

TABLE 1

ELECTROMIGRATION OF RARE EARTH ELEMENTS ON CONTINUOUS ELECTROPHORESIS IN A CHAMBER FILLED WITH QUARTZ POWDER

(V. P. SHVEDOV AND A. V. STEPANOV, *Radiochemistry*, 1 (1960) 65)

Electrolyte: 0.6 % citric acid.

pH value	Ionic mobility μ ($\text{cm}^2/\text{V. sec.} \times 10^5$)				
	La	Ce	Y	Pm	Eu
1.95		21.5	18.9		18.9
2.2	20.6	19.4	15.9		12.3
2.4	16.2	15.0	12.3	10.6	9.3
2.6	14.1	11.5	7.9	7.9	7.4
2.8	11.5	8.8	5.8	4.7	4.0
3.1	6.8	4.4	0.0	-0.4	-1.2
3.3		-1.6	-7.4	-6.8	-7.4
3.5	-5.6	-6.8	-9.7	-8.8	-9.7
3.8	-10.6	-10.6	-11.5	-11.5	-11.5

Electrolyte: citric acid at pH 2.6, but of varying concentration.

Citric acid concentration	Ionic mobility μ ($\text{cm}^2/\text{V. sec.} \times 10^5$)				
	La	Ce	Y	Pm	Eu
0.1	17.2	16.7	14.1		
0.3	16.7	14.1	11.5		
0.6	14.1	11.5	7.9	7.9	7.4
1.0		8.4	5.3	5.3	3.8

TABLE 2

 R_F VALUES OF ALKYLCHLOROSTANNATES(J. FRANC, M. WURST AND V. MOUDRY, *Collection Czechoslov. Chem. Commun.*, 26 (1961) 1313)

Solvent: Ethanol-acetic acid-water (100:5:70).

Paper: Whatman No. 2.

Impregnation: Liquid paraffin (30 % in petrol ether; b.p. fraction 190-275°).

Temperature of run: $21^\circ \pm 1^\circ$.

Time of run: 16 - 18 h.

Detection: 0.25 % ethanolic dithizone or 0.2 % Catechol Violet solution.

Compound	R_F	Compound	R_F
SnCl ₄	0.74	iso(C ₄ H ₉) ₂ SnCl ₂	0.53
(C ₂ H ₅) ₂ SnCl ₃	0.84	(C ₅ H ₁₁) ₂ SnCl ₂	0.45
(C ₂ H ₅) ₂ SnCl ₂	0.88	(C ₅ H ₁₁) ₄ Sn	0.19
(C ₂ H ₅) ₃ SnCl	0.91	iso(C ₅ H ₁₁)SnCl ₃	0.60
(C ₂ H ₅) ₄ Sn	0.95	iso(C ₅ H ₁₁) ₂ SnCl ₂	0.43
(C ₃ H ₇) ₂ SnCl ₂	—	iso(C ₅ H ₁₁) ₃ SnCl	0.30
(C ₃ H ₇) ₄ Sn	0.57	iso(C ₅ H ₁₁) ₄ Sn	0.17
iso(C ₃ H ₇) ₂ SnCl ₂	0.69	(C ₈ H ₁₇) ₂ SnCl ₃	0.45
(C ₄ H ₉) ₂ SnCl ₃	0.66	(C ₈ H ₁₇) ₃ SnCl	0.12
(C ₄ H ₉) ₂ SnCl ₂	0.55	(C ₈ H ₁₇) ₄ Sn	0.05
(C ₄ H ₉) ₃ SnCl	0.43		
(C ₄ H ₉) ₄ Sn	0.35		

TABLE 3

DISTRIBUTION COEFFICIENTS BETWEEN THE ANION-EXCHANGE RESIN DOWEX-1 X 8, 100 - 200 MESH, AND NITRIC ACID
 (F. ICHIKAWA, S. URUNO AND H. IMAI, *Bull. Chem. Soc. Japan*, 34 (1961) 954)

Li		Be		B		C		N		O	
Na		Mg		Al		Si		P		S	
K		Ca		Ga(III)		Ge(IV)		As		Se	
Rb		Sr		Y		Zn		In(III)		Te	
Cs		Ba		Lantha- nide		Cu		Cd		Hg(II)	
Fr		Ra		Actinide		Ni		Pd(II)		Pt(IV) (IV)	
La		Ce(III)		Pr		Co		Rh		Ir(IV)	
Ac		Th(IV)		Pa(IV)		Mn(IV)		Ru		Os(III)	
						Cr(III)		Fe(III)		Re(VII)	
						V		Tc(VII)		W	
						Ti		Nb(V)		Ta	
						Sc		Zr*		Hf	
						no ads.		Mo(VI)		Os(VIII)	
						log K_d		Cr(VI)		Pt(IV)	
						2		Mn(VII)		Au(III)	
						1		Ru(VIII)		Bi	
						0		Rh(VIII)		Pb(II)	
						-1		Ir(VII)		Sb(V)	
						1 10M		Os(VIII)		Sn(IV)	
						HNO ₃		Pt(VI)		Te	

* L. R. BUNNEY, N. E. BALLOU, S. PASCUAL AND S. FOIT, *Anal. Chem.*, 31 (1959) 324.
 ** F. NELSON AND K. A. KRAUS, *J. Am. Chem. Soc.*, 76 (1954) 5916.
 *** H. UMEZAWA, *J. At. Energy Soc. Japan*, 2 (1960) 478.

TABLE 4

R_F VALUES OF SOME FATTY ACIDS, ACRYLIC ACIDS AND IODOPHLORETIC ACIDS(H. J. CAHNMANN AND T. MATSUURA, *J. Am. Chem. Soc.*, 82 (1960) 2050)Solvents: S₁ = Ethanol-water-15 N NH₄OH (40:5:1).S₂ = Propan-1-ol-water-15 N NH₄OH (40:5:1).(L. C. MITCHELL, *J. Assoc. Offic. Agr. Chem.*, 37 (1954) 1021; 38 (1955) 832).

Paper: Whatman 3 MM (ascending).

Detection: D₁ = Aqueous bromophenol blue containing citric acid (E. P. KENNEDY AND H. A. BARKER, *Anal. Chem.*, 23 (1951) 1033) for aliphatic acids.D₂ = Diazotised N¹,N¹-diethylsulphanilamide (T. MATSUURA AND H. J. CAHNMANN, *J. Am. Chem. Soc.*, 81 (1959) 871).

Acid	<i>R_F</i>	
	S ₁	S ₂
Acetic	0.38	0.22
Propionic	0.45	0.30
Acrylic	0.43	0.28
Hydracrylic	0.29	0.16
Dihydracrylic	0.12	0.06
Phloretic	0.42	0.31
3-Iodophloretic		
3,5-Diodophloretic		

TABLE 5

ELECTROPHORETIC MOBILITIES OF SOME AMINES

(K. BLAU, *Biochem. J.*, 80 (1961) 193)

Electrolyte: 0.04 M sodium barbiturate adjusted to pH 8.0.

Paper: Whatman No. 1.

Potential applied: 20 V/cm.

Time of run: 1 h.

Zero marker: N-2,4-dinitrophenyl-ethanolamine.

Units: M (cm moved).

Detection: D₁ = Iodine vapour.D₂ = Folin's reagent.D₃ = Ninhydrin-Cu (NO₃)₂ reagent.D₄ = Alkaline ferricyanide-nitroprusside.D₅ = Ehrlich's reagent.D₆ = Isatin.D₇ = U.V. light (fluorescence).D₈ = Diazotised *p*-anisidine-sulphanilamide.D₉ = Alkaline picric acid.D₁₀ = Nessler's reagent.D₁₁ = Sakaguchi reagent.D₁₂ = Potassium iodoplatinate reagent.

(Paper air dried before application of detection reagents.)

Compound	M	Compound	M
Adrenaline	3.5	Glucosamine	2.5
<i>n</i> -Amylamine	7.0	Histamine	6.2
Isoamylamine	6.8	Hydroxylamine	1.4
Arginine	5.1	5-Hydroxytryptamine	3.1
<i>n</i> -Butylamine	7.2	3-Hydroxytyramine	4.3
Creatinine	0.7	Methylamine	13.4
1,4-Diaminobutane	10.2	Nicotine	3.6
1,5-Diaminopentane	10.4	Noradrenaline	3.5
Diethanolamine	6.1	Phenethylamine	5.9
Diethylamine	7.9	Piperidine	6.6
Dimethylamine	11.7	<i>n</i> -Propylamine	8.1
Ethanolamine	8.5	Pyrrolidine	9.4
Ethylamine	11.4	Tryptamine	4.7
		Tyramine	5.2

TABLE 6

 R_F VALUES OF AMINO ACIDS AND PEPTIDES(C. MILSTEIN AND F. SANGER, *Biochem. J.*, 79 (1961) 456)Solvent: Butan-1-ol-acetic acid-water-pyridine (30:6:24:20; by vol.), (S. G. WALEY AND J. WATSON, *Biochem. J.*, 55 (1953) 328).

Paper: Whatman No. 52.

Time of run: 48 h.

Detection: Ninhydrin.

Compound	R_F	Compound	R_F
Arginine	0.13	Leu.Ser P	0.18
Histidine	0.13	Gly.Ser P	0.03
Glutamic acid	0.14	Ser P.Gly	0.04
Aspartic acid	0.09	Ser P.Ala	0.07
Proline	0.25	Ala.Ser P	0.06
Glycine	0.12	Glu.Ser P	0.05
Alanine	0.19	Thr.Ser P	0.05
Valine	0.36	Ser P.His	0.04
Leucine	0.55	Leu.Gly.Gly	0.40
Threonine	0.23	Gly.Gly.Gly	0.09
Serine	0.12	Ala.Ser.Thr*	0.08
Serine phosphate	0.03	His.Ser.Asp*	0.03

* Tentative identification.

TABLE 7

 R_F VALUES (RELATIVE) OF PARTIAL HYDROLYSIS PRODUCTS OF 6-O- α -ISOMALTOTRIOSYLSORBITOL
(R. W. BAILEY, D. H. HUTSON AND H. WEIGEL, *Biochem. J.*, 80 (1961) 514)Solvent: Ethyl acetate-water-pyridine (2:2:1 by vol., upper layer; M. A. JERMYN AND F. A. ISHERWOOD, *Biochem. J.*, 44 (1949) 402).

Paper: Not specified.

Detection: D_1 = $AgNO_3$ /acetone-ethanolic NaOH (W. E. TREVELYAN, D. P. PROCTER AND J. S. HARRISON, *Nature*, 166 (1950) 444). D_2 = Aniline hydrogen phthalate (S. M. PARTRIDGE, *Nature*, 164 (1949) 443). D_3 = *p*-Anisidine-HCl (L. HOUGH, J. K. N. JONES AND W. H. WADMAN, *J. Chem. Soc.*, (1950) 1702). D_4 = Aniline-diphenylamine-phosphoric acid (S. SCHWIMMER AND A. BEVENUE, *Science*, 123 (1956) 543). D_5 = Triphenyltetrazolium chloride (D. S. FEINGOLD, G. AVIGAD AND S. HESTRIN, *Biochem. J.*, 64 (1956) 351).

