played the major role in the design and interpretation of the research.

It is much more reasonable to expect universalistic departments to base their decision on expected *future* scientific contributions, and these expectations legitimately may depend on many factors besides predoctoral productivity. It may be that the prestige of the doctoral department is in fact a good indicator of future productivity, either because prestigious departments manage to recruit the best students or because they provide superior training. In fact, Cartter (1966) showed that subjective ratings of departments' effectiveness of graduate training were correlated almost perfectly with a measure of departmental prestige. For exactly the same reasons, the reputation of a new doctorate's dissertation supervisor—hereafter referred to as the mentor—may be a reasonable indicator of a scientist's future performance.

While there are only a few optimal ways to practice universalism, particularism can have many faces. Caplow and McGee (1958:127–8), for example, have suggested that departments choose candidates almost entirely on their expected contributions to the prestige of the department: "Men are hired, to put it baldly, on the basis of how good they will look to others." As a consequence, departments give only a cursory examination of the candidate's written work and concentrate, instead, on where he comes from and who recommends him. Such a process may still appear to be universalistic if disciplinary prestige is associated strongly with research productivity. Moreover, if departments really want to hire the most prestigious candidate, they will conduct a wide search and not give preference to other criteria.

More insidious is the notion that academic jobs are secured primarily through social ties. Many studies have shown that blue-collar workers find most jobs through friends and relatives (see references in Granovetter, 1974:4–5) and Granovetter (1974) finds a similar pattern for professional workers, at least according to self-reports. Caplow and McGee (1958:110) argue that departments often choose candidates on the basis of their social ties to the department. Inbreeding, the hiring of a new Ph.D. by his own doctoral department, is surely the most direct linkage. Somewhat more typical may be two-step ties in which the candidate is recommended by a friend of someone in the hiring department or a graduate of that department. To the degree that such ties are stratified, such a process should produce correlations between the prestige of the candidate's origin and the prestige of his destination.

All of these factors—past scientific contributions, expected future contributions, disciplinary prestige, and social ties—probably have some influence on the allocation of academic positions. Since each is consistent with a positive correlation between doctoral prestige and prestige of current position, it is difficult to assign relative weights to each factor. Nevertheless, the results presented in the remainder of this paper favor a particularistic interpretation. Specifically, it is shown that preemployment productivity has little if any impact on the prestige of the first position even though it is the best predictor of future productivity. While doctoral prestige has the strongest impact on the prestige of the first position, it has a much smaller impact on future productivity. Finally, it does not appear that departments make much use of any departmental-specific predictors of future productivity other than those that we have measured.

DATA AND MEASUREMENT

The sample consists of 239 male biochemists who received their Ph.D.s in fiscal years 1957, 1958, 1962 and 1963 and whose first faculty position was in a graduate department rated by Roose and Andersen (1970).[1] Career histories were

[1] Analysis was restricted to male biochemists due to the small number of females who obtained doctorates in biochemistry during this period, and to the difficulty in obtaining complete information on those females who did obtain degrees. Work is currently in progress to collect complete information on these females. Complete scores from the Roose and Andersen study were kindly provided by Charles J. Andersen.

obtained from *American Men and Women of Science* (tenth, eleventh and twelfth editions). The prestige of the doctoral department was measured by the complete three-digit rating of faculty quality of biochemistry departments, a partial listing of which appeared in Cartter (1966). These scores ranged from 100 for the least prestigious to 500 for the most prestigious. The prestige of the first job was somewhat more difficult to measure since the biochemists worked in several departments. Accordingly, a prestige score for each university was constructed based on a weighted average of the Roose and Andersen (1970) ratings of the departments of biochemistry (1/2), chemistry (1/4), physiology (1/12), microbiology/bacteriology (1/12) and pharmacology (1/12).[2] These scores also ranged from 100 to 500.

For all but two of the sample, the name of the mentor was obtained from *Dissertation Abstracts*, *Directory of Graduate Research*, or a mail survey of graduate deans. A measure of the mentor's accomplishments was obtained by counting citations to his or her first-authored publications in the 1961 *Science Citation Index*. While we will interpret these counts as a measure of prestige, it should be kept in mind that they may reflect both the performance of a scientist and his or her standing in the scientific community.

