the estrogen glucuronides and sulfates were combined in the urinary measurements. The possibility that a change in conjugation might be the singular endocrine feature distinguishing women at risk for familial cancer is attractive, since it would suggest that the risk factor is linked not to the amount of estrogen secreted but to its metabolic fate, which is dependent on an enzymatic spectrum under genetic control. The conjugative control of the enterohepatic circulation of estrogens and the greater biological impact of the sulfates relative to the glucuronides (*14*) offer just two of the possible mechanisms by which conjugative changes can be expressed as risk factors for breast cancer. Examination of the urinary samples from our study for their estrogen sulfate content should reveal whether these conjugates are indeed higher in the women at high-risk for familial breast cancer.

A dominant theme of the participation of estrogens in the etiology of breast cancer has been the "estriol hypothesis," which postulates that estriol in contrast to estrone and estradiol is protective against breast cancer (*15-17*). Much recent biological and epidemiological evidence has cast serious doubt on this hypothesis (*18-20*), and our study has also failed to support it. The urinary and plasma estriol concentrations of the high-risk subjects are either higher or similar to those of controls, and the decrease in urinary estrone and estradiol gives them a greater estriol ratio or proportion rather than the lower values called for by the estriol hypothesis.

Our results describe a definitive endocrine difference that can be associated with increased risk for familial breast cancer. Whether the same abnormality is associated with risk for nonfamilial breast disease is an intriguing question, the answer to which would require a prospective study of formidable dimensions because of the need to sample urine throughout the menstrual cycle. In an effort to reduce such a potential study to more manageable proportions we have analyzed our estrogen data in terms of daily differences. This analysis has revealed that the significant differences in estradiol excretion are limited to the periovulatory and immediate postovulatory periods, while those of estrone excretion are even more limited to a 3-day postovulatory period. It seems that the differences found originate in the metabolism of the preovulatory secretory surge of estradiol and are reflected in the subsequent urinary excretion of the products. Careful monitoring of the menstrual cycle would permit the selection of single urine collections for the detection of urinary estrogen differences. The dependence of the urinary estrogen differences on the phase of the menstrual cycle emphasizes the absolute necessity for measuring the urinary hormones on specific days of the cycle in any further studies of this type.

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References and Notes

1. N. L. Petrakis, *Cancer* **39**, 2709 (1977).
2. D. E. Anderson, *ibid.* **34**, 1090 (1974).
3. B. E. Henderson, V. R. Gerkins, M. C. Pike, J. T. Cassagrande, in *Genetics of Human Cancer*, J. J. Mulvihill, R. W. Miller, J. F. Fraumeni, Jr., Eds. (Raven, New York, 1977), p. 291.
4. M. C. Pike, J. T. Cassagrande, J. B. Brown, V. Gerkins, B. E. Henderson, *J. Natl. Cancer Inst.* **59**, 1351 (1977).
5. B. E. Henderson *et al.*, *N. Engl. J. Med.* **293**, 790 (1975).
6. H. G. Kwa, F. Clefton, M. deJong-Bakker, R. D. Bulbrook, J. L. Hayward, D. Y. Wang, *Int. J. Cancer* **17**, 441 (1976).
7. B. MacMahon, P. Cole, J. Brown, *J. Natl. Cancer Inst.* **50**, 21 (1973).
8. P. Cole, J. B. Brown, B. MacMahon, *Lancet* **1976-II**, 596 (1976).
9. J. Fishman and H. L. Bradlow, *Clin. Pharmacol. Ther.* **22**, 721 (1977).
10. F. DeWaard, *Cancer Res.* **35**, 3351 (1975).
11. J. Fishman, D. K. Fukushima, J. O'Connor, R. S. Rosenfeld, H. T. Lynch, J. F. Lynch, H. Guirgis, K. Maloney, *ibid.* **38**, 4006 (1978).
12. B. Zumoff, J. Fishman, J. Cassouto, T. F. Gallagher, L. Hellman, *J. Clin. Endocrinol. Metab.* **28**, 937 (1968).
13. R. W. Morgan, D. V. Vakil, J. B. Brown, L. Ellinson, *J. Natl. Cancer Inst.* **60**, 965 (1978).
14. H. J. Ruder, L. Loriaux, M. B. Lipsett, *J. Clin. Invest.* **51**, 1020 (1972).
15. H. M. Lemon, *Cancer* **23**, 787 (1969).
16. P. Cole and B. MacMahon, *Lancet* **1969-I**, 604 (1969).
17. L. E. Dickinson, B. MacMahon, P. Cole, J. B. Brown, *N. Engl. J. Med.* **291**, 1211 (1974).
18. J. H. Clark, Z. Paszko, E. J. Peck, *Endocrinology* **100**, 91 (1977).
19. R. D. Bulbrook, M. C. Swain, D. Y. Wang, J. L. Hayward, S. Kumaoka, O. Takatani, O. Abe, J. Utsunomiya, *Eur. J. Cancer* **12**, 725 (1976).
20. B. Zumoff, J. Fishman, H. L. Bradlow, L. Hellman, *Cancer Res.* **35**, 3365 (1975).
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Racial Differences in Blood Pressure Control

