SCIENTISTS IN ORGANIZATIONS: DISCRIMINATION PROCESSES IN AN INTERNAL LABOR MARKET

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It has been argued that discrimination against women may stem from their location in female-dominated occupations. In order to examine whether men and women working in the same occupation are similarly treated the attention is focused on the scientific enterprise that is considered to be governed by universalistic criteria. Whereas earlier studies of discrimination in science were conducted in academic settings or in the entire labor market, a more recent trend in organizational analysis is followed that emphasizes the significant role of internal labor markets in determining employment practices within large firms. This study, which employs a "one occupation-one firm" design, indicates that female scientists clearly have fewer promotion opportunities than their male counterparts. The article concludes that controlling for organizational position in wage equations produces a downward biased estimated level of wage discrimination. These results suggest that internal labor markets may act as a subtle mechanism of discrimination against women.

In a recent study, Hartmann (1987) concludes that "to the extent women may be discriminated against... discrimination appears to take the form of their location in female-dominated occupations. In this sense the internal labor market model holds: women and men in the same occupations are generally treated similarly (though not entirely); it is just that they are not usually in the same occupations" (p. 90). With the aim of rigorously examining this conclusion, we have chosen to study a situation in which female and male scientists are employed by one large Israeli firm.

Women are under-represented in scientific achievement (Zuckerman and Cole 1975; Cole and Cole 1973). This phenomenon has been attributed to a successive filtering process which tends to lower the probability of women's engagement in scientific research. Zuckerman and Cole (1975) suggest that discrimination might be one of the barriers that acts in reducing the participation of women in science. The possible ex-

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istence of discrimination is ostensibly surprising, because the norm of universalism, which is a cornerstone of the ethos of science (Merton 1973), stresses that the evaluation of scientific work should not be based on particularistic, scientifically irrelevant criteria.

Studies that have attempted to estimate the extent of gender-based discrimination in science have produced inconsistent results. Cole and Cole (1973) conclude that discrimination against women scientists is insignificant and that "the scientific stratification system is basically universalistic and rational" (pp. 151-152). Other studies, however, point to differences in the allocation of rewards to male and female scientists (Reskin 1978; Cole 1979; Simon, Clark, and Galway 1967; Zuckerman and Cole 1975; Perrucci 1970), regardless of the fact that female scientists show greater devotion to their careers than their male counterparts (as evidenced by the high proportion of women scientists who remain single—50%—as compared with only 10% among men) (Zuckerman and Cole 1975). It is also argued that male scientists are generally better paid than female scientists (Zuckerman and Cole 1975; Cole 1979).

Several studies have sought to estimate the portion of the gap between the average wage rates of male and female scientists that may be attributed to discrimination (for a review see Bognanno 1987). Most of these studies were conducted in academic settings, several of them at a single university (Loeb and Ferber 1973; Gordon, Morton, and Braden 1974; Hoffman 1976; Ferber 1974; Kats 1973), while others have used aggregated data (Astin and Bayer 1972; Johnson and Stafford 1974, 1975). Very few studies have been undertaken in nonacademic settings. Ferber and Kordick (1978) used a national sample of Ph.D.s and Malkiel and Malkiel (1973) have studied professional employees of a single corporation.[1] We thus lack an extensive study of wage discrimination among male and female nonacademic scientists at the firm level.

It has been suggested (Cain 1986; Halaby 1979) that a firm-level analysis of wage discrimination has the advantage of a better model specification (i.e., criteria for wage payments can be specified in the model) and of a better control of contextual variables such as industry or employer's policies. This argument is supported by previous studies of wage differentials in academic science.

The observed wage gap in studies of discrimination against women scientists ranges from 11 to 22%, and the unexplained gap (which serves as the estimator of wage discrimination) varies between 9 and 16%—depending on the type of study. Studies using firm-level analyses reveal lower unexplained gaps than do studies using aggregated data; those conducted in a single university report small unexplained gaps, ranging from 7 to 9%.

Although variations in salary are constrained by legal regulations and by employment practices, there is greater room for disparity in the allocation of employees to the hierarchical niches created by the organization, because managers have authority to determine the qualifications and demographic profiles required for these positions (Granovetter 1981; Baron 1984; Cohen and Pfeffer 1986).