Productivity of the sample members was measured using counts of both publications and citations to them. *Chemical Abstracts* (1955–1973) was used to locate the articles published by the sample members, whether or not they were the senior author. Citations to these articles were coded from *Science Citation Index* (Vols. 1961, 1964, 1966, 1968, 1970, 1972, and 1974). The name of the first author on multiple-authored papers where the cohort member was not the first author was used to locate citations to junior authored papers; thus downward bias in counts for scientists who were predominantly junior authors was avoided. For a given year in the scientist's career, the publication measure reflects publications in a three-year period ending in that year. The citation measure for that year is restricted to citations to papers published in that three-year period. Since coverage of *Science Citation Index* and *Chemical Abstracts* increased during the period covered by our analyses, counts were standardized within years of the Ph.D. For details, see Long (1978).

In addition to these key variables, Astin's (1971) measure of "selectivity" of the scientist's undergraduate institution was used. This index has values ranging from one to seven, with seven being the most selective category. This measure has been interpreted by some as a crude indicator of intelligence and by others as a measure of the quality of the undergraduate education. In any case, a number of studies have shown it to be a moderately good predictor of future success.

RESULTS

Consistent with earlier studies, we find a correlation of .39 between doctoral prestige and prestige of the first job. Destination prestige also has a correlation of .34 with mentor's citations, .22 with both undergraduate selectivity and citations, and .14 with publications. Equation 1 of Table 1 presents the results of entering these variables into a single regression equation. Doctoral prestige clearly has the strongest effect, followed by a moderate but significant effect of the mentor's prestige and a slightly weaker effect of baccalaureate selectivity. On the other hand, the effects of the two productivity measures are small, inconsistent in sign, and statistically insignificant. These results are similar to those reported by Long (1978) for a special subset of this sample.

For a clear interpretation of these findings, it is instructive to note the different effects of doctoral prestige and mentor's citations on the preemployment productivity of students, and their similar effects on the prestige of the initial academic position. While the prestige of the mentor and the doctoral department are moderately correlated (r=.41), they have quite different effects on predoctoral productivity. When the number of predoctoral publications and citations of our sample

[2] These weights (contained in parentheses) were based on estimates of the number of biochemists teaching in each field.

Table 1. Regressions Relating Preemployment Statuses of Biochemists to Prestige of First Position

		Coefficients[a] of:								
Equation		PHD	MENT	SEL	PUB	CIT	ENRL	Intercept	R^2	d.f.
1. All	β	.282	.178	.144	−.021	.109			.224	231
Biochemists	b	.241	5.60	9.25	−2.18	4.75		128.6		
	t	4.42	2.67	2.43	0.26	1.33				
2. All Biochemists,	β	.416	.134	.117	−.028	.102	−.184		.243	230
Enrollment Added	b	.335	4.22	7.52	−2.98	4.45	−.510	128.7		
	t	4.92	1.96	1.96	0.36	1.26	2.38			
3. All Biochemists, Institution	β	.445	.221	.134	−.029	.007	−.326		.353	210
Dummies Added	b	.380	6.96	8.62	−3.08	3.35	−.905	114.5		
	t	3.61	2.95	2.17	0.36	0.93	1.25			
	r	.390	.342	.223	.143	.221	.054			
		: Test of significance of the 20 dummy variables—$F_{20,210}=1.79$, $p<.05$								
4. Inbred	β	.340	.094	.135	−.052	.103	−.269		.169	178
Biochemists	b	.283	2.97	8.43	−5.50	4.40	−.708	156.8		
Excluded	t	3.41	1.17	1.91	0.55	1.07	2.91			
	r	.235	.254	.216	.092	.161	−.089			

Note: Dependent variable is the Roose-Andersen bioscience prestige score of the first academic position. Item identifications are: PHD=Ph.D. prestige, Cartter prestige of the Ph.D. department; MENT=square root of five-year citation counts for mentor; SEL=selectivity of baccalaureate institution; PUB=publication level, square root of standardized levels of three-year publication counts ending in the first year of the first job; CIT=citation level, square roots of standardized values of citations to publications in the three-year period ending in the first year of the first job; ENRL=number of biochemistry graduate students enrolled in the doctoral department in 1962.

[a] Row β gives standardized regression coefficients; row b gives unstandardized regression coefficients; row t gives the t-statistics (with more than 120 degrees of freedom in the regression, critical values for a two-tailed test of significance at the .10, .05 and .01 levels are: 1.645, 1.960 and 2.576, respectively; for a one-tailed test the critical values are 1.282, 1.645 and 2.326 for significance levels .10, .05 and .01, respectively); row r gives zero-order correlation coefficients with dependent variable.

members are regressed on doctoral prestige, mentor's citations, enrolled time in graduate education and baccalaureate selectivity (regressions not shown), the effects of the mentor's prestige are strong, positive and statistically significant, while those of doctoral prestige are trivial and statistically insignificant. These results hold even after controlling for the extent of predoctoral collaboration with the mentor (regressions not shown). Yet, the influence of the mentor on his or her student's first academic position is weaker than that of departmental prestige, and operates directly rather than indirectly through the effect of productivity on departmental prestige of the initial academic appointment.