Compound*	R_F
6-O- α -Isomaltotriosylsorbitol	0.32
6-O- α -Isomaltosylsorbitol	0.45
$\begin{array}{c} \text{G-Gr} \quad \text{G-Gr} \quad \text{G-S} \\ \quad \quad \quad \text{and} \quad \\ \text{G} \quad \quad \text{G} \quad \quad \text{G} \end{array}$	0.55
Isomaltose and 6-O- α -D-glucopyranosylsorbitol	0.75
Nigerose	0.85
Glucose and sorbitol	1.00

* Gr = reducing glucose unit; G = glucosyl unit; S = sorbitol; — = α -1:6-link; | = α -1:3-link.

TABLE 8

ELECTROPHORETIC MOBILITIES OF PARTIAL HYDROLYSIS PRODUCTS OF 6-O- α -ISOMALTOTRIOSYL-SORBITOL(R. W. BAILEY, D. H. HUTSON AND H. WEIGEL, *Biochem. J.*, 80 (1961) 514)Electrolyte: pH 5.5 molybdate solution (E. J. BOURNE, D. H. HUTSON AND H. WEIGEL, *Chem. & Ind. (London)*, (1959) 1047).Paper: See E. J. BOURNE, D. H. HUTSON AND H. WEIGEL, *Chem. & Ind. (London)*, (1959) 1047.

Potential: 50 V/cm (approx.).

Migration: M_S (units relative to sorbitol).

Detection: See Table 7.

Compound*	M_S
6-O- α -Isomaltotriosylsorbitol	0.50
6-O- α -Isomaltosylsorbitol	0.60
$\begin{array}{c} \text{G-Gr} \\ \\ \text{G} \end{array} + \begin{array}{c} \text{G-Gr} \\ \\ \text{G} \end{array}$	0.00
$\begin{array}{c} \text{G-S} \\ \\ \text{G} \\ \\ \text{G-S} \\ \\ \text{G} \end{array}$	0.60
$\begin{array}{c} \text{G-S} \\ \\ \text{G} \end{array}$	0.00
Isomaltose	0.00
6-O- α -D-Glucopyranosylsorbitol	0.75
Nigerose	0.00
Glucose	0.00
Sorbitol	1.00

* Gr = reducing glucose unit; G = glucosyl unit; S = sorbitol; — = α -1:6-link; | = α -1:3-link.

TABLE 9

 R_F VALUES OF PRODUCTS OF 2-AMINO-2-DEOXY-D-GLUCOSE HYDROCHLORIDE WITH AMMONIA
(M. I. TAHA, *J. Chem. Soc.*, (1961) 2468)

Solvent: Ethyl acetate-acetic acid-water (9:2:2, v/v).

Paper: Whatman No. 1 (descending).

Detection: $D_1 = 4\%$ aq. AgNO_3 with excess ammonia (S. M. PARTRIDGE, *Biochem. J.*, 42 (1948) 238). $D_2 = 0.1\%$ ninhydrin in butan-1-ol.

Compound	R_F
2-Methyl-6-D-arabo-tetrahydroxybutyl-pyrazine	0.705
2-Methyl-5-D-arabo-tetrahydroxybutyl-3-D-erythro-trihydroxypropylpyrazine	0.673
2,5-Bis-(D-arabotetrahydroxybutyl)-pyrazine	0.46

TABLE 10

R_F AND RELATIVE R_F VALUES OF 4-O-(β -D-GLUCOPYRANOSYL)-D-RIBITOL AND RELATED COMPOUNDS

(J. BADDILEY, J. G. BUCHANAN AND F. E. HARDY, *J. Chem. Soc.*, (1961) 2180)

Solvents: S_1 = Butan-1-ol-ethanol-water (5:1:4).

S_2 = Butan-1-ol-ethanol-water-ammonia (sp. gr. 0.88) (40:10:49:1) (E. L. HIRST, L. HOUGH AND J. K. N. JONES, *J. Chem. Soc.*, (1949) 928).

S_3 = Butan-1-ol-ethanol-water (4:1:1).

S_4 = Diisopropyl ether.

S_5 = Light petroleum (b.p. 60-80°).

S_6 = Ethyl acetate-pyridine-water (7:2:1).

Paper: Whatman No. 1 or No. 4 (not specified) (descending).

Impregnation: I = Dimethyl sulphoxide (B. WICKBERG, *Acta Chem. Scand.*, 12 (1958) 615).

Detection: D_1 = Periodate-Schiff reagents (J. BADDILEY, J. G. BUCHANAN, R. E. HANDSCHUMACHER AND J. F. PRESCOTT, *J. Chem. Soc.*, (1956) 2818), for α -glycol groups.

D_2 = Periodic acid-Schiff reagents (J. G. BUCHANAN, C. A. DEKKER AND A. G. LONG, *J. Chem. Soc.*, (1950) 3162), for isopropylidene groups.

D_3 = Perchloric acid (D. A. APFLEGARTH AND J. G. BUCHANAN, *J. Chem. Soc.*, (1960) 4706), for triphenylmethyl ethers.

Compound	R_F S_1	R_{Rib}^* S_1	R_F		R_T^{**} S_4	R_F	
			S_2	S_4I		S_5I	S_6
2,3-O-Isopropylidene-D-ribitol	0.71						
2,3-O-Isopropylidene-1,5-di-O-triphenylmethyl-D-ribitol						0.88	
Triphenylmethanol					1.00	0.23	
Glycerol							0.43
Ethylene glycol							0.55
5-O-Benzyl-2,3-O-isopropylidene-D-ribono-1,4-lactone			0.90				
Ribonolactone			0.42				
2,3-O-Isopropylideneribonolactone			0.80				
5-O-Benzyl-2,3-isopropylidene-D-ribitol	0.90						
4-O-Acetyl-5-O-benzyl-2,3-O-isopropylidene-1-O-triphenylmethyl-D-ribitol					1.25		
5-O-Benzyl-2,3-O-isopropylidene-1-O-triphenylmethyl-D-ribitol					1.25	0.73	
O-Benzyl-O-glucosyl-O-isopropylidene-O-triphenylmethyl-ribitol				0.01			
Ribitol monoglucosides***		0.50, 0.58					

* $R_{Rib} = R_F$ compound/ R_F ribitol.

** $R_T = R_F$ compound/ R_F triphenylmethanol.

*** Tentative identification.

TABLE 11

ELECTROPHORETIC MOBILITIES OF POLYHYDROXY COMPOUNDS IN GERMANATE AND BORATE SOLUTIONS

(W. J. POPIEL, *Chem. & Ind. (London)*, (1961) 434)Electrolytes: $E_1 = 0.04 M$ germanium dioxide solution adjusted to pH 10 with sodium hydroxide. $E_2 =$ pH 10 borate buffer (E. J. BOURNE, A. B. FOSTER AND P. M. GRANT, *J. Chem. Soc.*, (1956) 4311).

Paper: Whatman No. 3 (14 × 56 cm).

Apparatus: Horizontal (*cf.* A. B. FOSTER, *Chem. & Ind. (London)*, (1952) 1050), tap water cooled. Temperature of run: 13–16°.

Potential drop: 12 V/cm (12 mA).

Time of run: 2 h.

Mobility: $M_G =$ Migration rate relative to D-glucose.

Zero marker: 2,3,4,6-Tetra-O-methyl-D-glucose.

Detection: $D_1 =$ Diazotised *p*-nitroaniline (T. SWAIN, *Biochem. J.*, 53 (1953) 200) for phenolic compounds. $D_2 =$ Silver nitrate-sodium ethoxide (W. E. TREVELYAN, D. P. PROCTER AND J. S. HARRISON, *Nature*, 166 (1950) 444). $D_3 =$ Ammoniacal $AgNO_3$ (L. HOUGH, *Nature*, 165 (1950) 400), followed by incubation at 50° until reduction sufficient.

Compound	M_G		Compound	M_G	
	E_1	E_2		E_1	E_2
Ethylene glycol	< 0.1	—	D-Glucose	1.0	1.00
Propylene glycol	0.1	—	D-Galactose	1.5	0.93
Sucrose	0.1	0.18	D-Xylose	1.8	1.00
Cellobiose	0.3	0.29	D-Mannose	1.8	0.72
Maltose	> 0.3	0.34	D-Arabinose	2.0	—
Raffinose	0.5	0.28	D-Glucitol	2.5	0.89
<i>meso</i> -Inositol	0.6	0.51	D-Mannitol	2.7	0.90
Glycerol	> 0.6	0.44	D-Fructose	2.7	0.90
Gentiobiose	0.7	0.75	D-Ribose	2.8	0.77
Lactose	0.8	0.38	Galactitol	2.9	0.98

TABLE 12

 R_F VALUES OF COENZYME Q_{10} AND ITS ETHOXY HOMOLOGUES(B. O. LINN, N. R. TRENNER, B. ARISON, R. G. WESTON, C. H. SHUNK AND K. FOLKERS, *J. Am. Chem. Soc.*, 82 (1960) 1647)Solvents: $S_1 =$ Water-dimethylformamide (3:97) equilibrated with vaseline. $S_2 =$ Dimethylformamide equilibrated with iso-octane.

Paper: Whatman No. 1 (circular).

Impregnation: Dipping in 5% (w/v) solution of vaseline in iso-octane.

Detection: U.V. light.

Compound	R_F	
	S_1	S_2
Coenzyme Q_9	0.49	0.79
Coenzyme Q_{10}	0.40	0.70
Ethoxy homologue	0.32	0.63
Diethoxy homologue	0.29	0.53

TABLE 13

R_F VALUES OF SOME QUINONE OXIMES(K. REHNELT, *Ber. Naturwiss. Ges. Bayreuth*, 9 (1955/6) Beilage)Solvent: Butanol-methanol-water (30:70:100) in an atmosphere of ammonia.
Paper: Schleicher & Schüll 2043b.

<i>Compound</i>	<i>R_F</i>
Naphtho-1,2-quinone 1-oxime	0.79
Phenanthrene-9,10-quinone monoxime	0.72
Chrysene-1,2-quinone monoxime	0.5 (diffuse)

TABLE 14

R_F VALUES OF SOME CYCLIC AMINO COMPOUNDS(K. REHNELT, *Ber. Naturwiss. Ges. Bayreuth*, 9 (1955/6) Beilage)

Solvent: 2 N HCl-amyl alcohol-methanol-benzene (10:14:28:28).