Studies examining gender-based promotion discrimination in science have concentrated on academia and provided inconclusive results. Bayer and Astin (1975), using a national sample of scientists, and Ferber and Green (1982), using data from one university, found some weak evidence for this type of discrimination. However, we lack evidence regarding discrimination in hierarchical progression among nonacademic scientists. Hierarchical promotion, as opposed to professional promotion, is subject to

managerial discretion. Several researchers (e.g., Kanter 1977; Baron 1984) have argued that organizations offer different promotion opportunities for males and females; as Kanter (1977) maintains: "Women populate organizations, but they practically never run them" (p. 16).

The present study differs from earlier studies of discrimination in science in at least two ways. First, we concentrate on nonacademic scientists. It is unfortunate that the overwhelming majority of past studies have dealt with academic scientists while the great bulk of scientists in Western societies are not practicing academic science, but are employed in large R&D corporations and governmental laboratories. Those differ significantly from academic institutions in their working conditions and in the allocation of rewards. Second, we study discrimination against female scientists in one large-scale corporation rather than in the labor market as a whole. A firm-level analysis enables us to examine possible organizational rather than labor market determinants of differential allocation of privileges and rewards (Baron and Bielby 1980).

METHODS

Firm and Sample

All 1,722 scientists included in our study are employed by a large-scale R&D organization in Israel that operates several functional divisions located in the central part of the country, and specializes in advanced telecommunication technology and diagnostic systems. Of its scientists, 8% are women. The data used in the study were obtained from the firm's computerized personnel file.

The investigated firm is one of the largest R&D establishments in Israel. The country has approximately 330 R&D units at industrial plants and 24 government-sponsored R&D institutes.

Because the empirical study focuses on an Israeli scientific organization, it is unclear whether the results can be generalized to other countries. The scientific and technological community in Israel is similar to and different from those in the United States and Western Europe. Most Israeli scientific centers have established technological and scientific relationships with international companies including a pattern of regular visits and communication. Further, the occupational values held by Israeli researchers and those working in the United States and Western Europe are similar (Goldberg and Kats 1984). Nevertheless, considerable differences in size, mobility patterns, and economic structure may limit the applicability of the findings to other countries. Employment practices in the United States and in Israel are markedly different. In our research site, as is the case in Israel in general, all employees are unionized. Owing to collective labor contracts, only small salary differentials are found among workers who occupy the same hierarchical level. Employees are rewarded mainly by means of hierarchical promotion.

Two promotion systems for scientists operate in the investigated firm: a wage grade ladder and hierarchical promotion. The wage grade system, which comprises a number of grades, each associated with a corresponding salary level, is anchored in a labor contract. Promotion along this ladder is based on an internal peer evaluation procedure. A positive decision results in a salary increase. In addition to the wage grade system, the

firm operates a managerial career ladder, consisting of six hierarchical levels. Promotion along this ladder is based solely on managerial discretion and bureaucratic criteria and involves higher compensation and status symbols.

Whereas this study focuses on scientists, the analyses are replicated for a second group of 251 professional workers with academic credentials employed by the same organization (e.g., economists, lawyers, business administrators, social workers), 43% of whom are women. Although both promotion systems (the wage grades and the hierarchical progression) are available for the professional workers, the mechanism for advancement along the wage grades ladder for professionals differs from that for scientists. Whereas scientists are evaluated by their peers, the professionals' promotion depends solely on managerial decisions. We would thus expect to find greater promotion disparity between males and females among the professional group than among the scientists. Sex discrimination has indeed been found among professionals working in a single firm (Osterman 1979; Malkiel and Malkiel 1973).

The analyses involving scientists and professionals are provided for comparison purposes, because discrimination may stem from at least two sources.

1. The employment practices of the investigated corporation. In this case the level of discrimination should be similar for both occupational groups, assuming that their wages are similarly structured.
2. Occupational characteristics. In this case differences in discrimination between the two groups might emerge.

It is also possible that an interaction between corporational and occupational factors contributes to gender-based discrimination. Such an eventuality cannot be examined in our case, because only one organization was investigated.