Our initial conclusion, then, is that neither the quantity nor the "quality" of one's early publications has significant influence on where one ends up in the prestige hierarchy. In the remainder of this paper, the baseline model presented in Equation 1 of Table 1 will be elaborated in several ways. *In no case are any effects of productivity on the prestige of the first job found.*

Preemployment productivity. This lack of effect cannot be explained by any lack of variation in preemployment productivity. The publication measure used in Equation 1 had a mean of 2.8, a median of 2.2 and a variance of 5.7. The range was from 0 (14.6% of the cases) to 13 (0.4% of the cases). There was even more variation in the citation measure: the mean was 13.6, the median was 6.7, the variance was 260.4, and the range was from 0 to 90.

Neither are the results attributable to an improperly specified functional form. Although only results using a square root transformation of the productivity measures (used to reduce skewness) are reported, logarithmic and cube root transformations, as well as the untransformed counts, were tried. To eliminate further the possibility of bias or attenuation due to improper functional form, the productivity measures were entered as sets of dummy variables. In addition to raw citation counts, the mean number of citations per paper was also tried as perhaps a better indicator of a candidate's ability. Finally, articles and citations to them which were not the result of coauthoring with the mentor also were examined. None of these measures had a significant effect on destination prestige. Thus it appears to be highly unlikely that the lack of effect of productivity is due to the way in which productivity was measured.

Doctoral prestige. It is possible that the effect of doctoral prestige is a consequence of its correlation with some other, more fundamental variable. Several characteristics of the doctoral institution were examined including Astin's (1971) measure of selectivity, whether or not the department was administratively located in an agricultural school, the percentage of all students who were graduate students, the year the first Ph.D. was awarded, the dollar amount of funding in 1964 from the National Institutes of Health (the principal agency supporting biochemical research), and several indicators of the size of the institution and its components. Only the number of biochemistry graduate students enrolled in 1962 had a significant effect on the prestige of the first job. Its effect was sizable and negative as shown in Equation 2 of Table 1. The coefficients for both mentor's citations and undergraduate selectivity were reduced by this addition to the model, but the effect of doctoral prestige increased by 50%. This increase is the result of the .60 correlation between enrollment size and doctoral prestige, and the fact that these two variables have effects on destination prestige that are opposite in sign.

Three explanations for the negative effect of enrollment seem reasonable. First, large enrollments may reflect more lenient admissions policies and thus lower average ability of graduates. Second, large enrollments may reduce the effectiveness of training during the graduate education. And finally, large enrollments tend to produce large graduating cohorts and the increased competition for available jobs may hurt all of the graduates of a department. Although we cannot distinguish empirically among these three explanations, biochemistry enrollments will be added to the baseline model for the remainder of the analysis.

In Equation 3 of Table 1 we examined the possibility that there are other, unmeasured characteristics of institutions or departments which might help or hinder their doctorate graduates. This was accomplished by adding a set of 20 dummy variables representing the 20 biochemistry departments which graduated three or more of the doctorates in our sample. While these 20 departments represented only 29% of the producing departments, they accounted for 64% of the biochemists in the sample. The addition of these dummy variables increased the R^2 from .24 to .35 ($F_{20,210}=1.79$, $p<.01$), indicating that there are significant differences among departments in the prestige attainments of their graduates that cannot be attributed to the prestige of the doctoral departments themselves. For example, Johns Hopkins has a coefficient of −32, while Chicago has a coefficient of 65. This says that once the effect of origin prestige, mentor's citations, undergraduate selectivity and the individual's productivity have been removed, Hopkins graduates averaged 32 points lower and Chicago graduates 65 points higher in destination prestige than graduates of the 49 departments not represented by dummy variables. Moreover, net of other variables, the difference between the attainments of Hopkins graduates and Chicago graduates, 97 points on the prestige scale, is more than one standard deviation. Differences of this sort are very likely substantial, yet do not lend themselves to a simple explanation. None of the characteristics of departments and institutions that were mentioned above account for these differences, and from Equation 3 it is clear that they persist after controlling for departmental prestige, productivity of the mentor and individual productivity. It may be that they reflect peculiar characteristics of individual departments at a particular point in the history of the discipline or errors in the measurement of departmental prestige. Clearly, further investigation is needed here.