<i>Compound</i>	<i>R_F</i>
3-Aminopyrene	0.96
2-Aminonaphthalene	0.90
1,2-Diaminonaphthalene	0.74
<i>p</i> -Aminophenol	0.41

TABLE 15

R_F VALUES OF PODOPHYLLOTOXIN AND RELATED COMPOUNDS(B. F. CAIN, *J. Chem. Soc.*, (1961) 2599)

Solvent: Benzene saturated with propylene glycol.

Paper: Whatman No. 1 (circular, 27 cm diam.).

Impregnation: 40 % propylene glycol in acetone (dipped, blotted and air-dried).

Detection: Oven-dried paper sprayed with 1 % tetracyanoethylene in freshly distilled acetone.

<i>Compound</i>	<i>R_F</i>	<i>Colour*</i>
Podophyllotoxin	0.01	B
Deoxypodophyllotoxin	0.93	P
α -Peltatin	0.09	B
β -Peltatin	0.54	P
Matairesinol	0.44	B

* P = Purple; B = blue.

TABLE 16

R_F VALUES OF SOME AROMATIC AND ALIPHATIC SULPHINIC ACIDS
(L. GRINGRAS AND G. SJÖSTEDT, *Acta Chem. Scand.*, 15 (1961) 435)

Solvent: Butan-1-ol-propan-1-ol-water (1:1:1).

Paper: Whatman No. 1 (ascending; 24 × 40 cm).

Time of run: 16 h.

Temperature of run: 20°.

Detection: Dil. KMnO_4 soln.; dinitrophenyl-indole; but especially stabilized tetrazotized *o*-dianisidine (0.2%–0.5% soln.).

Compound	R_F
Benzenesulphinic acid	0.58
<i>p</i> -Toluenesulphinic acid	0.65
2-Naphthalenesulphinic acid	0.73
2,6-Dichloro- <i>p</i> -toluenesulphonic acid	0.81
	(0.79*)
Ethanesulphinic acid	0.40
Methanesulphinic acid	0.25**

* Trace in ordinary commercial grade.

** From reduced methanesulphonyl chloride.

TABLE 17

R_F AND RELATIVE R_F VALUES OF CERTAIN AMINODIPHENYL-ODONIUM IODIDES
(F. M. BERINGER AND I. LILLIEN, *J. Am. Chem. Soc.*, 82 (1960) 725)

Solvents: S_1 = Benzene-methanol-butan-1-ol-water (3.5:3.0:2.5:1.0).

S_2 = Benzene-methanol-butan-1-ol-water (8.0:3.0:6.0:1.0).

S_3 = Benzene-methanol-butan-1-ol-pyridine-water (3.5:2.0:2.0:2.0:1.3).

S_4 = Methanol-water (1.0:1.0).

(All parts by vol.)

Paper: Not specified.

Detection: Not specified.

Amine	S_1		S_2		S_3		S_4	
	R_F	R_F ratio*	R_F	R_F ratio*	R_F	R_F ratio*	R_F	R_F ratio*
4,4'-Diamine	0.602	1	0.126, 0.139	1 1	0.503	1	—	—
3-Amine	0.670	1.11	0.245, 0.250	1.94, 1.80	0.552	1.10	0.697	1
4-Amine	0.685	1.14	0.258, 0.285	2.05 2.05	0.576	1.15	0.706	1.02
<i>p</i> -Nitroaniline**	—	—	—	—	—	—	0.926	1.33
Time of run (min)	235		365, 280		290		150	
Temp. of run (°C)	23		19 21		21		20	

* Ratios with diamine value as denominator.

** Reference standard.

TABLE 18

 R_F AND R_F FUNCTIONS

(J. A. THOMA*, Indiana University, Bloomington, Ind., U.S.A.)

R_F	$x/R_F - x$	$R_F/(x - R_F)$	$\frac{\log_{10}}{(x/R_F - x)}$ or $\frac{-\log_e}{[R_F/(x - R_F)]}$	$\frac{\log_{10}}{(x/R_F - x)}$ $\frac{-\log_{10}}{[R_F/(x - R_F)]}$
0.01	99.00	0.0101	4.595	1.996
0.02	49.00	0.0204	3.892	1.690
0.03	32.33	0.0309	3.476	1.510
0.04	24.00	0.0417	3.178	1.380
0.05	19.00	0.0526	2.944	1.279
0.06	15.67	0.0638	2.752	1.195
0.07	13.29	0.0753	2.587	1.123
0.08	11.50	0.0870	2.442	1.061
0.09	10.11	0.0989	2.313	1.005
0.10	9.000	0.1111	2.197	0.9542
0.11	8.091	0.1236	2.091	0.9080
0.12	7.333	0.1364	1.992	0.8653
0.13	6.692	0.1494	1.901	0.8256
0.14	6.143	0.1628	1.815	0.7884
0.15	5.667	0.1765	1.735	0.7533
0.16	5.250	0.1905	1.658	0.7202
0.17	4.882	0.2048	1.586	0.6886
0.18	4.556	0.2195	1.516	0.6585
0.19	4.263	0.2346	1.450	0.6297
0.20	4.000	0.2500	1.386	0.6021
0.21	3.762	0.2658	1.325	0.5754
0.22	3.545	0.2821	1.266	0.5497
0.23	3.348	0.2987	1.208	0.5248
0.24	3.167	0.3158	1.153	0.5006
0.25	3.000	0.3333	1.099	0.4771
0.26	2.846	0.3514	1.046	0.4543
0.27	2.704	0.3699	0.9946	0.4320
0.28	2.571	0.3889	0.9445	0.4102
0.29	2.448	0.4085	0.8954	0.3889
0.30	2.333	0.4286	0.8473	0.3680
0.31	2.226	0.4493	0.8001	0.3475
0.32	2.125	0.4706	0.7538	0.3274
0.33	2.030	0.4925	0.7082	0.3076
0.34	1.941	0.5152	0.6633	0.2881
0.35	1.857	0.5385	0.6190	0.2688
0.36	1.778	0.5625	0.5754	0.2499
0.37	1.703	0.5873	0.5322	0.2311
0.38	1.632	0.6129	0.4895	0.2126
0.39	1.564	0.6393	0.4473	0.1943
0.40	1.500	0.6667	0.4055	0.1761
0.41	1.439	0.6949	0.3640	0.1581
0.42	1.381	0.7241	0.3228	0.1402
0.43	1.326	0.7544	0.2819	0.1224
0.44	1.273	0.7857	0.2412	0.1047
0.45	1.222	0.8182	0.2007	0.0872
0.46	1.174	0.8519	0.1603	0.0696
0.47	1.128	0.8868	0.1201	0.0522
0.48	1.083	0.9231	0.0800	0.0348
0.49	1.041	0.9608	0.0400	0.0174
0.50	1.000	1.0000	0.0000	0.0000

(continued on p. D11)

TABLE 18 (continued)

R_F	$1/R_F - 1$	$R_F/(1 - R_F)$	$\frac{\log_e}{\text{or}} \frac{(1/R_F - 1)}{[R_F/(1 - R_F)]}$	$\frac{\log_{10}}{\text{or}} \frac{(1/R_F - 1)}{[R_F/(1 - R_F)]}$
0.51	0.9608	1.041	-0.0400	-0.0174
0.52	0.9231	1.083	-0.0800	-0.0348
0.53	0.8868	1.128	-0.1201	-0.0522
0.54	0.8519	1.174	-0.1603	-0.0696
0.55	0.8182	1.222	-0.2007	-0.0872
0.56	0.7857	1.273	-0.2412	-0.1047
0.57	0.7544	1.326	-0.2819	-0.1224
0.58	0.7241	1.381	-0.3228	-0.1402
0.59	0.6949	1.439	-0.3640	-0.1581
0.60	0.6667	1.500	-0.4055	-0.1761
0.61	0.6393	1.564	-0.4473	-0.1943
0.62	0.6129	1.632	-0.4895	-0.2126
0.63	0.5873	1.703	-0.5322	-0.2311
0.64	0.5625	1.778	-0.5754	-0.2499
0.65	0.5385	1.857	-0.6190	-0.2688
0.66	0.5152	1.941	-0.6633	-0.2881
0.67	0.4925	2.030	-0.7082	-0.3076
0.68	0.4706	2.125	-0.7538	-0.3274
0.69	0.4493	2.226	-0.8001	-0.3475
0.70	0.4286	2.333	-0.8473	-0.3680
0.71	0.4085	2.448	-0.8954	-0.3889
0.72	0.3889	2.571	-0.9445	-0.4102
0.73	0.3699	2.704	-0.9946	-0.4320
0.74	0.3514	2.846	-1.046	-0.4543
0.75	0.3333	3.000	-1.099	-0.4771
0.76	0.3158	3.167	-1.153	-0.5006
0.77	0.2987	3.348	-1.208	-0.5248
0.78	0.2821	3.545	-1.266	-0.5497
0.79	0.2658	3.762	-1.325	-0.5754
0.80	0.2500	4.000	-1.386	-0.6021
0.81	0.2346	4.263	-1.450	-0.6297
0.82	0.2195	4.556	-1.516	-0.6585
0.83	0.2048	4.882	-1.586	-0.6886
0.84	0.1905	5.250	-1.658	-0.7202
0.85	0.1765	5.667	-1.735	-0.7533
0.86	0.1628	6.143	-1.815	-0.7884
0.87	0.1494	6.692	-1.901	-0.8256
0.88	0.1364	7.333	-1.992	-0.8653
0.89	0.1236	8.091	-2.091	-0.9080
0.90	0.1111	9.000	-2.197	-0.9542
0.91	0.0989	10.11	-2.314	-1.005
0.92	0.0870	11.50	-2.442	-1.061
0.93	0.0753	13.29	-2.587	-1.123
0.94	0.0638	15.67	-2.752	-1.195
0.95	0.0526	19.00	-2.944	-1.279
0.96	0.0417	24.00	-3.178	-1.380
0.97	0.0309	32.33	-3.476	-1.510
0.98	0.0204	49.00	-3.892	-1.691
0.99	0.0101	99.00	-4.595	-1.996

* Compiled with grants from the Corn Industries Research Foundation and the Public Health Service (Research Grant RG.-8500).

TABLE 19

 R_F VALUES OF AMINOPURINE 1-N-OXIDES AND ACETIC ANHYDRIDE REACTION PRODUCTS(M. A. STEVENS, H. W. SMITH AND G. B. BROWN, *J. Am. Chem. Soc.*, 82 (1960) 1148)Solvents: $S_1 = 1\%$ $(\text{NH}_4)_2\text{SO}_4$ -isopropyl alcohol (1:2, v/v). $S_2 = 5\%$ Na_2HPO_4 -isoamyl alcohol (3:2, v/v).

Paper: Whatman No. 1 (ascending).

Temperature of run: 25°.

Detection: $D_1 =$ Pauly reagent.