Variables

Table 1 presents the variables used in this study and their descriptive statistics—for the whole sample and for male and female workers broken down by occupational group. Two dependent variables were examined: total monthly salary (TOTAL) and managerial promotion (PROMOTION). The organizational promotion variable reflects location in the organization's hierarchy. The variable ranges from 0 (no managerial position) to 5 (Division head).[2] Although the variable represents position on a certain hierarchy level, it may be safely used as a proxy for promotion because the organization under study hires virtually no outsiders to managerial positions.

Among the independent variables, the group of human capital variables includes age (as a proxy for labor market experience, see, Hartmann 1987; Roos 1981), age squared, tenure, and two dummy variables indicating Ph.D. and M.A. academic degrees—where the scientists with an undergraduate degree serve as the reference group. Another group of independent variables (included only in the wage equations) contains 4 dummy variables indicating 4 managerial levels—with scientists in nonmanagerial posts constituting the reference group. The third group of independent variables is composed of demographic attributes: gender—the focal variable of the present study, number of children, and marital status (see Treiman and Terrel 1975; Osterman 1979). The latter

Table 1
The Variables Used in the Study:
Definitions, Means, and Standard Deviations
(in Parentheses)—for the Whole Sample and by Gender

	Scientists			*Professional Workers*		
Variable	*Whole Sample*	*Men*	*Women*	*Whole Sample*	*Men*	*Women*
Dependent						
TOTAL[a]	1766.00	1794.00	1570.70	1644.30	1870.60	1347.30
	(572.80)	(576.60)	(479.30)	(539.70)	(534.30)	(380.40)
PROMOTION[b]	2.06	2.13	1.37	2.19	2.58	1.68
	(1.24)	(1.27)	(0.66)	(1.25)	(1.30)	(0.96)
Independent						
Human Capital						
AGE[c]	39.60	39.70	38.30	38.70	41.10	35.60
	(7.40)	(7.20)	(8.60)	(8.20)	(8.70)	(6.20)
AGESQ[d]	1621.80	1629.70	1543.80	1563.70	1761.20	1304.10
	(634.40)	(622.90)	(736.10)	(698.40)	(763.30)	(497.30)
TENURE[e]	10.30	10.40	8.90	8.30	8.90	7.60
	(6.90)	(6.80)	(7.20)	(5.90)	(6.50)	(4.90)
Education						
MA	0.25	0.25	0.30	0.18	0.20	0.14
	(0.43)	(0.43)	(0.46)	(0.38)	(0.40)	(0.35)
Ph.D.[g]	0.18	0.18	0.15	0.01	0.03	0.00
	(0.38)	(0.38)	(0.36)	(0.12)	(0.16)	—
Managerial Level						
L_1[h]	0.23	0.23	0.18	0.23	0.23	0.23
	(0.42)	(0.42)	(0.39)	(0.42)	(0.42)	(0.42)
L_2[i]	0.19	0.20	0.08	0.21	0.28	0.12
	(0.39)	(0.40)	(0.28)	(0.41)	(0.45)	(0.33)
L_3[j]	0.12	0.13	0.01	0.15	0.21	0.07
	(0.32)	(0.33)	(0.08)	(0.35)	(0.41)	(0.25)
L_4[k]	0.01	0.01	0.00	0.01	0.02	0.00
	(0.10)	(0.11)	—	(0.10)	(0.14)	—
Demographic						
HOURS[l]	99.80	99.90	99.00	99.60	99.60	99.60
	(2.80)	(2.30)	(5.50)	(4.30)	(4.80)	(3.40)
MARRIED[m]	0.91	0.92	0.78	0.86	0.88	0.83
	(0.28)	(0.26)	(0.42)	(0.35)	(0.32)	(0.38)
KIDS[n]	1.90	1.90	1.50	1.70	1.70	1.60
	(1.10)	(1.20)	(1.20)	(1.10)	(1.10)	(1.10)
GENDER[o]	0.91	—	—	0.57	—	—
	(0.29)	—	—	(0.50)	—	—
N	1722	1581	141	252	143	109