Equation 3 also provides additional support for the importance of departmental prestige in the allocation of academic positions to graduates, and the lack of importance of scientific productivity in this process. The effect of departmental prestige increased, as did the coefficients for the mentor's citations, departmental enrollment and undergraduate selectivity. The already small coefficients for productivity were reduced even further.

Hagstrom and Hargens (1968) have suggested that much of the association between doctoral prestige and the prestige of the first job may be accounted for by the phenomenon of inbreeding. When those scientists whose doctoral and first teaching institution were the same (i.e., inbred scientists) were excluded from their analysis, the effect of doctoral prestige on first job prestige was approximately halved. Besides inflating the effect of doctoral prestige, the inclusion of inbred scientists may attenuate the effect of preemployment productivity. This would follow if productivity were more important in the placing of scientists who are not inbred than for inbred scientists for whom particularistic factors are very likely to be operating. The inclusion of inbred scientists in Equations 1 through 3 of Table 1 might, then, contribute to the lack of importance of productivity. In Equation 4 the 52 biochemists who were inbred were excluded. The effect of doctoral prestige fell by only about 20% (compared with 50% for Hagstrom and Hargens), while the effects of productivity remained trivial and unchanged. The difference between these two studies in the effect of doctoral prestige appears to be the result of including enrollments in Equation 4. When this variable is omitted from the equation for noninbred scientists, the standardized coefficient for doctoral prestige falls from .34 to .15. The only variable whose effect has greatly changed is the mentor's citation level. When inbred scientists are excluded, the effect of the mentor is reduced and loses statistical significance, suggesting a process by which prestigious mentors at prestigious institutions seek to retain their students after they obtain a doctorate.

Postdoctoral training. For 65% of the sample, the first teaching job did not immediately follow the Ph.D., but was preceded by one or more years of postdoctoral research training. Fifty-eight percent of these individuals had job titles such as "postdoctoral fellow" or "trainee," while the remainder simply held brief positions as a research associate or a similar title. We have been unable to detect any differences in the career patterns of these two groups of postdoctoral appointees and accordingly have followed the prevailing practice of not distinguishing between "fellows" and those with "fellow-like" positions (Curtis, 1969:44). Hereafter, both groups will be referred to as fellows or postdoctorals.

It is reasonable to expect that holding a postdoctoral position should make some difference in how biochemists obtain their first teaching position. First, the mere passage of time and change of location should weaken ties with the doctoral institution while providing new social ties in the postdoctoral institution. Second, it may be argued that productivity is not important in the placement of new doctorates because they have not yet had the time to establish themselves as researchers. The postdoctoral fellowship provides the young scientist with additional time to demonstrate his or her competence through additional publications. On average, postdoctorals in our sample began their first teaching positions two and one-half years after the doctorate, with 46% having positions lasting three or more years. Finally, the additional research training received by fellows presumably should increase their desirability to academic employers in research intensive locations, resulting in a higher destination prestige for postdoctorals than for those without such advanced training (cf. Curtis, 1969:69–70).

For the most part, these expectations were not strongly supported by the data. When a dummy variable for postdoctoral position was added to the baseline model, it was found that fellows obtained positions only about 17 points higher on the prestige scale than nonfellows, net of other variables. The difference, however, was not statistically significant. An analysis of covariance (not shown) was then performed to determine if the effects of other variables in the model differed for postdoctorals and nonpostdoctorals. Although, as expected, the effects were somewhat attenuated for the postdoctorals, none of the differences was statistically significant.

What is especially important about these null results is that even though postdoctorals have substantially more publications and citations than nonpostdoctorals, no effect of productivity on destination prestige is found. Fellows averaged 3.1 publications and 16.0 citations for the three-year period before the receipt of their first teaching position, compared with 2.1 publications and 9.0 citations for nonfellows. Even when all publications from two years before the doctorate until the year of the job were included in the regression for fellows, no effects of publications or citations were found. Clearly, the absence of productivity effects cannot be explained by insufficient time to publish.

It appears, then, that merely holding a postdoctoral position does not greatly affect one's entry into the academic career. There is evidence, however, that *where* one held such a position does make a difference. Seventy-six percent of the fellows were located in rated graduate departments, 17% were in prestigious locations other than United States graduate institutions (e.g., N.I.H., Cambridge University, Brookhaven National Laboratories), while the remaining 8% were located in either industrial laboratories or nongraduate educational institutions. After excluding nonfellows from the analysis, dummy variables indicating the type of location of the fellowship were added to the baseline model, yielding the results presented in Equation 1 of Table 2. Net of other variables, the destination prestige of low prestige fellows is nearly 60 points lower than that of fellows in rated departments. Those in prestigious locations, but not American graduate departments, also did worse but the difference was slight and not statistically significant.