Compound	R_F		Colour* D_1
	S_1	S_2	
Adenine 1-N-oxide	0.48	0.48	tP
O-Acetyl-adenine 1-N-oxide (acetate)	0.51	Dec.**	n
5-Methyl-3-[5'-(4'-formamido)-imidazolyl]-1,2,4-oxadiazole	0.77	0.57	OR
5-Methyl-3-[5'-(4'-acetamido)-imidazolyl]-1,2,4-oxadiazole	0.78	0.66	O
5-Methyl-3-[5'-(4'-diacetamido)-imidazolyl]-1,2,4-oxadiazole	0.85	Dec.**	O
8-Hydroxyadenine 1-N-oxide	0.45	0.52	n
5-Methyl-3-[5'-(2'-hydroxy-4'-amino)-imidazolyl]-1,2,4-oxadiazole	0.54***	0.45	n
2,8-Dihydroxyadenine	—	0.08	n
5-Methyl-3-[5'-(4'-amino)-imidazolyl]-1,2,4-oxadiazole	0.70***	0.51	OR
2-Methyladenine 1-N-oxide	0.49	0.53	tlY
O-Acetyl-2-methyladenine 1-N-oxide	0.70	0.53	n

* P = pink; O = orange; R = red; Y = yellow; t = transient; l = light; n = none.

** Decomposed during run.

*** Figure is variable due to weak buffering power of ammonium sulphate.

TABLE 20

 R_F VALUES OF 6-MERCAPTOPURINE, 6-MERCAPTO-8-HYDROXYPURINE, 6-THIOXANTHINE AND 6-THIOURIC ACID(F. BERGMANN AND H. UNGAR, *J. Am. Chem. Soc.*, 82 (1960) 3957)Solvents: $S_1 = 95\%$ ethanol-acetic acid-water (85:5:10). $S_2 =$ Propan-2-ol-dimethyl formamide-water (65:25:10). $S_3 =$ Propan-2-ol-dimethyl formamide-25% NH_4OH (65:25:10).

Paper: Whatman No. 1 (descending).

Detection: U.V. light (Mineralight lamp; main emission about 255 m μ).

Compound	R_F			Colour* (fluorescence)
	S_1	S_2	S_3	
6-Mercaptopurine	0.48	0.65	0.52	Yh
6-Mercapto-8-hydroxypurine	0.42	0.58	0.33	pBV
6-Thioxanthine	0.42	0.53	0.31	Y-WB
6-Thiouric acid	0.08	—	—	SB

* B = blue; S = sky; V = violet; W = white; Y = yellow; Yh = yellowish; p = pale.

TABLE 21

 R_F VALUE OF THIOSTREPTOIC ACID(M. BODANZSKY, J. T. SHEEHAN, J. FRIED, N. J. WILLIAMS AND C. A. BIRKHEIMER, *J. Am. Chem. Soc.*, 82 (1960) 4747)

Solvent: Butan-1-ol-acetic acid-water (4:1:1).

Paper: Whatman No. 1.

Detection: Not specified.

Compound	R_F
$ \begin{array}{c} \text{NH}_2 \quad \text{S} \text{---} \text{CH} \\ \quad \quad \\ \text{CH}_2 \text{---} \text{CH} \text{---} \text{C} \text{=N} \text{---} \text{C} \text{---} \text{COOH} \\ \quad \quad \\ \text{CH}_2 \text{---} \text{CH} \text{---} \text{C} \text{=N} \text{---} \text{C} \text{---} \text{COOH} \\ \quad \quad \\ \text{NH}_2 \quad \text{S} \text{---} \text{CH} \end{array} $	0.08-0.10
Thiostreptoic acid	

TABLE 22

 R_F VALUES OF HYDROLYSIS PRODUCTS OF STAPHYLOMYCIN FACTOR S(H. VANDERHAEGHE AND G. PARMENTIER, *J. Am. Chem. Soc.*, 82 (1960) 4414)Solvents: S_1 = Butan-1-ol-acetic acid-water (4:1:5). S_2 = *tert.*-Amyl alcohol-2,6-lutidine-water (178:178:114). S_3 = Pyridine-acetic acid-water-butanol (10:10:50:40).

Paper: Whatman 3 MM.

Detection: Ninhydrin; 1% ferric chloride; Schwartz reagent; Rydon and Smith reagent; periodic acid-Nessler reagent; *p*-nitrobenzoyl chloride-pyridine.

Compound	R_F		
	S_1	S_2	S_3
3-Hydroxypicolinic acid	0.45		0.50
2-Hydroxypyridine	0.66	0.69	
3-Hydroxypyridine	0.63	0.90	
4-Hydroxypyridine	0.48	0.46	
Staphylomycin S	0.9		
Staphylomycin S acid	0.9		
4-Hydroxypipicolinic acid isomers*	0.87,		0.14,
	1.27†		0.18
3-Hydroxypipicolinic acid isomers*	0.95,		
	1.67†		0.50
5-Hydroxy-D-pipicolinic acid (Thr, AmBut, Pro)**	1.31		0.22†,
			0.27
PhGly			0.39
N-MePhe			0.58
(3HyPic, Thr, AmBut, Pro)**			0.79
(3HyPic, Thr, AmBut, Pro, N-MePhe)**			0.94,
			0.87

* R_{Fala} ($R_{Fala} = R_F \text{ compound} / R_F \text{ alanine}$).

** Peptides: constituents of hydrolysates given in parentheses.

† Minor constituent.

TABLE 23

R_F VALUES OF TRIAMCINOLONE AND ITS MICROBIOLOGICAL REDUCTION PRODUCTS(L. L. SMITH, J. J. GABARINI, J. J. GOODMAN, M. MARX AND H. MENDELSON, *J. Am. Chem. Soc.*, 82 (1960) 1437)

Solvents: S₁ = System I.
 S₂ = System II.
 S₃ = System IV.
 S₄ = System V.

For these systems and other paper chromatographic details see L. L. SMITH, T. FOELL, R. DE MAIO AND M. HALWER, *J. Am. Pharm. Assoc.*, 48 (1959) 528.

Detection: D₁ = Tetrazolium blue.

D₂ = Isonicotinic acid hydrazide reagent (L. L. SMITH AND T. FOELL, *Anal. Chem.*, 31 (1959) 102).

Compound	<i>R_F</i>				Colour*
	S ₁	S ₂	S ₃	S ₄	D ₁ D ₂
9 α -Fluoro-11 β ,16 α ,17 α ,20 β ,21-pentahydroxy-4-pregnen-3-one		0.13			— Yf
Triamcinolone (9 α -fluoro-11 β ,16 α ,17 α ,21-tetrahydroxy-1,4-pregnadiene-3,20-dione)		0.42		0.16	
16 α ,20 β ,21-Triacetoxy-9 α -fluoro-11 β ,17 α -dihydroxy-4-pregnen-3-one		0.95	0.84	0.16	— Yf
20 β -Dihydrotriamcinolone	0.08	0.10		0	— **
16 α ,20 β -Diacetoxy-9 α -fluoro-11 β ,17 α ,21-trihydroxy-1,4-pregnadien-3-one			0.57		—
Triamcinolone diacetate			0.86		—
9 α -Fluoro-11 β ,16 α ,17 α -trihydroxy-20 β ,21-isopropylidenedioxy-1,4-pregnadien-3-one				0.21	— **
9 α -Fluoro-11 β -hydroxy-16 α ,17 α ,20 β ,21-bis-isopropylidenedioxy-1,4-pregnadien-3-one				0.78, 0.79	— Yf
16 α -Acetoxy-9 α -fluoro-11 β ,17 α -dihydroxy-20 β ,21-isopropylidenedioxy-1,4-pregnadien-3-one				0.50	— **
20 β ,21-Cyclohexylidenedioxy-9 α -fluoro-11 β ,16 α ,17 α -trihydroxy-1,4-pregnadien-3-one				0.45	—
Triamcinolone 16 α ,17 α -acetonide				0.16	—

* Y = yellow; f = fluorescence; — = negative result.

** Positive to strong methanolic reagent (L. L. SMITH AND T. FOELL, *Anal. Chem.*, 31 (1959) 102).

TABLE 24

 R_F VALUES OF TRIAMCINOLONE AND RELATED 16α -HYDROXY-STERIODS(L. L. SMITH, M. MARX, J. J. GARBARINI, T. FOELL, V. E. ORIGONI AND J. J. GOODMAN, *J. Am. Chem. Soc.*, 82 (1960) 4616)

Solvents: S_1 = System I.
 S_2 = System II.
 S_3 = System III.
 S_4 = System IV.
 S_5 = System V.

For these systems see L. L. SMITH, T. FOELL, R. DE MAIO AND M. HALWER, *J. Am. Pharm. Assoc.*, 48 (1959) 528.

Paper: See L. L. SMITH, T. FOELL, R. DE MAIO AND M. HALWER, *J. Am. Pharm. Assoc.*, 48 (1959) 528.

Detection: D_1 = Alkali reagent (I. E. BUSH, *Biochem. J.*, 50 (1951) 370).
 D_2 = Isonicotinic hydrazide reagent (L. L. SMITH AND T. FOELL, *Anal. Chem.*, 31 (1959) 102).
 D_3 = *p*-Phenylenediamine phthalate reagent (A. BODÁNZSKY AND J. KOLLONITSCH, *Nature*, 175 (1955) 729).
 D_4 = Tetrazolium blue reagent*.

Compound	R_F					Colour**			
	S_1	S_2	S_3	S_4	S_5	D_1	D_2	D_3	D_4
9 α -Fluoro-11 β ,16 α ,17 α -trihydroxy-17 α β -hydroxymethyl-4-D-homo-androstene-3,17-dione	0.12	0.30	0.13	0.10		Yf	Yf	+	+
9 α -Fluoro-11 β ,16 α ,17 α -trihydroxy-17 α β -hydroxymethyl-1,4-D-homo-androstadiene-3,17-dione	0.10	0.22	0.08	0.06		n	+	n	
Triamcinolone isomer acetonide		0.88			0.09				
Triamcinolone isomer ketal				0.65, 0.69	0.14				
9 α -Fluoro-17 α β -hydroxymethyl-16 α ,17 α -isopropylidenedioxy-1,4-D-homo-androstadiene-3,11,17-trione					0.41- 0.43				n
11 β -Acetoxy-9 α -fluoro-16 α ,17 α -dihydroxy-17 α β -hydroxymethyl-1,4-D-homo-androstadiene-3,17-dione (A)			1.40 [§]						+
Triamcinolone			1.00 [§]						
Triamcinolone 11 β -acetate			2.40 [§]						
Acetylation product of A					0.39				
Triamcinolone 16 α ,21-diacetate					0.29				
Triamcinolone 11 β ,16 α ,21-triacetate					0.53				

* Not directly specified.

** Y = yellow; f = fluorescence; + = positive; n = negative.

§ $R_T = R_F$ compound/ R_F triamcinolone.

TABLE 25

R_F VALUES OF 16 α ,17 α -CYCLIC ORTHOESTERS OF TRIAMCINOLONE AND RELATED 16 α -HYDROXY-STERIODS

(L. L. SMITH AND M. MARX, *J. Am. Chem. Soc.*, 82 (1960) 4625)

Solvents: S_1 = Toluene-petroleum ether-methanol-water (12:8:13:7).

