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A Compilation of Amino Acid Analyses of Proteins

XIX. Residues per Thousand Residues—6

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ABSTRACT

The amino acid analyses of 186 proteins are given as residues per 1000 residues. Additional information as carbohydrate composition, content of uncomon amino acids, and sources of all proteins are also presented.

Index Entries: Protein, amino acid analyses of; analyses, amino acids of proteins; amino acids, analyses of proteins.

INTRODUCTION

An alphabetical list of the 186 proteins and their sources, whose amino acid analyses are given in Table 2, can be found in Table 1. All this information and numerical data were compiled from published literature sources that are cited in the list of references to Table 2. The amino acid

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analyses are given as residues per 1000 residues regardless of how the original data was presented, e.g., mol%. All values have been rounded to the nearest value of ten except for values below 10, where rounding to the nearest tenth has been done. The numerical values for aspartic acid and glutamic acid include any asparagine and glutamine that may have been present prior to hydrolysis. Half-cystine values have been obtained, in many analyses, from cysteic acid values or *S*-carboxymethyl values and methionine values from methionine sulfoxide. Where the analytical data has been corrected to "zero" time hydrolysis, for serine and threonine, it is indicated in the footnotes to Table 2. Table 2 has carbohydrate composition data, numerical data for uncommon amino acids that may be present, and references to other preparations and analyses of similar proteins.

The method used to compile these numerical data has been described (*1*). This paper is part of a continuing compilation of amino acid analyses (*2*).

REFERENCES

1. Kirschenbaum, D. M. (1980), *J. Chem. Info, Comput. Sci.* **20**, 152.
2. Kirschenbaum, D. M. (1983), *Appl. Biochem. Biotech.* **8**, 315.

TABLE 1
Protein Index

No.		
1	Name:	Glycoprotein
	Source:	Carrots (*Daucus carota* cv.) cell wall
2	Name:	Glycoprotein
	Source:	Eel (*Anguilla japonica*)
3	Name:	Glycoprotein
	Source:	*Halobacterium salinarium* cell envelope
4	Name:	Glycoprotein (mw less than 160K)
	Source:	Kidney bean chloroplasts
5	Name:	Glycoprotein (mw 93K)
	Source:	Kidney bean chloroplast
6	Name:	Glycoprotein (mw 38K)
	Source:	Kidney bean chloroplasts
7	Name:	Glycoprotein
	Source:	Runner bean (*Phaseolus coccineus*) cell wall
8	Name:	Glycoprotein
	Source:	*Phaseolus vulgaris* cv. Pinto
9	Name:	Glycoprotein
	Source:	Sponge tissue (*Spongia officinalis*)

(*continued*)

TABLE 1 (*continued*)

10	Name:	Glycoprotein (massive form)
	Source:	Sponge tissue (*Suberites massa*)
11	Name:	Glycoprotein
	Source:	Plasma membrane (*Thermoplasma acidophilum*)
12	Name:	Glycoprotein (PI)
	Source:	Tobacco cells (cell line X D-6S)
13	Name:	Glycoprotein (PII)
	Source:	Tobacco cells (cell line X D-6S)
14	Name:	Glycoprotein (extracellular)
	Source:	Tobacco cells (cell line X D-6S)
15	Name:	Glycoprotein antigen
	Source:	Tobacco leaves (*N. tobacum*)
16	Name:	Glycoprotein
	Source:	*Trypanosoma equiperdum* Bo Tat-1
17	Name:	Glycoprotein
	Source:	*Trypanosoma equiperdum* Bo Tat-2
18	Name:	Glycoprotein
	Source:	*Trypanosoma equiperdum* Bo Tat-78
19	Name:	Glycoprotein
	Source:	*Trypanosoma equiperdum* Bo Tat-100
20	Name:	Glycoprotein
	Source:	*Trypanosoma equiperdum* Bo Tat-28
21	Name:	Glycoprotein
	Source:	Surface coat *Trypanosoma rhodesiense* var. CP3 B4
22	Name:	Glycoprotein
	Source:	Surface coat *Trypanosoma rhodesiense* var. 10
23	Name:	Glycoprotein
	Source:	Surface coat *Trypanosoma rhodesiense* var. 12
24	Name:	Glycoprotein
	Source:	Surface coat *Trypanosoma rhodesiense* var. 13
25	Name:	Glycoprotein (236K)
	Source:	Epstein-Barr virus membrane
26	Name:	Glycoprotein
	Source:	Vesicular stomatitis virus Brazil
27	Name:	Glycoprotein
	Source:	Vesicular stomatitis virus Indiana
28	Name:	Glycoprotein
	Source:	Vesicular stomatitis virus New Jersey
29	Name:	Glycoprotein g2
	Source:	Rous sarcoma virus
30	Name:	Glycoprotein g2
	Source:	Rous sarcoma virus (RAV-1)