By restricting the analysis to postdoctorals in rated departments, the effect of the prestige rating of the postdoctoral location could be added to the baseline model. Equations 3 and 4 of Table 2 show that postdoctoral prestige is clearly the best predictor of the destination prestige, while the effect of the doctoral prestige is much reduced and no longer statistically significant. It is as if hiring departments pay attention only to an applicant's current position and disregard his previous institutional affiliation. Nevertheless, since doctoral prestige and postdoctoral prestige are moderately correlated ($r=.37$), the sum of the direct and indirect effects of doctoral prestige is not substantially reduced. Thus, to a certain extent, postdoctoral prestige mediates the effect of doctoral prestige. On the other hand, the results suggest that the fellowship is valuable in overcoming the negative influences of a doctorate from a low prestige institution.

Postdoctorals not only obtain a new location from which to launch their careers, but also a new mentor with whom they may work even more closely. Unfortunately, the names of these mentors are unavailable. We suspect that the inclusion of their citation level in the model would further reduce the effects of both doctoral prestige and the dissertation supervisor's citation level.

Overall, then, we may conclude that while postdoctorals as a group do not do much better in prestige attainments than nonpostdoctorals, the prestige of their postdoctoral position becomes the key determinant of the prestige of their first job. Further, even though fellows have had greater time in which to demonstrate their ability as researchers and have published significantly more papers, the effect of productivity on the prestige of their first teaching position remains statistically insignificant.

Academic rank. A final variable which should be considered is the academic rank of the first job. The trade-off between the cosmopolitan reward of position in a prestigious department and the local reward of high academic rank was discussed by Caplow and McGee (1958) who noted that downward mobility in the prestige hierarchy was almost always accompanied by advancement in academic rank. Hargens (as quoted by Cole and Cole, 1973:260) found a similar phenomenon in a larger sample of scientists. To incorporate

Table 2. Regressions Relating Preemployment Statuses of Fellows to Prestige of First Position

Equation		PHD	MENT	SEL	PUB	CIT	LOW	HIGH	POST	RANK	Intercept	R^2	d.f.
		Coefficients[a] of:											
1. All Fellows	β	.244	.156	.128	.039	.033	−.188	−.045				.220	146
	b	.204	4.70	8.32	4.27	1.37	−58.9	−10.2			161.5		
	t	2.88	1.83	1.70	0.40	0.32	2.44	0.61					
2. All Fellows, Rank Added	β	.241	.125	.128	.038	.039	−.161	−.032		−.204		.259	145
	b	.200	3.76	8.32	4.13	1.62	−50.6	−7.22		−39.6	355.1		
	t	2.91	1.49	1.74	0.39	0.39	2.13	0.41		2.79			
	r	.362	.316	.224	.119	.190	−.212	−.071		−.276			
3. Fellows in Rated Departments	β	.201	.171	.151	.058	.034						.160	111
	b	.173	5.15	9.15	6.18	1.39					162.1		
	t	2.05	1.73	1.70	0.47	0.27							
4. Fellows in Rated Departments, Postdoctoral Prestige Added	β	.123	.147	.139	.048	.013			.311			.246	110
	b	.105	4.43	8.47	5.14	.546			.339		73.9		
	t	1.28	1.56	1.65	0.41	0.11			3.54				
5. Fellows in Rated Departments,	β	.128	.105	.147	.046	.017			.335	−.232		.297	109
	b	.110	3.17	8.95	4.90	.704			.364	−42.5	268.8		
	t	1.38	1.13	1.80	0.40	0.14			3.91	2.83			
	r	.299	.294	.223	.147	.192			.402	−.221			

Note: Dependent variable is the Roose-Andersen bioscience prestige score of the first academic position. Item identifications are: PHD=Ph.D. prestige, Cartter prestige of the Ph.D. department; MENT=square root of five-year citation counts for mentor; SEL=selectivity of baccalaureate institution; PUB=publication level, square root of standardized levels of three-year publication counts ending in the first year of the first job; CIT=citation level, square root of standardized values of citations to publications in the three-year period ending in the first year of the first job; LOW=nonrated graduate school locations with low prestige; HIGH=nonrated graduate school locations with high prestige; POST=Roose-Andersen bioscience prestige score of the postdoctoral fellowship location; RANK=academic rank of first faculty position: 4=instructor, 5=assistant professor, 6=associate professor, 7=full professor.