Abstract. *Children from an entire biracial geographical population were examined for blood pressure. A sample of 278 children, stratified by diastolic blood pressure, was reexamined 1 to 2 years later. Dopamine β-hydroxylase, renin activity, and resting heart rate were observed in black and white children. In the group with high blood pressure, whites had higher heart rates and greater renin activity than blacks. Dopamine β-hydroxylase concentrations in blacks were lower than in whites over the entire spectrum of blood pressure levels. High blood pressure seems to have a different metabolic background in the two races which may influence the early natural history of essential hypertension. Therefore, the rationale of prevention, and possibly treatment, of early hypertension in blacks and whites may differ.*

It is well known that the mortality and prevalence of hypertension in the United States are higher in black persons than in whites (*1*). In young adult black patients with hypertension, a preponderance of low-renin hypertension has also been described (*2*). In adult subjects with no hypertension, the sodium excretion in response to a sodium load was found to be slower in blacks than in whites (*3*). The nature of these differences is not clear. In an attempt to distinguish genetic from environmental causes of hypertension we investigated school children in a biracial community at an early age, when complications of the disease are less likely to be established.

During the 1973–1974 school year 3524 children (ages 5 to 14 years, 63 percent white, 37 percent black) were examined in the Bogalusa Heart Study (*4*). Resting blood pressure, systolic and diastolic (fourth phase), was measured three times by each of three observers: two used a mercury sphygmomanometer and one an automatic blood pressure recorder. In a statistical analysis only three age groups of children were included, namely, those ages 6 to 7, 9 to 10, and 12 to 13. For each of these groups the four race-sex combinations were considered separately, resulting in 12 subgroups. For each subgroup, the rank of the median diastolic blood pressure values from each observer was assessed, and these three ranks were added for each child. The sum score formed the basis for a stratified random sampling, sex- and race-specific, with weighting of the extreme pressures. This sample of 368 children was reexamined in 1975 and 1976 in more detail, grouped into five strata labeled 1 (low blood pressure) to 5 (high blood pressure). The sample represented all children in the extreme 2 percent for strata 1 and 5, and a 70 percent random

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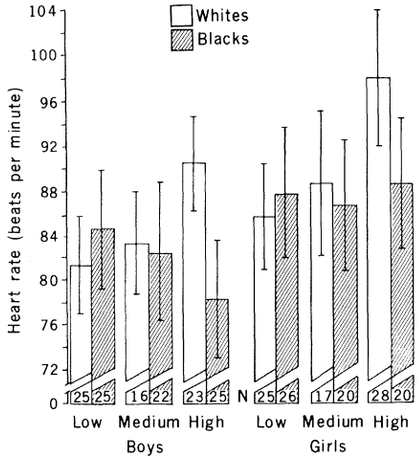

Fig. 1. Resting heart rate [mean ± 2 standard error (S.E.)] by race, sex, and blood pressure stratum. Ages range from 7 to 15 years, including one child of 16 years. In whites the heart rate is increased in the high blood pressure strata. This is not the case for blacks.

sampling fraction of all children in the next 4 to 9 percent for strata 2 and 4; stratum 3 consisted of a 3 to 8 percent random sampling fraction of the remaining children. At the time of the reexamination, 314 children still lived in the community: 53 had moved and 1 had died; in addition, 32 refused to participate and 4 were unavailable. Thus, 278 (76 percent) of those selected but 89 percent of those available were reexamined. Within each blood pressure stratum the distributions of age, race, and sex of the selected children were approximately equal.