(*continued*)

TABLE 1 (*continued*)

31	Name:	Glycoprotein g2
	Source:	Rous sarcoma virus (RAV-2)
32	Name:	Glycoprotein g2
	Source:	Rous sarcoma virus (B 77)
33	Name:	Glycoprotein (sexual inducer)
	Source:	Green alga (*Volvox carteri* str. KA-1)
34	Name:	Glycoprotein
	Source:	Green alga (*Volvox carteri*) sheath
35	Name:	Glycoprotein A
	Source:	Armadillo (*Dasypus novemcinctus mexicanus* Peters)
36	Name:	Glycoprotein B
	Source:	Armadillo (*Dasypus novemcinctus mexicanus* Peters)
37	Name:	Glycoprotein (U-II)
	Source:	Beef heart valve
38	Name:	Glycoprotein (BR)
	Source:	Beef peripheral nerve myelin
39	Name:	Glycoprotein (PAS-II)
	Source:	Beef peripheral nerve myelin
40	Name:	Glycoprotein
	Source:	Beef cervical mucus
41	Name:	Glycoprotein A
	Source:	Beef achilles tendon
42	Name:	Glycoprotein (LGP-1)
	Source:	Beef synovial fluid
43	Name:	Glycoprotein (LGP-II)
	Source:	Beef synovial fluid
44	Name:	Glycoprotein (G2B)
	Source:	Beef cortical cone
45	Name:	Glycoprotein I
	Source:	Beef nasal cartilage
46	Name:	Glycoprotein
	Source:	Beef bone matrix
47	Name:	Glycoprotein
	Source:	Beef tendon
48	Name:	Glycoprotein
	Source:	Beef bone matrix
49	Name:	Glycoprotein
	Source:	Beef tendon
50	Name:	Glycoprotein
	Source:	Beef erythrocyte membrane
51	Name:	Glycoprotein
	Source:	Beef thymocyte membrane

(*continued*)

TABLE 1 (*continued*)

52	Name:	Glycoprotein
	Source:	Beef aortic endothelial cells culture medium
53	Name:	Glycoprotein (Chromogranins)
	Source:	Beef adrenal medulla
54	Name:	Glycoprotein
	Source:	Beef lens capsule
55	Name:	Glycoprotein
	Source:	Beef (calf) tendon
56	Name:	Glycoprotein
	Source:	Beef (calf) cornea
57	Name:	Glycoprotein
	Source:	Beef (calf) cartilage
58	Name:	Glycoprotein
	Source:	Beef (calf) aorta
59	Name:	Glycoprotein
	Source:	Beef (calf) skin
60	Name:	Glycoprotein (Tamm-Horsfall)
	Source:	Beef (calf) Urine
61	Name:	Glycoprotein (GP-1)
	Source:	Beef (calf) thyroid plasma membrane
62	Name:	Glycoprotein (GP-2)
	Source:	Beef (calf) thyroid plasma membrane
63	Name:	Glycoprotein (GP-3)
	Source:	Beef (calf) thyroid plasma membrane
64	Name:	Glycoprotein
	Source:	Dog tracheal mucus
65	Name:	Glycoprotein
	Source:	Dog tracheal mucus
66	Name:	Glycoprotein
	Source:	Dog tracheal mucus
67	Name:	Glycoprotein (A)
	Source:	Dog rib cartilage
68	Name:	Glycoprotein (G)
	Source:	Dog rib cartilage
69	Name:	Glycoprotein
	Source:	African elephant (*Loxodonta africana*) thoracic aorta
70	Name:	Glycoprotein
	Source:	African elephant (*Loxodonta africana*) abdominal aorta
71	Name:	Glycoprotein (type II)
	Source:	Guinea pig testes
72	Name:	Glycoprotein (type III)
	Source:	Guinea pig testes