[a] Row β gives standardized regression coefficients; row b gives unstandardized regression coefficients; row t gives t-statistics; row r gives zero-order correlations with dependent variable.

this trade-off between rank and prestige into our model of the allocation of the initial teaching position, the independent variable of the academic rank of the first position was added.[3] The results of this addition are presented in Equations 2 and 5 of Table 2. It proves to be an important variable, decreasing the expected prestige of the first job by approximately 40 points for every advancement in rank. When rank was included in the regression for all 239 biochemists (regression not shown), the effect was halved, although still significant, reflecting the lesser variation in the rank of the first position among nonfellows.

ASSESSING UNIVERSALISM

Let us summarize the results to this point. The principal determinant of the prestige of a biochemist's first teaching job is the prestige of his most recent departmental affiliation, with somewhat weaker effects of mentor's prestige and the selectivity of the undergraduate institution. A negative effect of the size of graduate enrollment in the doctoral department also is found, along with substantial differences among individual departments which are unattributable to either their prestige or their enrollment. For fellows, there is a trade-off between academic rank and the prestige of the position accepted. In no case is an effect of preemployment productivity found.

These results are combined in the augmented model shown in Table 3. This regression differs from that in Equation 2 of Table 1 by the addition of a variable which is the prestige of the postdoctoral department for all those who held postdoctoral positions in rated departments.[4] As before, doctoral prestige has the strongest effect, followed by postdoctoral prestige and doctoral enrollment. Mentor's citations and undergraduate selectivity have effects which are positive and marginally significant. The effects of publications and citations, however, are far from statistically significant.

Taken alone, these results do not tell us much about the observance of the norm of universalism in science. Certainly the absence of any productivity effects runs contrary to an extreme interpretation of universalism which would require that

[3] Academic rank was coded as follows: 4=instructor; 5=assistant professor; 6=associate professor; 7=full professor. To determine the effects of this arbitrarily chosen metric, we also used a series of dummy variables to determine the effect of rank. The results were similar.

[4] For biochemists who did not hold a postdoctoral position in rated graduate departments, this variable was assigned a value of 358, the mean for those who did not hold such positions. Also included in the equation was a dummy variable coded 1 if the individual did hold a postdoctoral position in a rated graduate department, otherwise 0. The coefficient for this variable has no substantive interpretation; it is included only to make the model invariant to the particular value (in this case 358) assigned to those cases without a postdoctoral prestige score.

Table 3. Regression Relating Preemployment Statuses of Fellows and Nonfellows to Prestige of First Position

		Coefficients[a] of:									
Equation		PHD	MENT	SEL	PUB	CIT	ENRL	POST	Intercept	R^2	d.f
1. All	β	.379	.124	.104	−.041	.085	−.163	.171		.275	228
Biochemists	b	.324	3.90	6.67	−4.38	3.69	−.454	.277	37.8		
	t	4.52	1.84	1.75	0.53	1.06	2.13	2.94			
	r	.390	.342	.223	.143	.221	.054	.269			

Note: Dependent variable is the Roose-Andersen bioscience prestige score of the first academic position. Item identifications are: PHD=Ph.D. prestige, Cartter prestige of the Ph.D. department; MENT=square root of five-year citation counts for mentor; SEL=selectivity of baccalaureate institution; PUB=publication level, square root of standardized levels of three-year publication counts ending in the first year of the first job; CIT=citation level, square roots of standardized values of citations to publications in the three-year period ending in the first year of the first job; ENRL = number of biochemistry graduate students enrolled in the doctoral department in 1962; POST = Roose-Anderson bioscience prestige of fellowship location for fellows in rated graduate departments, 358 for others.

[a] Row β gives standardized regression coefficients; row b gives unstandardized regression coefficients; row t gives t-statistics; row r gives zero-order correlations with dependent variable.

positional prestige be allocated only on the basis of past scientific contributions. But it is much more reasonable, and surely in keeping with Merton's notion of universalism, to expect departments to choose among new doctorates on the basis of their anticipated contributions. It is conceivable that preemployment productivity might actually be a very poor predictor of future productivity, while such variables as doctoral prestige and mentor's citations might be quite good indicators. Clearly departments which want doctorates who will be productive researchers should rationally base their choice on those variables which are known to be good predictors, not on some a priori distinction between universalistic and particularistic criteria.