Urine was collected during two 24-hour periods immediately preceding a physical examination and venipuncture. Direct contact with parents and teachers, oral and written instructions, provision of nonobtrusive collection equipment, mailed reminders, and home and school visits were all part of an elaborate program with a rigid protocol. Feedback to the children about the quantity of urine collected in the first 24-hour period sometimes resulted in improved yields during the second 24-hour period. Urine was examined for creatinine by a modification of the Folin-Wu method (*5*), and for sodium by an IL 343 flame photometer (Instrumentation Laboratory, Inc.).

On the morning of the examination the children reported at 8:00 a.m. after fasting overnight. They were kept standing for the next 1 to $1^1/_2$ hours.

Venipuncture took place between 9:00 and 9:30 a.m.; blood plasma was examined for renin activity by the method of Sealey and Laragh (*6*) as modified by McDonald and Fischer (*7*), and serum for dopamine β-hydroxylase (DβH) by the method of Nagatsu and Udenfriend (*8*). Replicate blood and urine samples labeled with fictitious local names were collected daily from half the children for intralaboratory reliability assessment.

Children with potential secondary hypertension were excluded by a physical examination and urinalysis of a fresh, clean-catch urine sample (*9*) (six children). The blood pressure methodology and the overall blind, randomized study design, as well as observer training and pilot study methodology have been described earlier (*4*). Repeat, basal-like, first- and fourth-phase pressures were taken with a mercury sphygmomanometer (Baumanometer) and with the Physiometrics automatic blood pressure recorder. The heart rate of each child in a supine, resting position was recorded by a limb electrocardiogram.

Urine samples taken during the second 24-hour period were used in this analysis unless the creatinine excreted was less than 10 mg per kilogram of body weight in boys or 8 mg per kilogram of body weight in girls. In the latter case, urine collected during the first 24-hour period was used. If neither period complied with these specifications, the child was deleted from urinary data analysis. Thus, 249 children qualified for inclusion in the urine data set.

Nutritionists obtained information about the dietary sodium intake from 185 children constituting a 50 percent random sample of all 10-year-olds in the Bogalusa Heart Study by using an improved, 24-hour recall method administered during the 1973–1974 school year (*10, 11*).

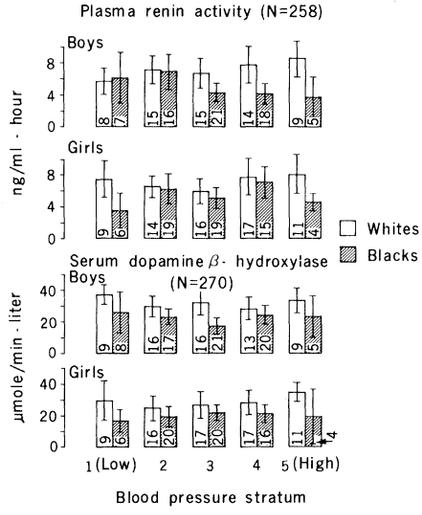

Fig. 2. Plasma renin activity and serum dopamine β-hydroxylase (mean ± 2 S.E.) by race, sex, and blood pressure stratum in children ages 7 to 15 years. Observations for 14 children were excluded from the renin data, and for two children from the DβH data. Mean renin activity is less in blacks than in whites in the medium and especially in the combined high blood pressure stratum. Mean DβH levels are consistently lower in blacks.