(*continued*)

TABLE 1 (*continued*)

73	Name:	Glycoprotein
	Source:	Hamster sublingual gland
74	Name:	Glycoprotein (GP-1)
	Source:	Hen's egg vitelline membrane
75	Name:	Glycoprotein
	Source:	Horse erythrocyte membrane
76	Name:	Glycoprotein
	Source:	Horse erythrocyte membrane
77	Name:	Glycoprotein
	Source:	Horse aorta (urea extract)
78	Name:	Glycoprotein
	Source:	Horse aorta (urea extract)
79	Name:	Glycoprotein
	Source:	Human aorta (24 yr old)
80	Name:	Glycoprotein (BGP-1)
	Source:	Human bile
81	Name:	Glycoprotein (Clb)
	Source:	Human bronchial mucus (cystic fibrosis)
82	Name:	Glycoprotein (Ai)
	Source:	Human bronchial mucus (chronic bronchitis)
83	Name:	Glycoprotein
	Source:	Human sputum (chronic bronchitis and asthmatics)
84	Name:	Glycoprotein
	Source:	Human erythrocyte membrane
85	Name:	Glycoprotein
	Source:	Human erythrocyte membrane
86	Name:	Glycoprotein
	Source:	Human erythrocyte membrane
87	Name:	Glycoprotein
	Source:	Human erythrocyte membrane
88	Name:	Glycoprotein (G P-II)
	Source:	Human erythrocyte membrane
89	Name:	Glycoprotein (G P 140)
	Source:	Human fibroblast (cultured)
90	Name:	Glycoprotein
	Source:	Human lung mucosal gel
91	Name:	Glycoprotein
	Source:	Human lung (alveolar proteinosis) secretion
92	Name:	Glycoprotein A_1
	Source:	Human meconium
93	Name:	Glycoprotein B
	Source:	Human meconium

(*continued*)

TABLE 1 (*continued*)

94	Name:	Glycoprotein AB
	Source:	Human meconium
95	Name:	Glycoprotein H
	Source:	Human meconium
96	Name:	Glycoprotein Le^a
	Source:	Human meconium
97	Name:	Glycoprotein (PAS-0)
	Source:	Human milk fat globule membrane
98	Name:	Glycoprotein
	Source:	Human ovarian cyst fluid
99	Name:	Glycoprotein
	Source:	Human parotid saliva
100	Name:	Glycoprotein
	Source:	Human platelet surface
101	Name:	α_2SB-Glycoprotein
	Source:	Human serum
102	Name:	β_2-Glycoprotein-I
	Source:	Human serum
103	Name:	Glycoprotein (HPG-1)
	Source:	Human placenta
104	Name:	Glycoprotein (HPG-2)
	Source:	Human placenta
105	Name:	Glycoprotein (AGP1)
	Source:	Human dentine
106	Name:	Glycoprotein (LAG-A3)
	Source:	Human dentine
107	Name:	Glycoprotein (high-density fraction)
	Source:	Human tracheobronchial secretions
108	Name:	Glycoprotein (low-density fraction)
	Source:	Human tracheobronchial secretions
109	Name:	Glycoprotein (Tamm-Horsfall)
	Source:	Human urine
110	Name:	Glycoprotein
	Source:	Human urine
111	Name:	Glycoprotein (HLA-A9)
	Source:	Human urine
112	Name:	Glycoprotein (HLA-B12)
	Source:	Human urine
113	Name:	Glycoprotein
	Source:	Cell line SKCO-1 surface protein
114	Name:	Glycoprotein
	Source:	Bonnet monkey (*Macaca radiata*) cervical mucus