Definitions:
[a] Total Monthly Salary (in U.S. Dollars)
[b] A continuous variable coded as: 0 = nonmanager; 1 = first level manager; 5 = highest level manager
[c] Age (in years)
[d] Age squared
[e] Time in the agency (in years)
[f] A dummy coded as: 1 = an M.A. degree; 0 = otherwise
[g] A dummy coded as: 1 = a Ph.D. degree; 0 = otherwise
[h] A dummy coded as: 1 = a manager at lowest level; 0 = otherwise
[i] A dummy coded as: 1 = a manger at second level; 0 = otherwise
[j] A dummy coded as: 1 = a manager at third level; 0 = otherwise
[k] A dummy coded as: 1 = a manager at highest level; 0 = otherwise
[l] The portion of the position as a percent of a full-time one
[m] A dummy coded as: 1 = married; 0 = otherwise
[n] Number of children
[o] A dummy coded as: 1 = male; 0 = female

two variables are included because they serve as proxies for labor market attachment (Treiman and Hartmann 1981).

Analysis

OLS regressions were conducted for both groups of workers: scientists and professional workers. The discrimination level was estimated in two ways. First, using one regression equation for each occupational group—where the gender coefficient serves as the estimator of the discrimination level. Second, two separate regressions were conducted within each occupation—one for males and the other for females, with the observed gap between the two gender groups decomposed into "explained" and "unexplained" portions (Oaxaca 1973; Iams and Thornton 1975).

PROMOTION DISCRIMINATION

Table 1 shows that women are consistently less likely to occupy managerial positions than are men. Could this be a result of organizational discriminatory practices? Wolf and Fligstein (1979a,b) argue that although women's qualifications generally determine their authority level, a significant role is still played by "behaviors and policies of employers" who view women as less competent than men to supervise other workers. Employers' power reflected in such behaviors and policies may be viewed as gender-based promotion discrimination. The fact that the organization offers different promotion opportunities to different gender groups has also been observed by Kanter (1977). In our case it is of special interest to determine whether universalistic procedures do in fact characterize promotion processes among scientists.

Table 2
Regressions Results of PROMOTION
as Dependent Variable—Scientists*

			Regressions			
Variable	*Whole Sample*		*Men*		*Women*	
AGE	0.18	(5.03)	0.22	(5.32)	0.08	(1.30)
AGESQ	-0.002	(5.31)	-0.003	(5.56)	-0.001	(1.31)
TENURE	0.08	(13.30)	0.08	(12.8)	0.02	(1.82)
M.A.	0.21	(3.27)	0.22	(3.30)	-0.05	(0.39)
Ph.D.	0.38	(4.94)	0.37	(4.52)	0.13	(0.79)
HOURS	0.01	(0.74)	-0.01	(0.53)	0.02	(1.89)
MARRIED	0.18	(1.87)	0.13	(1.14)	0.30	(1.89)
KIDS	0.03	(1.00)	0.03	(1.05)	-0.04	(0.55)
LOCAL 1	-0.42	(4.19)	-0.42	(3.60)	-0.25	(1.71)
LOCAL 2	0.45	(3.86)	0.46	(3.78)	0.53	(1.15)
GENDER	0.47	(5.27)	—		—	
CONSTANT	-3.77		-2.74		-2.24	
N	1722		1581		141	
R^2	0.26		0.25		0.10	

Notes: *T values in parentheses. See Table 1 for definitions.

Table 3
Regressions Results of PROMOTION
as Dependent Variable—Professional Workers*

			Regressions			
Variable	*Whole Sample*		*Men*		*Women*	
AGE	0.18	(2.35)	0.23	(1.93)	0.12	(1.11)
AGESQ	-0.002	(1.98)	-0.002	(1.61)	-0.001	(0.87)
TENURE	0.01	(0.95)	0.003	(0.15)	0.03	(1.36)
M.A.	-0.02	(0.13)	-0.12	(0.50)	-0.09	(0.34)
Ph.D.	1.32	(2.15)	1.08	(1.52)	—	
HOURS	0.001	(0.07)	-0.01	(0.26)	0.03	(1.04)
MARRIED	-0.02	(1.22)	-0.01	(0.02)	0.65	(2.40)
KIDS	-0.002	(0.03)	0.15	(1.30)	-0.22	(2.15)
LOCAL 1	-0.97	(5.15)	-1.26	(4.80)	-0.61	(2.30)
LOCAL 2	-0.12	(0.40)	-0.23	(0.55)	0.07	(0.17)
GENDER	0.69	(4.94)	—		—	
CONSTANT	-2.66		-2.37		-4.04	
N	251		142		109	
R^2	0.27		0.23		0.16	

Notes: *T values in parentheses. See Table 1 for definitions.