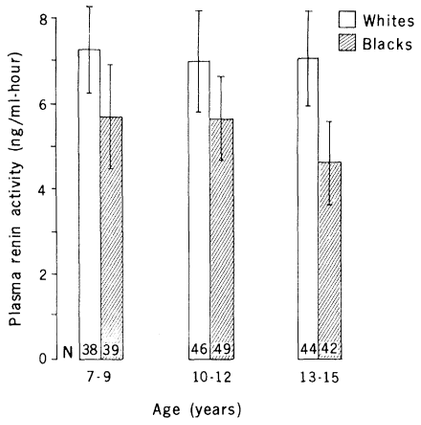

Fig. 3. Plasma renin activity (mean ± 2 S.E.) by age and by race. Fourteen of 272 observations were excluded because of missing data. The group of 13- to 15-year-old children included one 16-year-old. Blacks had significantly lower renin values than whites ($P < .0001$). For children of an older age the difference between blacks and whites is larger, although renin activity was not significantly different in comparisons of the various age groups ($P > .05$ by two-way analysis of variance).

In the statistical analyses, data from boys and girls were combined when analyses of the separate sexes showed similar results. In some presentations, strata 1 and 2 were combined to form the "low" stratum and strata 4 and 5 to form the "high" stratum. Because of the age-, race-, and sex-specific stratified sampling procedure, the blood pressure strata were similar with respect to age, race, and sex. A three-factor analysis of variance model for unequal size samples was used to test for race, sex, or blood pressure stratum effects. If statistically significant three-factor or two-factor interactions existed, then only simple effects were examined for those variables; otherwise, main effects were tested (*12*).

Laboratory samples were analyzed by using blind duplicate retrieval and manipulation. Error coefficients of variation were 20 percent for plasma renin, 18 percent for serum DβH, 4.6 percent for urine sodium, and 7 to 13 percent for urine creatinine. These results show customary and acceptable intralaboratory reliability.

Mean blood pressures on the mercury sphygmomanometer are given by race and blood pressure stratum in Table 1. There was a clear difference in reexamined blood pressures among the five blood pressure strata, the high blood pressure strata maintaining the higher values. Racial differences were noted

particularly in the upper blood pressure stratum (*4*).

Resting heart rates are given for each race and sex by blood pressure stratum in Fig. 1. There is a marked positive increase in resting heart rate over the blood pressure strata for whites, but this was not noted for blacks (race versus blood pressure stratum interaction, $P < .0005$). These results are compatible with the conclusion that in white children resting heart rates are elevated in the high blood pressure stratum, but not in black children.

The population showed a mean urinary sodium excretion of 105 mEq or 2.42 g per 24 hours, assuming complete urine collection. The reported mean sodium intake of 185 10-year-old Bogalusa children 1 to 2 years earlier assessed by a 24-hour recall was 3.33 g of sodium per 24 hours (*11*). Hence the amounts of reported sodium intake were slightly higher than the observed amount of excretion, thus providing some measure of internal consistency among our studies. No significant differences in the amount of sodium excreted between the races were noted in the various blood pressure strata nor were there differences among blood pressure strata after correction for area of body surface.

The plasma renin activity and DβH are given by race, sex, and blood pressure stratum in Fig. 2. Plasma renin activity over blood pressure strata differed between whites and blacks (race versus blood pressure stratum interaction, $P < .05$). In whites there was an increase in plasma renin activity over blood pressure stratum, but in blacks a decrease was noted, so that in the high blood pressure stratum blacks had markedly less renin activity than whites. Similarly, renin activity decreases slightly in blacks as age increases to older age groups (Fig. 3).

Mean serum DβH concentrations (Fig. 2) were consistently lower in blacks ($P < .0001$). No sex differences were noted, nor differences in DβH levels when blood pressure strata were compared. Dopamine β-hydroxylase levels increased with age ($P < .005$).

Dopamine β-hydroxylase levels were plotted against renin levels for each race and blood pressure stratum (Fig. 4). In the high blood pressure strata a marked racial difference was noted with the absence of high-renin–high-DβH children among blacks, indicating a relationship opposite to that in white children.

Paffenbarger *et al.* (*13*), Kahn *et al.* (*14*), and Frohlich *et al.* (*15*) have found that high heart rate (pulse rate) is predictive of high blood pressure. Apparently, this may be true for white children primarily. According to Julius and Conway (*16*), elevated recumbent heart rate in borderline hypertensive patients is associated with elevated cardiac output. Our data do not permit us to test this hypothesis.