(*continued*)

TABLE 1 (*continued*)

115	Name:	Glycoprotein
	Source:	Mouse epithelial basement membrane
116	Name:	Glycoprotein (VRS)
	Source:	Mouse erythrocyte membranes
117	Name:	Glycoprotein
	Source:	TA_3 ascites cells (strain A mouse)
118	Name:	Glycoprotein
	Source:	Pig thoracic aorta
119	Name:	Glycoprotein
	Source:	Pig duodenum
120	Name:	Glycoprotein
	Source:	Pig epidermis (ear skin)
121	Name:	Glycoprotein
	Source:	Pig (Hampshire) erythrocytes.
122	Name:	Glycoprotein
	Source:	Pig small-intestinal mucus
123	Name:	Glycoprotein (PO)
	Source:	Rabbit peripheral nerve
124	Name:	Glycoprotein (Tamm-Horsfall)
	Source:	Rabbit urine
125	Name:	Glycoprotein (GM 50-C)
	Source:	Rat brain
126	Name:	Glycoprotein (Thy-1)
	Source:	Rat brain
127	Name:	Glycoprotein (rSGP-4)
	Source:	Rat erythrocyte membrane
128	Name:	Glycoprotein (Band 1-B)
	Source:	Rat inflammation connective tissue
129	Name:	Glycoprotein (GP1)
	Source:	Wistar rat kidney cortex
130	Name:	Glycoprotein (GP2)
	Source:	Wistar rat kidney cortex
131	Name:	Glycoprotein (GP3)
	Source:	Wistar rat kidney cortex
132	Name:	Glycoprotein (GPT)
	Source:	Wistar rat kidney cortex
133	Name:	β_2-Glycoprotein-I
	Source:	Rat serum
134	Name:	Glycoprotein 1
	Source:	Rat stomach mucosa
135	Name:	Glycoprotein 2
	Source:	Rat stomach mucosa

(*continued*)

TABLE 1 (*continued*)

136	Name:	Glycoprotein (Thy-1L+)
	Source:	Rat thymocyte membranes
137	Name:	Glycoprotein (Thy-1L-)
	Source:	Rat thymocyte membranes
138	Name:	Glycoprotein (MAT-B1)
	Source:	Rat ascites mammary adenocarcinoma cells.
139	Name:	Glycoprotein (MAT-C1)
	Source:	Rat ascites mammary adenocarcinoma cells
140	Name:	Glycoprotein
	Source:	Sheep hydatid-cyst fluid
141	Name:	Glycoprotein
	Source:	Squid (*Sepia officinalis*) skin
142	Name:	Glycoprotein
	Source:	*Streptococcus* A cell membrane
143	Name:	Glycoprotein
	Source:	Plasma membrane AH66 cells
144	Name:	Hemagglutinin A
	Source:	Castor bean
145	Name:	Hemagglutinin (light chain)
	Source:	Influenza virus
146	Name:	Hemagglutinin (heavy chain)
	Source:	Influenza virus
147	Name:	Hemocyanin (chain e)
	Source:	Spider (*Eurypelma californicum*)
148	Name:	Hemocyanin (α chain)
	Source:	*Tachypleus tridentatus*
149	Name:	Hemocyanin (ζ chain)
	Source:	*Tachypleus tridentatus*
150	Name:	Hemocyanin
	Source:	Centipede (*Scutigera longicornis*) hemolymph
151	Name:	Hemoglobin
	Source:	Crustacean (*Lepidurus bilobatus*)
152	Name:	Hemoglobin
	Source:	*Lepidurus lynchi*
153	Name:	Hemoglobin
	Source:	*Caenestheriella setosa*
154	Name:	Hemoglobulin
	Source:	Snapping turtle (*Macroclemys temminckii*)
155	Name:	Hemoglobin
	Source:	Emydid turtle (*Clemmys caspica* = *Emys caspica*)
156	Name:	Hemoglobin
	Source:	American alligator (*Alligator mississippiensis*)