S_2 = Benzene-petroleum ether-methanol-water (5:5:7:3).

Paper: Not specified (*cf.* L. L. SMITH, T. FOELL, R. DE MAIO AND M. HALWER, *J. Am. Pharm. Assoc.*, 48 (1959) 528).

Detection: D_1 = Tetrazolium blue reagent (alkaline).

D_2 = Isonicotinic acid hydrazide reagent (concentrated).

(*cf.* L. L. SMITH AND T. FOELL, *Anal. Chem.*, 31 (1959) 102).

Compound	R_F		Detection	
	S_1	S_2	D_1	D_2
9 α -Fluoro-11 β ,21-dihydroxy-16 α ,17 α -methoxymethylenedioxy-1,4-pregnadiene-3,20-dione	0.30	0.10	+	+
9 α -Fluoro-11 β ,21-dihydroxy-16 α ,17 α -(1-methoxy-1-ethylidenedioxy)-1,4-pregnadiene-3,20-dione (I)	0.44	0.17	+	+
21-Acetate of I*	0.21	0.10	+	+
16 α -Acetate of I*	0.02	0.01	+	+
9 α -Fluoro-11 β ,21-dihydroxy-16 α ,17 α -(1-methoxy-propylidenedioxy)-1,4-pregnadiene-3,20-dione (II)	0.55	0.26		
16 α -Propionate of II*	0.04	0.02	+	+
21-Propionate of II*		0.19	+	+
9 α -Fluoro-11 β ,17 α ,21-trihydroxy-16 α - <i>n</i> -valeryloxy-1,4-pregnadiene-3,20-dione (III)	0.19			
Orthovalerate derivative corresponding to III*	0.55			
16 α ,17 α -Ethoxymethylenedioxy-9 α -fluoro-11 β ,21-dihydroxy-1,4-pregnadiene-3,20-dione (IV)	0.46	0.18		
21-Formate of IV*	0.21	0.10		
16 α -Formate of IV*	0.02	0.01		
16 α ,17 α -(1-Ethoxy-ethylidenedioxy)-9 α -fluoro-11 β ,21-dihydroxy-1,4-pregnadiene-3,20-dione	0.62	0.30	+	+
16 α -Acetoxy-9 α -fluoro-11 β ,17 α ,21-trihydroxy-1,4-pregnadiene-3,20-dione	0.01	0.01	+	+
9 α -Fluoro-11 β ,16 α ,17 α -trihydroxy-21-propionoxy-1,4-pregnadiene-3,20-dione	0.25	0.09		
9 α -Fluoro-11 β ,17 α ,21-trihydroxy-16 α -propionoxy-1,4-pregnadiene-3,20-dione	0.05	0.04		
9 α -Fluoro-11 β ,17 α -dihydroxy-16 α ,21-dipropionoxy-1,4-pregnadiene-3,20-dione	0.67	0.45		
21-Acetoxy-9 α -fluoro-11 β -hydroxy-16 α ,17 α -methoxymethylenedioxy-1,4-pregnadiene-3,20-dione	0.93	0.72	+	+

* Tentative identification.

TABLE 26

 R_F VALUES OF SOME AMINO ACIDS(G. M. PRICE, *Biochem. J.*, 80 (1961) 420)

Solvents: S_1 = Water-saturated phenol (J. J. PRATT AND J. L. AUCLAIR, *Science*, 108 (1948) 213).
 S_2 = Butan-1-ol-acetic acid-water (50:10:40; D. M. P. PHILLIPS, *Biochim. Biophys. Acta*, 3 (1949) 341).
 S_3 = 98% formic acid-acetone-water (14:60:26; S. BURROWS, F. S. M. GRYLLS AND J. S. HARRISON, *Nature*, 170 (1952) 800).
 S_4 = Lutidine-collidine-water (1:1:2; C. E. DENT, *Biochem. J.*, 43 (1948) 169).
 S_5 = Water-saturated isobutyric acid (R. CONSDEN, A. H. GORDON AND A. J. P. MARTIN, *Biochem. J.*, 38 (1944) 224).
 S_6 = Water-saturated butan-1-ol (R. CONSDEN *et al.*, *loc. cit.*).

Paper: Whatman No. 1 (3 cm strips; descending: S_1, S_2, S_4-S_6 ; ascending: S_3 (cf. F. P. W. WINTERINGHAM, P. M. BRIDGES AND G. C. HELLYER, *Biochem. J.*, 59 (1955) 13).

Time of run: 24-40 h.

Temperature of run: $T_1 = 25^\circ$ (S_1, S_2, S_4-S_6); $T_2 = 5^\circ$ (S_3).

Detection: $D_1 = 0.2\%$ ninhydrin in acetone (dip; $80-90^\circ$; 5 min; G. TOENNIES AND J. KOLB, *Anal. Chem.*, 28 (1951) 823).

$D_2 = 0.2\%$ isatin in acetone (dip; 105° ; 3 min; I. SMITH, *Nature*, 171 (1953) 43), appropriate part of chromatogram only (for proline).

Compound	R_F					
	S_1	S_2	S_3	S_4	S_5	S_6
α -Alanine	0.59	0.14	0.73	0.14	0.53	0.02
Aspartic acid	0.14	0.14	0.58	0.18	—	—
Glutamic acid	0.24	0.12	0.65	0.20	0.50	—
Glutamine	0.59	0.08	0.48	0.17	—	0.01
Proline	0.90	0.17	—	0.29	0.59	0.10

TABLE 27

 R_F VALUES OF SOME AMINO ACIDS AT LOW TEMPERATURES(R. Y. SHKOL'NIK, N. G. DOMAN AND V. N. KOSTYLEV, *Biokhimiya*, 26 (1961) 621)

Solvents: S_1 = Ethanol-conc. ammonia (50:100);

S_2 = Methanol-conc. ammonia (160:40).

Paper: Leningrad Chromatographic Paper No. 2, medium (50.5 cm \times 31.0 cm).

Temperature of run: -33° .

Detection: 0.2% ninhydrin in water-saturated *n*-butanol.

Compound	R_F	
	S_1	S_2
Aspartic acid	0.10	0.13
Histidine	0.16	0.12
Glutamic acid	0.18	0.30
Cystine	0.20	0.18
Glycine	0.41	0.64
Serine	0.52	0.60
Alanine	0.72	0.88
Phenylalanine	0.91	0.97
Leucine	0.91	0.97
Valine	0.96	0.92

Note: Trilon B (which was not defined by the authors in previous papers) \equiv Versene, *i.e.* disodium ethylenediaminetetraacetate, cf. R. Y. SHKOL'NIK AND N. G. DOMAN, *Biokhimiya*, 25 (1960) 276; *J. Chromatog., Chromatog. Data*, 5 (1961) D10, D11 (Tables 7 and 9).

TABLE 28

 R_F VALUES OF CERTAIN HISTIDINE DERIVATIVES, AMINO ACIDS AND PEPTIDES(D. G. SMYTH, A. NAGAMATSU AND J. S. FRUTON, *J. Am. Chem. Soc.*, 82 (1960) 4600)

Solvent: Butanol-pyridine-acetic acid-water (30:20:6:24).

Paper: Whatman No. 1 (ascending).

Time of run: 9 h (approx.).

Detection: D_1 = Pauly reagent (5 ml 5% NaNO_2 + 5 ml 5% sulphanilic acid, aqueous mixture extracted with butanol-1 (20 ml); spray, followed by half satd. aq. Na_2CO_3), for imidazolyl or phenolic groups. D_2 = Ninhydrin reagent (0.1% w/v in acetone; spray, dried at room temp.).
Chromatograms dried in cold air for both D_1 and D_2 .

Compound	R_F
Glycyl-L-histidinamide	0.22
L-Histidine	0.18
Carbobenzoyglycyl-L-histidinamide	0.77
α -N-Acetyl-DL-histidine	0.26
L-Histidine anhydride	0.33
Imidazole	0.54
L-Leucine	0.58
L-Leucinamide	0.63
L-Leucyl-L-leucine	0.84
L-Tyrosyl-L-tyrosine	0.65
L-Cystine	0.12

TABLE 29

 R_F VALUES OF SEVERAL PEPTIDES RELATED TO L-HISTIDYL-D-PHENYLALANYL-L-ARGINYL-L-TRYPTOPHYLGLYCINE(E. SCHNABEL AND C. H. LI, *J. Am. Chem. Soc.*, 82 (1960) 4576)Solvents: S_1 = Butan-2-ol-10% NH_4OH (85:15). S_2 = Butan-1-ol-acetic acid-water (4:1:1).

Paper: Whatman No. 1.

Detection: D_1 = Ninhydrin reagent. D_2 = Sakaguchi reagent. D_3 = Pauly reagent.For D_1 - D_3 see R. J. BLOCH, E. L. DURRUM AND G. ZWEIG, *A Manual of Paper Chromatography and Paper Electrophoresis*, 2nd Ed., Academic Press, New York, 1958, pp. 128-139.

Compound*	R_F	
	S_1	S_2
N α -Cbz-G-Tos-Arg	0.40	0.90
Tos-Arg		0.26-0.30
α -Cbz-G-Tos-anhydro Arg	0.90	0.90
α -Cbz-G-Tos-Arg·Try·Gly·OMe		0.85
G-Tos-Arg·Try·Gly·OMe		0.58
Cbz-im-Bz-His·D-Phe·G-Tos-Arg·Try·Gly	0.45	0.84
His·D-Phe·Arg·Try·Gly		0.05

* L-forms where applicable; note D-Phe.

TABLE 30

 R_F AND RELATIVE R_F VALUES OF SOME OF THE ACTH PEPTIDE GROUP(K. HOFMANN AND S. LANDE, *J. Am. Chem. Soc.*, 83 (1961) 2286)Solvents: S_1 = *n*-Butanol-acetic acid-water (S. M. PARTRIDGE, *Biochem. J.*, 42 (1948) 238). S_2 = Butan-2-ol-ammonia (J. F. ROLAND AND A. M. GROSS, *Anal. Chem.*, 26 (1954) 502).

Paper: Not specified.

Detection: D_1 = Ninhydrin reagent. D_2 = Ehrlich reagent. D_3 = Sakaguchi reagent. D_4 = Pauly reagent.