Brunner *et al.* (*2*) found that low-renin hypertension predominates in adult black hypertensive patients, although their study dealt with small samples of patients. Our data seem to agree with this observation for the age group 7 to 15 years in children in the high blood pressure strata. We found a positive correla-

Table 1. Blood pressure (mm-Hg, mean ± 2 standard error of the mean) on reexamination by mercury sphygmomanometer, by race and blood pressure stratum in children, ages 7 to 15 years—the Bogalusa Heart Study, 1975 to 1976 ($N = 272$). Sample size is given in parentheses; six children with possible secondary hypertension were not included in this population of 272.

Race	Blood pressure stratum				
	1 (low)	2	3	4	5 (high)
			Systolic		
White	95.0 ± 4.5 (18)	98.4 ± 3.5 (32)	102.4 ± 3.6 (33)	109.6 ± 3.4 (31)	112.1 ± 2.7 (20)
Black	98.0 ± 5.5 (14)	98.3 ± 3.8 (37)	104.4 ± 3.1 (42)	110.4 ± 4.3 (36)	119.6 ± 6.7 (9)
			Diastolic (fourth phase)		
White	49.9 ± 4.7 (18)	53.1 ± 3.1 (32)	59.6 ± 2.8 (33)	67.2 ± 2.2 (31)	69.5 ± 3.6 (20)
Black	51.4 ± 5.0 (14)	57.3 ± 2.8 (37)	60.5 ± 2.4 (42)	66.8 ± 3.0 (36)	68.9 ± 9.4 (9)

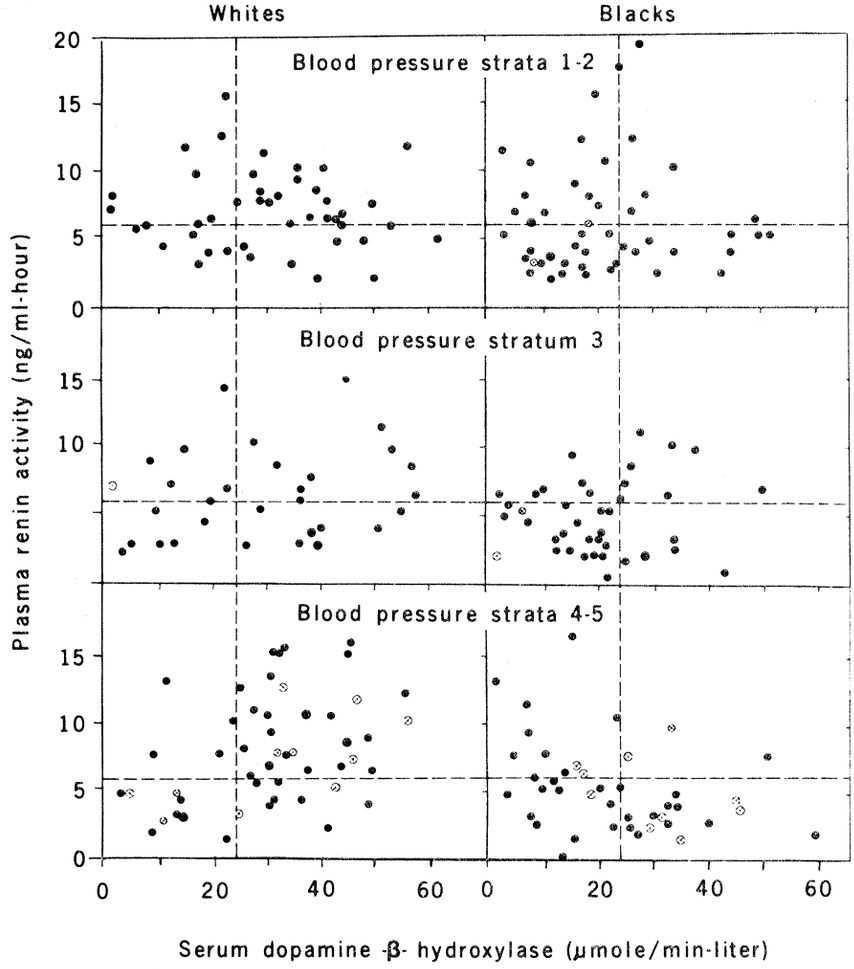

Fig. 4. Scattergrams of plasma renin activity by serum dopamine β-hydroxylase and by race and by blood pressure stratum. Median combined values for the children (ages 7 to 15) are represented by dashed lines. Seventeen of 272 observations were excluded because of missing data. The preponderance of children with combined high renin and high DβH, expected in the high blood pressure strata, is lacking among the blacks. Children whose diastolic mercury sphygmomanometer pressure (fourth phase) as measured during reexamination was in the upper tenth of his (her) age and race group are marked by open circles. They conform to the above conclusion.