In order to address this issue we used the promotion variable as a dependent variable in an OLS regression equation[3] including human capital and demographic variables and two additional dummy variables (Local 1, Local 2) representing the regional location of the organizational units—with the headquarters location serving as the omitted category.[4] Regional effects may be expected to be more salient for promotion than for salary, because each location has its own culture and standards, whereas salary practices are uniform across the corporation's units. Regional effects have previously been found to be related to promotion criteria (Halaby 1978). Different localities may also be used as indicators of unit size which has been found to be associated with promotion opportunities (Rosenbaum 1979; Baron 1984).

The results are presented in Table 2 (for scientists) and Table 3 (for professional workers). Gender was indeed found to be related to promotion.

WAGE DISCRIMINATION

Female scientists' average salary constitutes 88% of that of their male colleagues, with an observed gap of $223.30 between the two groups. Several differences between the male and female scientists may explain this salary gap. The men are, on average, older than the women, have worked longer with the organization and hold more (and higher) managerial positions (see Table 1). A higher propotion of male scientists are married (92% and 78% respectively). When these differences in characteristics are controlled for, it is found that only $36.80 (i.e., 16.5% of the observed gap) remain "unexplained" and can be attributed to discrimination (see Table 4). The gender coefficient, however, is *not*

Table 4
Regressions Results of TOTAL Monthly Salary as Dependent Variable—Scientists*

			Regressions			
Variable	*Whole Sample*		*Men*		*Women*	
AGE	90.80	(6.98)	64.30	(4.65)	25.10	(0.79)
AGESQ	-0.80	(5.56)	-0.55	(3.44)	-.07	(0.19)
TENURE	0.80	(0.29)	1.90	(0.65)	8.60	(1.02)
M.A.	-13.30	(.46)	-22.40	(0.72)	195.10	(2.56)
Ph.D.	6.60	(0.18)	11.70	(0.31)	248.40	(2.40)
L_1	190.50	(6.35)	188.30	(5.84)	213.50	(2.56)
L_2	252.20	(7.47)	282.20	(8.10)	155.20	(1.32)
L_3	546.50	(12.90)	598.10	(13.70)	104.60	(0.26)
L_4	830.40	(6.93)	839.90	(7.19)	0.00	
HOURS	15.10	(3.59)	17.40	(3.22)	11.40	(1.90)
MARRIED	89.20	(1.96)	66.70	(1.31)	66.30	(0.67)
KIDS	-14.70	(1.18)	-9.40	(0.72)	46.80	(1.17)
GENDER	36.80	(0.90)	—		—	
CONSTANT	-1333.50		-1856.60		-751.90	
N	1722		1581		141	
R^2	0.28		0.26		0.37	

Notes: *T values in parentheses. See Table 1 for definitions.

significantly different from zero. The decomposition method reveals an even lower estimated discrimination level—15.8 dollars, or 7% of the observed gap.

On examining the structure of the salary functions for male and female scientists, we find that men receive significant returns on their market experience (AGE), whereas women receive returns that do not differ significantly from 0 on this variable. Women, on the other hand, receive positive, significant returns on their education whereas men scientists do not.

Previous research indicates that the unexplained gap between men and women is reduced when either one organization or one occupational group is studied. In our case we have chosen to combine the two. Because female scientists were found in previous studies to suffer less from discrimination than females in other occupational groups, our results are not unexpected.

An interesting question emerges from our findings: Are the results affected by the single occupation analysis, by the specific occupation studied (scientists), or by the particular firm? In order to clarify this question, we compared our results with those obtained from another occupational group within the same organization. Table 5 presents the salary equation for the professional workers. The results indicate a significant discrimination against female professionals (b = 222.4; $p < .001$. When decomposing the gap, b = 209.8). This comparison suggests that the absence of wage discrimination among scientists is unique and can probably be attributed to their specific occupation rather than to the level of analysis.