Compound	R_F S_1	R_{Phe}^* S_1	Colour			
			D_1	D_2	D_3	D_4
Try·Gly·OMe(I)·HCl· $1/2H_2O$	0.7	—	+	+		
Diketopiperazine corresponding to (I)	0.75	1.9	—	+		
Cbz-Phe·nitro-Arg·Try·Gly·OMe· H_2O	—	1.9	—	+		
Cbz-Phe·nitro-Arg·Try·Gly· $2H_2O$	0.9	1.7	—	+		
Phe·nitro-Arg·Try·Gly· $2HBr·H_2O$	0.7	1.1	+	+		
Phe·nitro-Arg·Try·Gly· H_2O	0.6	1.1	+	+		
Phe·Arg·Try·Gly·acetate· H_2O	0.6	1.0	+	+	+	
N^a -Cbz-His·Phe·nitro-Arg·Try·Gly· $1.5H_2O$	—	1.6	—	+		+
N^a -Cbz-His·Phe·nitro-Arg·Try·Gly· $2HCl·2H_2O$	0.7	1.8	—	+	+	+
His·Phe·Arg·Try·Gly·acetate· $2H_2O$	0.48	0.76	+	+	+	+
	0.50	0.74				

* $R_{Phe} = R_F$ compound/ R_F phenylalanine.

TABLE 31

 R_F VALUES OF γ -(3-PYRIDYL)- β -OXO-N-METHYL-BUTYRAMIDE AND OTHER KOENIG-POSITIVE COMPOUNDS(H. MCKENNIS, E. R. BOWMAN AND L. B. TURNBULL, *J. Am. Chem. Soc.*, 82 (1960) 3974)Solvents: S_1 = Ammonia-ethanol-butanol (H. MCKENNIS, L. B. TURNBULL, H. N. WINGFIELD AND L. J. DEWEY, *J. Am. Chem. Soc.*, 80 (1958) 1634). S_2 = Formic acid-*sec.*-butanol-water (W. HAUSMANN, *J. Am. Chem. Soc.*, 74 (1952) 3181). S_3 = Benzene-methanol-acetate buffer (60:15:25, 0.2 M sodium acetate buffer, pH 5.6), cf. F. E. GUTHRIE, R. L. RINGER AND T. G. BOWERY, *J. Econ. Entomol.*, 50 (1957) 822.

Paper: Whatman No. 1.

Detection: Koenig reagent.

Compound	R_F		
	S_1	S_2	S_3
γ -(3-Pyridyl)- β -oxo-N-methyl-butylamide	0.74, 0.72	0.48, 0.43	0.05
γ -(3-Pyridyl)- β -oxo-butyric acid	0.22, 0.26	0.61, 0.76	
3-Pyridyl-acetic acid	0.26	0.34	
γ -(3-Pyridyl)-butyric acid	0.32	0.43	

TABLE 32

 R_F VALUES OF NEOMYCINS AND RELATED COMPOUNDS(K. L. RINEHART, A. D. ARGOUEDELIS, W. A. GOSS, A. SOHLER AND C. P. SCHAFFNER, *J. Am. Chem. Soc.*, 82 (1960) 3938)

Solvents: S_1 = *n*-Propanol-glacial acetic acid-water (9:1:10).
 S_2 = *n*-Butanol-pyridine-water (6:4:3).
 S_3 = *tert.*-Butanol-glacial acetic acid-water (2:2:1).
 S_4 = *n*-Propanol-glacial acetic acid-water (10:1:9).
 S_5 = *n*-Butanol-glacial acetic acid-water (4:1:5, organic phase).
 S_6 = *n*-Butanol-ethanol-water (4:1:5, organic phase).
 Paper: Not specified (descending), see also S. C. PAN AND J. D. DUTCHER, *Anal. Chem.*, 28 (1956) 836).
 Detection: D_1 = Ninhydrin (0.25 g) in pyridine (50 ml) and 95% ethanol (50 ml).
 D_2 = Aniline hydrogen phthalate reagent (phthalic acid (1.66 g) and aniline (0.93 g) in water-saturated *n*-butanol (100 ml).
 D_3 = Orcinol reagent (orcinol (0.5 g) and trichloroacetic acid (15 g) in water-saturated *n*-butanol (100 ml)).

Compound	R_{N-a}^* S_1	R_F					Colour**		
		S_1	S_2	S_4	S_5	S_6	D_1	D_2	D_3
Neomycin B ^a	1.00	0.26	0.00 ^b -0.02						
Neomycin C ^a	0.76	0.30							
Framycetin ^a	1.00	0.26							
Neamine ^a	0.96	0.43	0.20 ^b -0.50						
Catenulina ^a	0.85	0.52							
Kanamycin ^a	0.75	0.57							
Neobiosamine B			0.19	0.54					
Neosamine B			0.25	0.61					
D-Ribose ^c			0.596 ± 0.006	0.64	0.308 ± 0.005	0.287, 0.289			R n
D-Lyxose ^c			0.547 ± 0.004		0.248 ± 0.006				R n
D-Xylose ^c			0.542 ± 0.005		0.254 ± 0.006				R n
D-Arabinose ^c			0.536 ± 0.006		0.257 ± 0.007				R n
D-Xylulose ^c			0.671 ± 0.009		0.334 ± 0.007				B G
D-Ribulose ^c			0.692 ± 0.007		0.330 ± 0.006				B G
Methyl neobiosaminide B ^d			0.80 ^b , 0.81, 0.83 (0.44)						
Methyl N,N'-bis-(2,4-dinitrophenyl)-neobiosaminide B						0.905			P P
Neobiosamine B di-HCl			0.25						
N,N'-Bis-(2,4-dinitrophenyl)-neobiosamine B						0.895			
Neobiosaminol B di-HCl			0.22						
Neosamine B di-HCl			0.23						P YB
N,N'-Bis-(2,4-dinitrophenyl)-neosamine B						0.914			
Neosaminol B			0.157						+ —
N,N'-Bis-(2,4-dinitrophenyl)-neosaminol B						0.912			
Neamine HCl			0.131	0.485					
Methyl neobiosaminide B di-HCl			0.804	0.699					

* $R_{N-a} = R_F$ compound/ R_F N-acetyl-neomycin B.

** R = red; B = brown; P = purple; Y = yellow; G = green; n = negative.

^aAs sulphate; ^bfree base; ^c $R_F \pm$ standard deviation; ^dtendency to form double spots.

TABLE 33

R_F VALUES OF NEOMYCIN C, RELATED COMPOUNDS AND DEGRADATION PRODUCTS(K. L. RINEHART AND P. W. K. WOO, *J. Am. Chem. Soc.*, 83 (1961) 643)

- Solvents: S₁ = Butan-1-ol-acetic acid-water (2:2:1).
 S₂ = Pyridine-acetic acid-water (10:1:9).
 S₃ = Phenol-aqueous phosphate citrate buffer (100 g satd. with ca. 20 ml aqueous solution containing 3.7% NaH₂PO₄ and 6.3% sodium citrate; one phase system).
 S₄ = Phenol-water-KCN-NH₄OH (organic phase of phenol-H₂O (9:1, by wt.) where aqueous stationary phase contained a few crystals of KCN and 1% w/v NH₃).
 S₅ = Butan-1-ol-acetic acid-water (4:1:5).

Paper: See K. L. RINEHART, A. D. ARGOUDELIS, W. A. GOSS, A. SOHLER AND C. P. SCHAFFNER, *J. Am. Chem. Soc.*, 82 (1960) 3938.

- Detection: D₁ = Ninhydrin (K. L. RINEHART *et al.*, *loc. cit.*).
 D₂ = Aniline hydrogen phthalate (K. L. RINEHART *et al.*, *loc. cit.*).
 D₃ = Orcinol (K. L. RINEHART *et al.*, *loc. cit.*).
 D₄ = *p*-Dimethylaminoaniline monohydrate-trichloroacetic acid reagent (0.2 g + 1 g in 50 ml water).
 D₅ = Elson-Morgan reagents (*cf.* F. CRAMER, *Papierchromatographie*, 4th Ed., Verlag Chemie, Weinheim/Bergstr., 1958).
 D₆ = Phloroglucinol reagent (5% ethanolic phloroglucinol-glacial acetic acid-conc. HCl (2.5:25:1, by vol.); freshly prepared).
 D₇ = Sodium periodate-potassium permanganate reagent (1% aqueous solutions applied successively with a 3-4 min interval).

Compound	<i>R_F</i> *					Colour**				
	S ₁	S ₂	S ₃	S ₄	S ₅	D ₁	D ₂	D ₃	D ₄	D ₇
Neomycin C	0.00	0.33								
Neamine	0.00-0.51	0.42								
Methyl neobios-aminide C	0.81, 0.33***	0.69, 0.51		0.470 (1)						
Neobiosamine C	0.19	0.43		0.545 (1)		b	bn			
Neosamine C	0.17					p	bn			
D-Ribose	0.553 ± 0.012 (2)		0.598	0.630 ± 0.006 (3)	0.365 ± 0.005 (6)	c	r	c	bn	bn
D-Lyxose	0.500 ± 0.010 (2)		0.513	0.555 ± 0.003 (2)	0.341 ± 0.007 (4)					
D-Xylose	0.490 ± 0.007 (2)		0.456	0.470 (1)	0.333 ± 0.002 (4)					
D-Arabinose	0.479 ± 0.002 (2)		0.514	0.545 (1)	0.317 ± 0.006 (4)					
D-Xylulose	0.585 (1)				0.387 ± 0.009 (3)					
D-Ribulose	0.605 (1)				0.382 ± 0.005 (3)					
D-Ribitol	0.616									

* Numbers in parentheses indicate the number of determinations.

** b = blue; p = purple; c = colourless; bn = brown; r = red.

*** Multiple *R_F* values frequently observed are probably due to differing ionic species.

TABLE 34

RATIO OF ABSORPTION COEFFICIENT TO SCATTERING COEFFICIENT
(K/S) AS A FUNCTION OF PERCENT REFLECTANCE ($100R_{\infty}$)*

(For application of this table see R. B. INGLE AND E. MINSHALL, *J. Chromatog.*, 8 (1962) 369)