tion between 24-hour urinary sodium excretion and blood pressure as measured the same day in black children in the high blood pressure strata (*17*). Gleibermann (*18*) surveyed literature on the relationship between sodium intake and blood pressure in black communities and found a positive association in a composite scattergram. Helmer (*19*) and Gleibermann (*18*) have proposed an adaptive survival advantage for the genetic trait that would have conserved body sodium in blacks by preventing hyponatremic collapse. Sodium losses could have occurred through perspiration and laboring in the heat on a low-sodium diet. The possibility of an increased sodium sensitivity in the upper percentiles of blood pressure for black children deserves consideration in any effort to prevent hypertension.

Horwitz *et al.* (*20*) reported lower DβH levels in blacks than in whites among 90 normotensive and 70 hypertensive adult subjects, the largest difference occurring among hypertensive subjects. The absence of high-renin–high-DβH values (*21*) among the black children in the high blood pressure strata of our study clearly points to a racial difference in the hormonal makeup of the candidates for essential hypertension. Sympathomimetic influences on blood pressure and heart rate may be greater in whites and play a greater role in mediating early hypertension.

The present studies are being conducted on asymptomatic children leading normal lives where criteria for hypertension are indefinite. Although the data reported here pertain to children whose selection was based on their blood pressure level at one particular time, an increasing body of statistical evidence now suggests that the children in the high strata tend to remain there throughout childhood and perhaps into adulthood.

In view of our findings, which suggest racial differences in sympathomimetic and hormonal influences on blood pressure levels, approaches to prevention and possibly treatment of early essential hypertension in the two races may differ.

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References and Notes

1. T. Gordon and B. Divine, *Vital and Health Statistics* (Government Printing Office, Washington, D.C., 1966), series 11, No. 13, p. 7; C. J. MacLean, M. S. Adams, W. C. Leyshon, P. L. Workman, T. E. Reed, H. Gershowitz, L. R. Weitkamp, *Am. J. Hum. Genet.* **26**, 614 (1974).
2. H. R. Brunner, J. E. Sealey, J. H. Laragh, *Circ. Res.* **33** (Suppl. 1), 99 (1973).
3. F. C. Luft, C. E. Grim, J. T. Higgins, M. H. Weinberger, *J. Lab. Clin. Med.* **90**, 555 (1977).
4. A. W. Voors, T. A. Foster, R. R. Frerichs, L. S. Webber, G. S. Berenson, *Circulation* **54**, 319 (1976).
5. S. Natelson, *Techniques of Clinical Chemistry* (Thomas, Springfield, Ill., 1971), p. 286.
6. J. E. Sealey and J. H. Laragh, in *Hypertension Manual: Mechanisms, Methods, Management*, J. H. Laragh, Ed. (Dun-Donnelley, New York, 1973), pp. 87–108.
7. J. M. McDonald and G. A. Fischer, *Am. J. Clin. Pathol.* **59**, 858 (1973).
8. R. A. Stone, J. C. Gunnels, R. R. Robinson, S. M. Shanberg, N. Kirshner, *Circ. Res.* **35** (Suppl. 1), 47 (1974).
9. C. M. Kunin, *Detection, Prevention and Management of Urinary Tract Infections* (Lea and Febinger, Philadelphia, 1972), pp. 27–33.
10. G. C. Frank, G. S. Berenson, P. E. Schilling, M. C. Moore, *J. Am. Diet. Assoc.* **71**, 26 (1977).
11. G. C. Frank, G. S. Berenson, L. S. Webber, *Am. J. Clin. Nutr.* **31**, 328 (1978).
12. G. W. Snedecor and W. O. Cochran, *Statistical Methods* (Iowa State Univ. Press, Ames, 1967), pp. 349–352.
13. R. S. Paffenbarger, M. C. Thorne, A. L. Wing, *Am. J. Epidemiol.* **88**, 25 (1968).
14. H. A. Kahn, J. H. Medalie, H. N. Neufeld, E. Riss, U. Goldbourt, *Am. Heart J.* **84**, 171 (1972).
15. E. D. Frohlich, R. C. Tarazi, H. P. Dustan, *Am. J. Med. Sci.* **257**, 9 (1969).
16. S. Julius and J. Conway, *Circulation* **38**, 282 (1968).
17. G. S. Berenson, A. W. Voors, E. R. Dalferes, Jr., L. S. Webber, S. E. Shuler, *J. Lab. Clin. Med.* **93**, 535 (1979).
18. L. Gleibermann, *Ecol. Food Nutr.* **2**, 143 (1973).
19. O. M. Helmer, in *Colloque Internationale, Les Concepts de Claude Bernard sur le Milieu Intérieur* (Masson, Paris, 1965), p. 115.
20. D. Horwitz, R. W. ALexander, W. Lowenberg, H. R. Keiser, *Circ. Res.* **32**, 594 (1973).
21. N. Winer, D. S. Choksi, M. S. Yoon, A. D. Freedman, *J. Clin. Endocrinol.* **29**, 1168 (1969); R. Davies and J. D. H. Slater, *Lancet* **1976-II**, 594 (1976).
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Lung Maturation in the Fetal Rat: Acceleration by Injection of Fibroblast-Pneumonocyte Factor