(*continued*)

TABLE 1 (*continued*)

157	Name:	Hemoglobin
	Source:	Common iguana (*Iguana iguana*)
158	Name:	Hemoglobin
	Source:	Water snake (*Natrix rhombifera*)
159	Name:	Hemoglobin F1
	Source:	Hagfish (*Eptatretus burgeri*)
160	Name:	Hemoglobin F2
	Source:	Hagfish (*Eptatretus burgeri*)
161	Name:	Hemoglobin F3
	Source:	Hagfish (*Eptatretus burgeri*)
162	Name:	Hemoglobin F4
	Source:	Hagfish (*Eptatretus burgeri*)
163	Name:	Hemoglobin
	Source:	Garlic worms (*Travis foetida*) vascular
164	Name:	Hemoglobin
	Source:	Garlic worms (*Travis foetida*) coelomic cell
165	Name:	Hemoglobin
	Source:	Deep sea worm (*Vestimentifera*)
166	Name:	Hemoglobin (A1) β-chain
	Source:	Rabbit
167	Name:	Hemoglobin (A2) β-chain
	Source:	Rabbit
168	Name:	Hemoglobin
	Source:	Duck
169	Name:	Hemoglobin
	Source:	Mouse
170	Name:	Hemozoin
	Source:	*Plasmodium lophurae*
171	Name:	Hemozoin
	Source:	*Plasmodium berghei*
172	Name:	High-mobility group protein (HMG-1)
	Source:	Mouse neuroblastoma cell
173	Name:	High-mobility group protein (HMG 2)
	Source:	Mouse neuroblastoma cell
174	Name:	Histaminase (EC 1.4.3.6)
	Source:	Pig kidney
175	Name:	Histidine-rich protein
	Source:	Human epidermis
176	Name:	Histidine-rich protein
	Source:	Guinea-pig skin

(*continued*)

TABLE 1 (*continued*)

177	Name:	Histidine-rich polypeptide
	Source:	Malarial parasite (*Plasmodium lophurae*)
178	Name:	Histidine-rich protein
	Source:	Newborn rat skin
179	Name:	Hordein polypeptide B1
	Source:	Barley endosperm (*Hordeum vulgare*)
180	Name:	Hordein polypeptide C2
	Source:	Barley endosperm (*Hordeum vulgare*)
181	Name:	Hyaluronic acid
	Source:	Human lung washings
182	Name:	3-Hydroxy-3-methylglutaryl coenzyme A reductase
	Source:	Rat liver microsomes
183	Name:	3-Hydroxy-3-methylglutaryl coenzyme A reductase
	Source:	Rat liver microsomes
184	Name:	Hydroxynitril lyase (EC4.1.2.1U)
	Source:	*Maloideae communis*
185	Name:	Hydroxyproline-rich protein
	Source:	*Staphylococcus aureus* capsule
186	Name:	Hypoxanthine/guanine phosphoribosyltransferase (EC 2.4.2.8)
	Source:	Human erythrocytes