$100R_{\infty}$.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
5	9.02	8.83	8.64	8.46	8.29	8.12	7.96	7.80	7.65	7.50
6	7.36	7.23	7.10	6.97	6.84	6.72	6.61	6.50	6.39	6.28
7	6.18	6.08	5.98	5.89	5.79	5.70	5.62	5.53	5.45	5.37
8	5.29	5.21	5.14	5.07	4.99	4.92	4.86	4.79	4.73	4.66
9	4.60	4.54	4.48	4.42	4.37	4.31	4.26	4.20	4.15	4.10
10	4.05	4.00	3.95	3.91	3.86	3.81	3.77	3.73	3.68	3.64
11	3.60	3.56	3.52	3.48	3.44	3.40	3.37	3.33	3.30	3.26
12	3.23	3.19	3.16	3.13	3.09	3.06	3.03	3.00	2.97	2.94
13	2.91	2.88	2.85	2.83	2.80	2.77	2.74	2.72	2.69	2.67
14	2.64	2.62	2.59	2.57	2.54	2.52	2.50	2.47	2.45	2.43
15	2.41	2.39	2.36	2.34	2.32	2.30	2.28	2.26	2.24	2.22
16	2.20	2.19	2.17	2.15	2.13	2.11	2.09	2.08	2.06	2.04
17	2.03	2.01	1.993	1.997	1.961	1.945	1.929	1.913	1.898	1.883
18	1.868	1.853	1.838	1.824	1.809	1.795	1.781	1.767	1.754	1.740
19	1.727	1.713	1.700	1.687	1.674	1.662	1.649	1.637	1.624	1.612
20	1.600	1.588	1.576	1.565	1.553	1.541	1.530	1.519	1.508	1.497
21	1.486	1.475	1.464	1.454	1.443	1.433	1.423	1.413	1.403	1.393
22	1.383	1.373	1.363	1.354	1.344	1.335	1.325	1.316	1.307	1.298
23	1.289	1.280	1.271	1.262	1.254	1.245	1.237	1.228	1.220	1.212
24	1.203	1.195	1.187	1.179	1.171	1.163	1.155	1.148	1.140	1.132
25	1.125	1.117	1.110	1.103	1.095	1.088	1.081	1.074	1.067	1.060
26	1.053	1.046	1.039	1.033	1.026	1.019	1.013	1.006	1.000	0.993
27	0.987	0.980	0.974	0.968	0.962	0.956	0.950	0.944	0.938	0.932
28	0.926	0.920	0.914	0.908	0.903	0.897	0.891	0.886	0.880	0.875
29	0.869	0.864	0.858	0.853	0.848	0.842	0.837	0.832	0.827	0.822
30	0.817	0.812	0.807	0.802	0.797	0.792	0.787	0.782	0.777	0.773
31	0.768	0.763	0.759	0.754	0.749	0.745	0.740	0.736	0.731	0.727
32	0.722	0.718	0.714	0.709	0.705	0.701	0.697	0.693	0.688	0.684
33	0.680	0.676	0.672	0.668	0.664	0.660	0.656	0.652	0.648	0.644
34	0.641	0.637	0.633	0.629	0.625	0.622	0.618	0.614	0.611	0.607
35	0.604	0.600	0.596	0.593	0.589	0.586	0.582	0.579	0.576	0.572
36	0.569	0.565	0.562	0.559	0.556	0.552	0.549	0.546	0.543	0.539
37	0.536	0.533	0.530	0.527	0.524	0.521	0.518	0.515	0.512	0.509
38	0.506	0.503	0.500	0.497	0.494	0.491	0.488	0.485	0.483	0.480
39	0.477	0.474	0.471	0.469	0.466	0.463	0.461	0.458	0.455	0.453
40	0.450	0.447	0.445	0.442	0.440	0.437	0.434	0.432	0.429	0.427
41	0.424	0.422	0.420	0.417	0.415	0.412	0.410	0.407	0.405	0.403
42	0.400	0.398	0.396	0.393	0.391	0.389	0.387	0.384	0.382	0.380
43	0.378	0.376	0.373	0.371	0.369	0.367	0.365	0.363	0.361	0.358
44	0.356	0.354	0.352	0.350	0.348	0.346	0.344	0.342	0.340	0.338
45	0.336	0.334	0.332	0.330	0.328	0.326	0.324	0.323	0.321	0.319
46	0.317	0.315	0.313	0.311	0.310	0.308	0.306	0.304	0.302	0.301
47	0.299	0.297	0.295	0.294	0.292	0.290	0.288	0.287	0.285	0.283
48	0.282	0.280	0.278	0.277	0.275	0.273	0.272	0.270	0.269	0.267
49	0.265	0.264	0.262	0.261	0.259	0.258	0.256	0.255	0.253	0.251

(continued on p. D23)

TABLE 34 (continued)

<i>ionR_∞</i>	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
50	0.250	0.248	0.247	0.246	0.244	0.243	0.241	0.240	0.238	0.237
51	0.235	0.234	0.233	0.231	0.230	0.228	0.227	0.226	0.224	0.223
52	0.222	0.220	0.219	0.218	0.216	0.215	0.214	0.212	0.211	0.210
53	0.208	0.207	0.206	0.205	0.203	0.202	0.201	0.200	0.198	0.197
54	0.196	0.195	0.194	0.192	0.191	0.190	0.189	0.188	0.186	0.185
55	0.184	0.183	0.182	0.181	0.180	0.178	0.177	0.176	0.175	0.174
56	0.173	0.172	0.171	0.170	0.169	0.167	0.166	0.165	0.164	0.163
57	0.162	0.161	0.160	0.159	0.158	0.157	0.156	0.155	0.154	0.153
58	0.152	0.151	0.150	0.149	0.148	0.147	0.146	0.145	0.144	0.143
59	0.142	0.142	0.141	0.140	0.139	0.138	0.137	0.136	0.135	0.134
60	0.133	0.132	0.132	0.131	0.130	0.129	0.128	0.127	0.126	0.126
61	0.125	0.124	0.123	0.122	0.121	0.121	0.120	0.119	0.118	0.117
62	0.116	0.116	0.115	0.114	0.113	0.112	0.112	0.111	0.110	0.109
63	0.109	0.108	0.107	0.106	0.106	0.105	0.104	0.103	0.103	0.102
64	0.101	0.101	0.100	0.099	0.098	0.098	0.097	0.096	0.096	0.095
65	0.094	0.094	0.093	0.092	0.092	0.091	0.090	0.090	0.089	0.088
66	0.088	0.087	0.086	0.086	0.085	0.084	0.084	0.083	0.082	0.082
67	0.081	0.081	0.080	0.079	0.079	0.078	0.078	0.077	0.076	0.076
68	0.075	0.075	0.074	0.074	0.073	0.072	0.072	0.071	0.071	0.070
69	0.070	0.069	0.069	0.068	0.067	0.067	0.066	0.066	0.065	0.065
70	0.064	0.064	0.063	0.063	0.062	0.062	0.061	0.061	0.060	0.060
71	0.059	0.059	0.058	0.058	0.057	0.057	0.056	0.056	0.055	0.055
72	0.054	0.054	0.054	0.053	0.053	0.052	0.052	0.051	0.051	0.050
73	0.050	0.049	0.049	0.049	0.048	0.048	0.047	0.047	0.047	0.046
74	0.046	0.045	0.045	0.044	0.044	0.044	0.043	0.043	0.042	0.042
75	0.042	0.041	0.041	0.041	0.040	0.040	0.039	0.039	0.039	0.038
76	0.038	0.038	0.037	0.037	0.036	0.036	0.036	0.035	0.035	0.035
77	0.034	0.034	0.034	0.033	0.033	0.033	0.032	0.032	0.032	0.031
78	0.031	0.031	0.030	0.030	0.030	0.029	0.029	0.029	0.029	0.028
79	0.028	0.028	0.027	0.027	0.027	0.026	0.026	0.026	0.026	0.025
80	0.025	0.025	0.024	0.024	0.024	0.024	0.023	0.023	0.023	0.023
81	0.022	0.022	0.022	0.022	0.021	0.021	0.021	0.020	0.020	0.020
82	0.020	0.020	0.019	0.019	0.019	0.019	0.018	0.018	0.018	0.018
83	0.017	0.017	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.015
84	0.015	0.015	0.015	0.015	0.014	0.014	0.014	0.014	0.014	0.013
85	0.013	0.013	0.013	0.013	0.012	0.012	0.012	0.012	0.012	0.012
86	0.011	0.011	0.011	0.011	0.011	0.011	0.010	0.010	0.010	0.010
87	0.010	0.010	0.009	0.009	0.009	0.009	0.009	0.009	0.008	0.008
88	0.008	0.008	0.008	0.008	0.008	0.007	0.007	0.007	0.007	0.007
89	0.007	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
90	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
91	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
92	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
93	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
94	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001

* Reprinted with permission from D. B. JUDD, *Color in Science, Business and Industry*, John Wiley & Sons, Inc., New York, 1952, pp. 258-262.

TABLE 35

 R_F VALUES OF 2-AMINO-2-CARBOXYETHYL-2-GUANIDINO-ETHYL HYDROGEN PHOSPHATE (LORMBRICINE) ISOMERS AND RELATED COMPOUNDS(I. M. BEATTY AND D. I. MAGRATH, *J. Am. Chem. Soc.*, 82 (1960) 4983)

- Solvents: S_1 = Acetone-acetic acid-water (2:2:1) (E. E. JONES AND D. LIPKIN, *J. Am. Chem. Soc.*, 78 (1956) 2408).
 S_2 = Methyl ethyl ketone-methyl cellosolve-acetic acid-water (40:15:6:24) (G. PORCELLATI, *J. Neurochem.*, 2 (1958) 128).
 S_3 = Butan-1-ol-acetic acid-water (50:20:30).
 S_4 = Phenol saturated with water (4:1, w/v).
 S_5 = Methyl ethyl ketone-methyl cellosolve-3 N ammonia (2:7:3) (D. C. MORTIMER, *Can. J. Chem.*, 30 (1952) 653).
 S_6 = Methanol-aqueous ammonia (sp. gr. 0.91)-water (60:10:30) (R. S. BANDURSKI AND B. AXELROD, *J. Biol. Chem.*, 193 (1951) 405).
 S_7 = Propan-1-ol-aqueous ammonia (sp. gr. 0.91)-water (60:30:10).
 S_8 = Propan-1-ol-aqueous ammonia (sp. gr. 0.91)-water (73:20:7).
 S_9 = Ethanol-ammonium acetate buffer, pH 7.2 (70:30).

Paper: Whatman No. 1 (ascending).

- Detection: D_1 = Sakaguchi reagent (R. ACHER AND C. CROCKER, *Biochim. Biophys. Acta*, 9 (1952) 704), for guanidino compounds.
 D_2 = α -Naphthol-diacetyl reagent (D. E. GRIFFITHS, J. F. MORRISON AND A. H. ENNOR, *Biochem. J.*, 65 (1957) 612), for guanidino compounds.
 D_3 = 0.25% ninhydrin in water-saturated butan-1-ol, then heating (5-10 min at about 90°), for amino compounds.
 D_4 = Hanes and Isherwood reagent (C. S. HANES AND F. A. ISHERWOOD, *Nature*, 164 (1949) 1107), for phosphates.

Compound	R_F								
	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9
Ethanolamine	0.75	0.58	0.57	0.66	—	—	0.73	0.63	—
Serine	0.53	0.37	0.41	0.35	—	—	0.54	0.34	—
Phosphoethanolamine	0.47	0.30	0.33	0.35	—	—	0.30	0.08	—
Phosphoserine	0.35	0.23	0.26	0.10	—	—	0.26	0.04	—
D, L or DL-Serine ethanol- amine phosphodiester (SEP)	0.19	0.12	0.22	0.28	0.34	0.65	0.37	0.12	0.21
N-Amidinoserine	0.67	0.47	0.49	0.56	0.45	0.51	0.43	0.27	0.49
2-Guanidino-ethanol (HCl)	0.77	0.66	0.63	0.78	0.69- st-0.42	0.42- 0.66 (s)	0.50	0.34	0.74
2-Guanidino-ethyl phosphate	0.57	0.36	0.40	0.57	0.11	0.49	0.21	0.06	0.20
D, L or DL-Synthetic lombricine	0.30	0.15	0.26	0.51	0.29	0.58	0.32	0.11	0.26
Natural lombricine	0.30	0.15	0.27	0.50	0.30	0.60	0.32	0.11	0.26

s = streak; st = streak to.