Fortunately it is not necessary to speculate about the relative power of these variables in predicting future productivity. For our sample, future productivity was measured by the number of articles published in the fourth through sixth years after the receipt of the position and by the number of citations these publications received in the sixth year. These measures of future productivity were regressed on the variables considered thus far, restricting the analysis to the 134 biochemists who remained in the same department for at least six years. This restricted sample was necessary since earlier research (Long, 1978) has presented evidence for the importance of departmental location on productivity, a point to be examined below. The results are presented in Table 4.

The future level of publication is most strongly influenced by predoctoral publications as indicated by the strong and statistically significant standardized regression coefficient in Equation 1. The effects of doctoral prestige, postdoctoral prestige for fellows, the mentor's level of citations, and undergraduate selectivity are all positive, but their magnitudes are small and not statistically significant. It appears that those who publish early in their careers continue to publish, but that having a distinguished pedigree does not significantly affect future publication levels.

Doctoral origins appear to be far more important in the determination of future citation levels. Equation 2 indicates that the prestige of the doctoral department along with the size of that department are the most important factors predicting future citations. The effect of prestige is strong and positive while the effect of enrollment is strong and negative; both effects are statistically significant. The effects of preemployment productivity are both positive and statistically significant, albeit slightly weaker than the effects of doctoral characteristics. The mentor's prestige and the selectivity of the undergraduate institution have insignificant effects. These results suggest that doctoral prestige may be useful as an indicator of future citation levels of job candidates, but that preemployment productivity also should be considered.

These results, while accurate as far as they go, do not adequately reflect the causal mechanism involved in the effect of origin on future productivity. As Long (1978) has shown in similar analyses for the same sample, departmental location of employment is an important factor in determining scientific productivity. This is reflected in Equations 3 and 4 in which the prestige of the current employer is added to the earlier equations. The results suggest quite a different story. Much of the effect of the origin department is not direct, but rather operates indirectly through the effect of origin prestige on the first job. Thus, origin prestige influences the prestige of the first job, and the prestige of the first job influences the productivity of the scientist while he holds that job. For publications, the prestige of the current employer is the second strongest factor, behind preemployment publications; the effects of all other variables are reduced and statistically insignificant. For citations, the effect of current prestige is the strongest factor, followed by the statistically significant effect of earlier publications. The effects of doctoral characteristics are greatly reduced and are no longer statistically significant.

The absence of any effect of the mentor's level of citations and the selectivity of the baccalaureate institution is a strong indication that using them as criteria for

Table 4. Regressions Relating Predoctoral Statuses, Institutional Location, Preemployment Productivity and Academic Rank to Productivity Six Years after Receipt of First Job, for Those 134 Biochemists Who Do Not Change Institutions

		Coefficients[a] of:										
Equation		PHD	POST	MENT	SEL	ENRL	PUB	CIT	PRST	Inter-cept	R^2	d.f.
1. Future	β	.129	.121	.008	.114	−.055	.317	−.025			.165	124
Publications	b	.00120	.00246	.00230	.0788	−.00157	.383	−.0119		−.0664		
	t	1.04	1.41	0.08	1.28	0.48	2.75	0.21				
2. Future	β	3.06	.076	.033	.053	−.204	.203	.185			.276	124
Citations	b	.00657	.00356	.0282	.0846	−.0135	.573	.207		−.475		
	t	2.64	0.95	0.37	0.63	1.91	1.90	1.67				
3. Future	β	.035	.075	−.031	.086	−.025	.325	−.047	.255		.211	123
Publications,	b	.000326	.00151	−.0112	.0594	−.000718	.394	−.0224	.00314	−.188		
Current	t	0.28	0.87	0.32	0.98	0.23	2.89	0.40	2.67			
Prestige Added	r	.165	.189	.159	.167	−.027	.332	.243	.331			
4. Future	β	.186	.016	−.016	.017	−.166	.214	.157	.324		.350	123
Citations,	b	.00399	.000748	−.0139	.0270	−.0110	.604	.176	.00932	−.837		
Current	t	1.62	0.20	0.19	0.21	1.63	2.10	1.48	3.74			
Prestige Added	r	.241	.191	.266	.188	−.079	.393	.394	.444			

Note: Dependent variables are square roots of standardized citation and publication levels for the three-year period ending in the sixth year of the first job. Item identifications are: PHD=Ph.D. prestige, Cartter prestige of the Ph.D. department; MENT=square root of five-year citation counts for mentor; SEL=selectivity of baccalaureate institution; PUB=publication level, square root of standardized levels of three-year publication counts ending in the first year of the first job; CIT=citation level, square roots of standardized values of citations to publications in the three-year period ending in the first year of the job; PRST=Roose-Andersen bioscience prestige score of first job.