TABLE 2
Amino Acid Analyses Residues per 1000 Residues

Amino acid	Residues per 1000 residues					
Protein Index No.:	**1**	**2**	**3**	**4**	**5**	**6**
Glycine	120	62	92	133	138	114
Alanine	67	45	64	140	112	66
Valine	42	75	80	108	41	33
Leucine	22	41	51	182	142	76
Isoleucine	16	48	44	85	84	52
Proline	28	92	44	4	37	21
Serine	188	92	105	69	70	86
Threonine	35	183	95	56	55	45
Aspartic acid	57	69	212	6	3	16
Glutamic acid	88	108	120	39	50	84
Half-cystine	—	19	—	—	—	—
Methionine	3	15	9	—	—	—
Lysine	122	56	16	33	77	43
Arginine	10	28	21	—	—	—
Histidine	56	15	4	tr[4]	9	tr[4]
Phenylalanine	9	30	17	85	182	323
Tyrosine	36	18	26	4	tr[4]	41
Tryptophan	—	—	—	—	—	—
Amide ammonia	—[1]	—[2]	—[3]	—	—	—
Ref. No.	*1*	*2*	*3*	*4*	*4*	*4*

(*continued*)

TABLE 2 (*continued*)

Residues per 1000 residues							
7	**8**	**9**	**10**	**11**	**12**	**13**	**14**
45	80	93	90	96	84	81	58
37	110	87	78	81	141	148	213
44	70	76	69	75	49	64	55
25	100	67	76	83	96	33	19
15	40	56	60	58	21	20	9
70	50	49	48	11	54	32	53
139	70	56	57	103	118	120	148
37	50	67	66	82	73	105	93
50	60	109	111	112	47	43	33
78	90	97	101	75	74	60	53
—	—	13	12	—	ND[10]	ND[10]	ND[10]
—	10	26	23	5	3	2	5
75	80	37	57	43	29	32	21
14	40	48	45	39	14	11	ND[10]
0	20	14	22	14	41	23	tr[4]
14	30	45	47	50	20	19	ND[10]
9	20	29	38	70	17	9	tr[4]
—	30	—	—	—	—	—	—
—[5]	—[6]	—[7]	—[8]	—[9]	—[11]	—[12]	—[13]
5	*6*	*7*	*7*	*8*	*9*	*9*	*10*

(*continued*)

TABLE 2 (*continued*)

Amino acid	Residues per 1000 residues					
Protein Index No.:	**15**	**16**	**17**	**18**	**19**	**20**
Glycine	120	84	78	78	90	93
Alanine	69	154	142	135	123	148
Valine	49	30	33	39	35	43
Leucine	49	105	73	62	57	42
Isoleucine	46	23	35	29	28	34
Proline	73	31	36	30	55	34
Serine	86	72	84	64	65	67
Threonine	48	89	108	110	102	107
Aspartic acid	98	138	102	111	125	106
Glutamic acid	107	101	112	128	113	125
Half-cystine	64	10	18	24	22	25
Methionine	22	—	4.6	1.8	3.4	—
Lysine	58	86	86	105	98	94
Arginine	25	29	30	23	21	27
Histidine	23	8.5	21	15	25	9.1
Phenylalanine	29	20	14	27	16	27
Tyrosine	31	21	24	19	23	21
Tryptophan	—	—	—	—	—	—
Amide ammonia	—[14]	—[15]	—	—[16]	—	—[17]
Ref. No.	*11*	*12*	*12*	*12*	*12*	*12*

(*continued*)

TABLE 2 (*continued*)

Residues per 1000 residues							
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**
81	75	79	86	73	86	78	88
135	142	139	140	78	60	59	36
31	33	31	39	63	73	66	71
84	85	85	69	94	73	74	65
32	38	44	35	39	54	70	82
—	—	—	—	75	48	54	64
71	86	65	73	72	88	98	81
84	108	105	95	98	66	65	76
91	106	102	107	99	99	97	88
135	93	120	115	110	110	91	99
14	13	14	26	16	26	25	12
9	ND[10]	ND[10]	ND[10]	11	15	17	14
107	108	108	106	49	45	54	65
33	29	28	28	35	39	35	33
33	22	35	17	17	25	28	34
26	38	24	35	38	53	55	53
36	24	18	31	30	41	36	43
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
13	*13*	*13*	*13*	*14*	*15*	*15*	*15*