TABLE 36

R_F VALUES OF FESTUCLAVINE AND CERTAIN OTHER CLAVINE ALKALOIDS FROM
Aspergillus fumigatus FRES.

(J. F. SPILSBURY AND S. WILKINSON, *J. Chem. Soc.*, (1961) 2085)

Solvents: NaCl (8%) in aq. acetic acid (2%).

Paper: Whatman No. 1 (descending).

Length of run: 25.4 cm.

Detection: D_1 = U.V. light.

D_2 = Ehrlich reagent.

Compound	R_F	Colour*	
		D_1	D_2
Fumigaclavine A	0.62	B	B
Fumigaclavine B	0.51	B	B
Festuclavine	0.36	n	B
Pyroclavine	—	n	B
Costaclavine	—	n	B
Lysergine (anhydrofumigaclavine B)	0.25	B	B
Agroclavine	0.40	n	B

* B = blue; n = none.

TABLE 37

R_F VALUES OF CAROTENOID AND CHLOROPHYLL PIGMENTS OF MARINE MICROALGAE

(S. W. JEFFREY, *Biochem. J.*, 80 (1961) 336)

Solvents: S_1 = Fresh 4% (v/v) propan-1-ol in light petroleum (b.p. 60–80°): 1st dimension.

S_2 = Fresh 30% (v/v) chloroform in light petroleum (b.p. 60–80°); cf. E. F. LIND,

H. C. LANE AND L. S. GLEASON, *Plant Physiol.*, 28 (1953) 325; 2nd dimension.

Paper: Whatman No. 3MM (22 cm × 22 cm; ascending; equilibrated with solvent).

Temperature of run: 18–23° (in the dark).

Time of run: 30 min.

Detection: Visible light.

Compound	R_F^*	
	S_1	S_2
Carotenes	0.96	0.96
Chlorophyll <i>a</i>	0.84	0.29
Chlorophyllide <i>a</i>	0.38	0.00
Chlorophyll <i>b</i>	0.65	0.10
Chlorophyll <i>c</i>	0.20	0.00
Esterified astaxanthin	0.87	0.88
Lutein	0.74	0.73
Violaxanthin	0.65	0.48
Neoxanthin	0.32	0.05
Diatoxanthin	0.57	0.60
Diadinoxanthin	0.54	0.44
Dinoxanthin	0.54	0.44
Fucoxanthin	0.49	0.28
Neofucoxanthin A and B	0.49	0.08
Peridinin and neoperidinin	0.51	0.23
Pheophytin <i>a</i>	0.87	0.96
Pheophytin <i>b</i>	0.70	0.89
Pheophytin <i>c</i>	0.00	0.00

* Mean values of pigments isolated from 10 marine algae; values relative rather than absolute (cf. Z. ŠESTÁK, *J. Chromatog.*, 1 (1958) 293).

Isoamylamine	69	77	84	68	87	+	69	24	—	(2)	11	IP:72
n-Amylamine	68	83	87	71	92	+	27	26	—	(11)	12	—
Aniline	94	98 ^b	90	90 ^b	79	+	21	—	—	5	—	—
Arginine	14	26	38	12	20	—	70	26	22	(1)	19	SAKA:18
Atropine	69	81	92	68	86	+++	—	—	—	—	—	IP:35
Benzylamine	63	76	84	68	74	+	33	24	—	(1)	22	IP:72
Betaine	27	32	59	18	44	+	—	—	—	—	—	IP:(24)
Brucine	61	70	77	60	64	+++	7	—	—	—	—	IP:35
n-Butylamine	61	73	83	64	78	+++	69	24	—	(1)	24	—
Caffeine	93	86	85	64	54	++	—	—	—	—	—	UV:+
Canavanine	14	19	36	07	16	—	(52)	26	22	—	24	SAKA:18
N-(2-Chloroethyl)-dibenzylamine (Dibenamine)	86	90	78	93	96	++	—	—	—	—	—	IP:(26)
Choline	31	37	70	26	45	+++	—	—	—	—	—	IP:(71)
Citrulline	16	26	48	11	28	—	69	26	—	1	24	—
Creatine	37	54	57	40	30	+	—	—	22	—	—	—
Creatinine	36	51	71	40	37	—	(26)	—	72	—	—	JAF:9
Cystamine ^c	14	35	44	25	18	+++	31	22	(14)	(1)	24	IP:1
1,4-Diaminobutane	11	25	38	10	18	++	29	26	—	(1)	68	IP:72
1,2-Diaminoethane	13	27	33	04	14	+	18	24	—	(47)	63	IP:72
1,5-Diaminopentane	12	30	44	12	19	++	31	26	—	(2)	41	IP:72
1,3-Diaminopropane	10	26	36	22	15	+	68	24	—	—	19	IP:72
N,N'-Di-(3-aminopropyl)-1,4-diamino- butane (spermine)	02	02	12	43	05	—	26	—	—	—	—	IP:71
Diethanolamine	25	44	70	12	41	+	9	—	—	—	—	UV:+
Diethylamine	55	62	83	58	73	++	17	—	—	—	69	—
2-Dimethylaminoethanol	32	44	71	43	45	+	—	—	—	—	—	—
N-Dimethylaniline	87	99 ^b	97	— ^b	84	+++	—	—	—	—	—	—
Dimethylamine (reference compound)	33	43	70	30	47	+++	11	26	—	—	12	—
N,N-Dimethylguanidine	46	56	76	55 ^d	57	+++	—	—	17	—	—	—
N,N-Dimethylurea	70	73	76	62	74	+	—	—	(24)	(4) ^e	—	—
N,N'-Dimethylurea	62	66	74	61	83	+	—	—	—	(4) ^e	—	—
Diphenylamine	97	99	99	93	99	+++	41	—	—	46	3	UV:+
Ethanolamine	26	41	65	23	35	—	33	26	—	(2)	14	—
Ethylamine	39	50	72	36	50	++	68	24	—	—	2	—
Ethyleneimine	42	56	74	10	52	+	26	24	—	—	9	—
Glucosamine	16	36	49	33	20	—	39	—	—	(1)	19	UV:+

Pyridine-2-carboxylic acid (nicotinic acid)	75	71	78	39	41	+	—	—	—	—	—	—	—
Pyrrolidine	43	53	74	47	58	++	13	—	—	—	—	41	—
Quinine	77	91	97	80	74	++	—	—	—	—	—	—	UV: +; IP: 28
Quinoline	90	43	86	92	69	++	—	—	—	—	—	—	IP: 38
Sparteine	66	93	95	71	61	++	—	—	—	—	—	—	IP: 31
Trigonelline	26	32	54	18	38	+++	—	—	—	—	—	—	IP: 34
Tri- <i>n</i> -amylamine	95	96 ^b	98	95 ^b	98	++	—	—	—	—	—	—	IP: 71
Trimethylamine	30	67	65	55	50	++	—	69	—	—	—	—	—
Trimethylamine N-oxide	43	49	76	23	58	++	11	—	—	—	—	21	—
Trimethylvinylammonium (neurine)	37	41	77	26	47	+++	—	—	—	—	—	—	IP: 34
Tri- <i>n</i> -propylamine	83	89 ^b	98	— ^b	94	++	—	—	—	—	—	—	IP: 72
Tryptamine	62	76	81	67	64	+++	24	18	—	—	22	19	UV: +
Tyramine	55	72	80	67	62	+++	68	69	—	—	(1)	70	NN: 9
Urea	45	49	67	42	56	—	(11)	—	16	—	1	—	—
Yohimbine	78	84	95	86	89	+++	44	—	—	—	—	—	UV: +; IP: 63

* Not specified whether — indicates "negative" or "not tested".

^a Ammonia could only be detected in high concentrations.

^b Pyridine, some tertiary and some aromatic amines are difficult to detect, except at high concentrations, after being run in solvents containing pyridine.

^c Cysteamine gave the same colours and had the same R_F values as cystamine, and it was assumed that it was rapidly oxidized to cystamine after application to the paper.

^d The methylated guanidines always gave two spots in this solvent.

^e The dimethylureas were detectable only in high concentrations.

TABLE 39

 R_F AND RELATIVE R_F VALUES OF SOME TECHOIC ACID HYDROLYSIS PRODUCTS(M. V. KELEMEN AND J. BADDILEY, *Biochem. J.*, 80 (1961) 246)Solvents: S_1 = Propan-1-ol-aq. NH_4OH (sp. gr. 0.88)-water (6:3:1) (C. S. HANES AND F. A. ISHERWOOD, *Nature*, 164 (1949) 1107). S_2 = Butan-1-ol-pyridine-water (6:4:3) (A. JEANES, C. S. WISE AND R. J. DIMLER, *Anal. Chem.*, 23 (1951) 415).Paper: P_1 = Whatman No. 4 (ascending; 2 N CH_3COOH , then water wash). P_2 = Whatman No. 1 (descending).Detection: D_1 = Periodate-Schiff reagents (J. G. BUCHANAN, C. A. DEKKER AND A. G. LONG, *J. Chem. Soc.*, (1950) 3162; J. BADDILEY, J. G. BUCHANAN, R. E. HANDSCHUMACHER AND J. F. PRESCOTT, *J. Chem. Soc.*, (1956) 2818); for α -glycols. D_2 = $HClO_4$ -ammonium molybdate (C. S. HANES AND F. A. ISHERWOOD, *Nature*, 164 (1949) 1107); for phosphates. D_3 = Ninhydrin reagent (R. CONSDEN AND A. H. GORDON, *Nature*, 162 (1948) 180); for amino acids and their amides. D_4 = $AgNO_3$ reagent (W. E. TREVELYAN, D. P. PROCTER AND J. S. HARRISON, *Nature*, 166 (1950) 444); for reducing sugars. D_5 = Aniline phthalate (S. M. PARTRIDGE, *Nature*, 164 (1949) 443); for reducing sugars. D_6 = $FeCl_3$ (K. FINK AND R. M. FINK, *Proc. Soc. Exptl. Biol. Med.*, 70 (1949) 654); for hydroxamates. D_7 = U.V. light.

Compound	R_F S_1P_1	R_G^* S_2P_2
Alanine	0.58	0.40
Glycerol	0.81	1.80
Glycerophosphates	0.34	
Inorganic phosphates	0.16	
Glycerol diphosphates	0.13	
Glucosamine		0.69
Galactose		0.87
Glucose		1.00
Mannose		1.15
Xylose		1.28
Ribose		1.48

* $R_G = R_F$ compound/ R_F glucose.