Table 5
Regressions Results of TOTAL Monthly Salary as Dependent Variable—Professional Workers*

		Regressions	
Variable	*Whole Sample*	*Men*	*Women*
AGE	40.10 (1.41)	97.80 (2.43)	104.70 (1.96)
AGESQ	-0.15 (0.45)	-0.70 (1.54)	-1.30 (1.86)
TENURE	9.60 (2.04)	2.70 (0.46)	19.30 (2.50)
M.A.	191.60 (3.10)	260.30 (3.43)	82.60 (0.82)
Ph.D.	39.20 (0.19)	-173.30 (0.80)	0.00
L_1	70.00 (1.14)	92.10 (1.01)	52.90 (0.68)
L_2	179.90 (2.77)	178.50 (2.05)	221.30 (2.29)
L_3	403.20 (5.39)	405.90 (4.24)	418.90 (3.13)
HOURS	3.90 (0.68)	-3.70 (0.51)	1.10 (0.11)
MARRIED	217.40 (2.73)	273.90 (2.40)	171.50 (1.56)
KIDS	-20.40 (0.74)	42.90 (1.17)	14.50 (0.34)
GENDER	222.40 (4.23)	—	—
CONSTANT	-568.10	-936.10	-1144.70
N	251	142	109
R^2	0.57	0.57	0.33

Notes: *T values in parentheses. See Table 1 for definitions. There are no professional employees at level 4 (L_4).

From the analysis it is apparent that managerial positions are major determinants of salary level; male scientists occupying managerial positions receive high returns for being managers—returns that are significantly different from 0 for all 4 hierarchical levels (see Table 4). Female scientists are underrepresented in managerial posts and receive returns that are significantly different from zero only if they occupy the lowest supervisory position (L_1) Among the professional workers—males and females—levels 2 and 3 (L_2 and L_3) are significantly related to total salary (Table 5). Thus, a study of discrimination cannot overlook the fact that although female scientists are not discriminated against in terms of salary, they suffer from discrimination as far as the managerial promotion ladder is concerned (that is, gender has no direct effect on wages but a substantial indirect effect through hierarchical level).

SUMMARY AND CONCLUSIONS

Discrimination, which is considered to be incongruent with the norm of universalism in science, has not previously been studied in nonacademic corporations, where most scientists spend their careers. We used a firm-level analysis to determine whether universalistic criteria govern the allocation of rewards in nonacademic settings. We began by studying promotion discrimination against female scientists and found that gender played a part in promotion decisions. We then analyzed wage discrimination (controlling for managerial level) and found that gender did not determine the total salary level of scientists.[5] However, because discrimination affects the promotion process (and hence

wages), the conventional procedure of controlling for managerial level produces a downward biased estimated level of wage discrimination. We thus conclude that there is evidence of discrimination in organizational employment practices—and specifically in promotion to managerial positions—which in turn determines salary level.

This type of discrimination cannot be revealed by a "conventional" analysis of salary discrimination. As opposed to Hartmann's (1987) contention presented at the outset of this article, a major conclusion derived from our results is that internal labor markets, which are equipped with career ladders and promotion opportunities, may constitute a complex mechanism of gender-based discrimination. When wage discrimination against females working in such labor markets is not apparent, promotion procedures—the very nature of these markets—should be examined. We may find that one of the functions of internal labor markets is to preserve discrimination in environment where it is formally unacceptable.

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NOTES

1. The only description of the employees in their study is that "their work was considered technical and/or scientific" (Malkiel and Malkiel 1973, p. 695). They could be technicians or laboratory workers, not necessarily scientists.

2. There are six hierarchical levels in the corporation. Because the fourth level is only slightly lower than the fifth we combined the two in the wage analysis (L_3), and therefore ended up with four dummy variables (L_1 to L_4) where nonmanagers serve as the omitted category.

3. We considered the option of conducting a logistic regression on each of the dummy variables representing the organizational level, but decided against this on parsimonious grounds (such an analysis would have entailed more equations, a complicated interpretation and would have produced little benefit in terms of information).

4. Scientists are distributed among the geographic locations as follows: 88% in the main location, 7% in local 1 and 5% in local 2. Professional workers are distributed as follows: 80% in the main location, 15% in local 1 and 5% in local 2.

5. This finding can probably be attributed to the specific characteristics of the scientific occupation and its procedures of evaluation, because another group of professional employees in the same corporation does experience salary discrimination even when controlling for managerial level.

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