(*continued*)

TABLE 2 (*continued*)

Amino acid	Residues per 1000 residues					
Protein Index No.:	**29**	**30**	**31**	**32**	**33**	**34**
Glycine	93	86	78	73	339	180
Alanine	52	50	66	66	62	80
Valine	54	51	75	73	45	58
Leucine	83	81	82	88	67	43
Isoleucine	39	41	34	32	29	22
Proline	70	66	55	63	35	39
Serine	85	84	89	95	67	80
Threonine	76	72	68	68	79	80
Aspartic acid	113	95	89	91	87	94
Glutamic acid	117	98	106	109	53	36
Half-cystine	—	35	26	38	—	—
Methionine	13	69	38	25	12	7
Lysine	37	50	59	54	34	29
Arginine	45	55	51	43	36	29
Histidine	28	16	19	18	4	7
Phenylalanine	51	34	39	39	24	15
Tyrosine	45	19	28	27	17	22
Tryptophan	—	—	—	—	—	—
Amide ammonia	—[18]	—[19]	—[20]	—[21]	—	—
Ref. No.	*16*	*17*	*17*	*17*	*18*	*18*

(*continued*)

TABLE 2 (*continued*)

Residues per 1000 residues							
35	**36**	**37**	**38**	**39**	**40**	**41**	**42**
144	142	129	101	84	66	57	21
60	69	55	64	68	92	75	89
132	94	59	86	80	77	72	16
3	25	79	75	112	38	83	14
2	15	39	43	48	14	33	14
0	23	68	37	20	110	67	246
196[23]	158[23]	52	68	102	116	63	50
355[23]	243[23]	44	62	68	233	65	226
7	50	129	86	66	45	107	36
99	114	133	84	85	74	122	129
—	—	6.6	9	10	29	41	—
—[22]	—[22]	8.7	12	24	9.6	9	2
1	28	44	87	66	16	71	131
2	14	50	68	40	35	44	14
—[22]	—[22]	26	31	28	10	21	2
0	1.0	31	36	63	19	38	5
0	tr[4]	18	55	37	14	32	5
0	1.2	—	—[25]	—[26]	—	—	—
—	—	—[24]	86	133	—[27]	—[28]	—[29]
19	*19*	*20*	*22*	*22*	*23*	*24*	*25*

(*continued*)

TABLE 2 (*continued*)

	Residues per 1000 residues					
Protein Index No.:	**43**	**44**	**45**	**46**	**47**	**48**
Glycine	54	71	57	110	135	110
Alanine	77	86	72	69	70	73
Valine	52	86	74	49	44	41
Leucine	94	90	91	80	72	75
Isoleucine	42	42	28	32	29	24
Proline	40	77	73	67	79	79
Serine	56	*68*	63	77	68	62
Threonine	63	60	59	49	45	37
Aspartic acid	83	104	108	113	124	126
Glutamic acid	144	124	129	133	127	145
Half-cystine	29	21	24	21	21	20
Methionine	13	3.5	7	13	12	9
Lysine	100	37	87	42	36	46
Arginine	49	42	34	43	41	57
Histidine	25	22	23	28	26	23
Phenylalanine	40	40	41	36	36	35
Tyrosine	41	26	33	37	37	37
Tryptophan	—	—	—	—	—	—
Amide ammonia	—[30]	—[31]	—[32]	—[33]	—[33]	—[34]
Ref. No.	*37*	*28*	*29*	*30*	*30*	*30*

(*continued*)

TABLE 2 (*continued*)