Abstract. *Fibroblast-pneumonocyte factor, produced by the fetal lung fibroblast in response to glucocorticoids, was partially purified by column chromatography on Sephadex G-75. The resulting preparation showed two major and two minor bands on sodium dodecylsulfate–polyacrylamide gel electrophoresis. When fetal rats were injected on day 17 of gestation with 1 microgram of this material, they showed on day 20 biochemical evidence of accelerated lung maturation as compared to littermate controls. There were no differences between the two groups in body weights, organ weights, or circulating corticosteroid levels.*

Preparation of the fetal lung for breathing air depends upon synthesis and secretion of the pulmonary surfactant, which lowers alveolar surface tension with the onset of gaseous ventilation and stabilizes the terminal respiratory units. Surfactant, a complex lipoprotein, is produced by the alveolar type II pneumonocyte whose function is physiologically regulated by glucocorticoid hormones (*1*); it can be precociously induced by administration of exogenous glucocorticoids (*2*).

We have recently shown (*3*) that, although alveolar type II pneumonocytes can be stimulated to produce surfactant by glucocorticoids in mixed primary cell cultures (which contain endothelial, mesenchymal, and epithelial elements), pure cultures of human fetal alveolar type II pneumonocytes show only a minimal response (*4*). This observation ap-

Table 1. Effect of fibroblast-pneumonocyte factor on fetal pulmonary phospholipid profile. Control and experimental left fetal lungs were pooled within each litter ($N = 9$). The extracted phospholipids were separated by two-dimensional thin-layer chromatography (*9*) and quantitated by phosphorus assay (*6*). Results are expressed as the percentage of total phospholipids ± standard deviation.

Phospholipid	Control	Experimental
Phosphatidylcholine	42.6 ± 2.3	49.2 ± 2.5*
Disaturated phosphatidylcholine†	(25.7 ± 1.6)	(40.9 ± 2.9)*
Phosphatidylglycerol	0.5 ± 0.2	1.1 ± 0.2*
Lysophosphatidylcholine	5.7 ± 0.2	5.4 ± 0.2
Lyso-*bis*-phosphatidic acid	7.8 ± 1.4	7.4 ± 2.0
Phosphatidylinositol	5.8 ± 0.8	6.4 ± 1.2
Phosphatidylethanolamine	20.1 ± 3.1	18.9 ± 2.6
Phosphatidylserine	8.0 ± 1.9	5.3 ± 1.5
Total	90.5 ± 1.9	93.7 ± 2.8

*$P < .001$ †Percentage of phosphatidylcholine fraction found to be disaturated, as determined by the osmium tetroxide technique (*6*).

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