[a] Row β gives standardized regression coefficients; row b gives unstandardized regression coefficients; row t gives t-statistics; row r gives zero-order correlations with dependent variable.

awarding prestigious jobs is inconsistent with the principle of universalism. Similarly, the strong effect of preemployment productivity on later productivity suggests that departments are being nonmeritocratic in ignoring these variables in their hiring decisions. While doctoral characteristics have a strong effect on future citations when departmental location is not controlled for, our results suggest that this is the result of the particularistic effect of doctoral prestige on the allocation of the first job and the subsequent effect of departmental location on future productivity. Thus, rather than giving support for the use of doctoral characteristics as valid indicators of future productivity, it suggests the operation of cumulative advantage (cf. Allison and Stewart, 1974). After controlling for departmental location, the effect of doctoral prestige on future citations is still positive and marginally significant, but this is a weak defense of universalism.

Finally, the possibility that hiring departments made effective use of information concerning specific doctoral departments which we have not been able to measure was considered. Recall that significant differences among departments in the prestige attainments of their students were found that were unattributable to the prestige of the department. One possible explanation is that, apart from prestige, some departments were simply more effective than others in training or recruiting students with high research potential and that these differences were perceived by hiring departments. The evidence does not favor this explanation. When dummy variables for the 20 schools with the most biochemistry doctorates were entered into Equations 3 and 4 of Table 4 (regressions not shown), there was no significant increment in the R^2. Thus, characteristics other than prestige and enrollment were not associated with differences in future research productivity.

SUMMARY AND CONCLUSIONS

The basic result with which this paper was begun has hardly been altered by the preceding analysis: there is a substantial correlation between the prestige of scientists' doctoral departments and the prestige of their employing departments, and this relationship cannot be explained by any other variable that we have measured. In particular, it is not a consequence of the greater productivity of students from prestigious departments or of the fact that those from more prestigious departments have more prestigious mentors (an explanation suggested by Cole and Cole, 1973:117). For those who take postdoctoral training positions, the prestige of the postdoctoral institution replaces doctoral prestige as the key determinant of the prestige of the first teaching position. Besides this unexplained prestige effect, larger departments were found to do worse in placing their students net of other factors; moreover, there are significant differences among departments in the prestige attainments of their students which are not attributable to their prestige or enrollment.

To settle the question of whether the influence of doctoral prestige reflects universalistic or particularistic hiring practices, it is first necessary to determine whether doctoral prestige is a good predictor of later productivity. We have shown that it has only a modest effect on citation counts six years into the first job and virtually none on publications. But this result is overshadowed by the fact that preemployment productivity is a much better predictor of later productivity than doctoral prestige, either alone or in combination with other variables in this study. Yet, hiring departments seem to ignore completely this most obvious predictor of future productivity.

All of this seems to support the impressionistic conclusion of Caplow and McGee (1958) that hiring departments pay attention only to where a candidate comes from and who recommends him, while virtually ignoring written work, either published or unpublished. While the apparent effect of doctoral prestige on later productivity suggests that this process may not be entirely inconsistent with the meritocratic principle, we suspect that it is more accidental than deliberate. As evidence for that interpretation, we note that for fellows it is the postdoctoral prestige that has the principal effect on first job prestige even though postdoctoral prestige has no independent effect on later productivity. It therefore appears that departments rely on current affiliation irrespective of any predictive validity for research productivity.

Although these results are for a single scientific field, we see nothing peculiar about biochemistry that would raise doubts about their generalizability. Biochemistry does have one of the highest percentages of students who take postdoctoral research positions (Curtis, 1969), but we have shown that there is little difference between those who do and those who do not take such positions. Biochemistry also tends to be split between an agricultural and a medical orientation, and we have shown elsewhere that those who get degrees from a medical or arts college are far more likely to get postdoctoral fellowships than those from agricultural colleges (McGinnis et al., 1979). Still, we have found no significant differences between these groups in the effects of other variables on the prestige of the first job.

It may be argued that the first job is not a good site for observing universalism in science since information about job candidates is relatively poor and, hence, particularistic factors are bound to creep in. We have shown, however, that departments do not make good use even of that information which is readily available to them, namely, the number of articles a candidate has published, and for fellows this represents the results of a significant period of research. Moreover, whether or not the allocation of initial employment is typical of decision making in other areas of science, the fact that so many scientists stay in that first position means there is only limited opportunity to correct mistakes. Finally, Long (1978) has shown that past productivity has little effect on the destination prestige of those who change jobs later in their careers. His sample size is small, however, and we are currently undertaking a much larger study of mid-career job changes.

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