Residues per 1000 residues							
49	**50**	**51**	**52**	**53**	**54**	**55**	**56**
139	71	300	92	82	131	130	105
78	65	46	58	90	49	63	70
52	65	23	50	35	47	56	86
84	54	33	69	76	61	66	97
34	46	32	35	9	53	34	47
54	118	43	63	93	65	141	57
71	102	115	71	73	65	49	59
49	121	74	58	24	65	35	54
107	54	91	158	75	134	82	102
111	135	107	111	252	131	94	113
14	9	1	42	—	—	19	15
16	18	—	12	12	17	5	11
41	31	47	41	73	46	35	44
60	69	34	47	62	51	48	60
25	13	18	24	17	20	16	16
36	17	20	42	15	33	34	38
28	13	18	27	12	37	16	17
—	—	—	—	—	—	—	—
—[34]	—[35]	—[36]	—	—[37]	—[38]	—[39]	—[40]
30	*31*	*32*	*33*	*34*	*36*	*37*	*37*

(*continued*)

TABLE 2 (*continued*)

Amino acid	Residues per 1000 residues					
Protein Index No.:	**57**	**58**	**59**	**60**	**61**	**62**
Glycine	125	80	82	91	94	62
Alanine	102	92	72	68	66	71
Valine	65	67	67	70	58	93
Leucine	95	97	92	92	55	79
Isoleucine	44	55	48	30	16	34
Proline	44	50	90	25	55	56
Serine	56	61	57	77	157	94
Threonine	55	64	49	68	150	140
Aspartic acid	91	91	107	103	102	128
Glutamic acid	102	130	106	98	100	49
Half-cystine	8	15	10	79	3	3
Methionine	11	9.8	17	13	5	9
Lysine	68	67	59	35	54	37
Arginine	52	53	52	46	29	56
Histidine	34	23	17	26	23	14
Phenylalanine	31	35	35	37	22	47
Tyrosine	21	17	24	41	11	29
Tryptophan	—	—	—	—	—	—
Amide ammonia	—[41]	—[42]	—[43]	—[44]	—[45]	—[46]
Ref. No.	*37*	*37*	*37*	*38*	*39*	*39*

(*continued*)

TABLE 2 (*continued*)

Residues per 1000 residues							
63	**64**	**65**	**66**	**67**	**68**	**69**	**70**
57	80	99	87	98	86	124	160
116	52	41	87	67	76	105	100
93	71	90	80	68	69	74	51
25	84	160	84	94	96	79	74
19	40	54	30	44	51	47	44
113	106	80	79	63	54	67	78
155	140	86	72	56	51	47	46
123	160	80	72	52	50	47	46
86	54	98	105	123	104	86	94
61	96	99	107	116	124	119	121
1	11	11	59	25	16	10	9
7	2.9	4.7	6.5	10	14	17	11
66	28	36	40	50	68	51	50
22	26	9.0	26	54	54	43	45
33	17	23	21	21	22	18	19
17	20	19	32	36	38	36	31
8	11	8.7	13	26	26	29	21
—	—	—	—	—	—	—	—
—[47]	—[48]	—[49]	—[50]	—[51]	—[52]	—[53]	—[53]
39	*40*	*40*	*40*	*41*	*41*	*42*	*42*

(*continued*)

TABLE 2 (*continued*)

	Residues per 1000 residues					
Protein Index No.:	**71**	**72**	**73**	**74**	**75**	**76**
Glycine	183	74	104	30	60	81
Alanine	67	50	85	49	111	95
Valine	31	57	46	70	67	64
Leucine	62	80	37	87	85	76
Isoleucine	27	16	21	45	41	51
Proline	102	166	89	75	124	109
Serine	107	80	159[56]	60	97	96
Threonine	76	104	205[56]	54	109	97
Aspartic acid	57	52	44	126	83	80
Glutamic acid	93	113	96	108	99	88
Half-cystine	40	—	17	38	9	6.3
Methionine	13	17	—	3.6	7	7.8
Lysine	62	46	42	22	16	23
Arginine	31	15	24	99	47	42
Histidine	6	39	10	45	12	12
Phenylalanine	22	46	10	60	19	50
Tyrosine	13	45	10	31	14	19
Tryptophan	5	0	—	—	—	—
Amide ammonia	—[54]	—[55]	—[57]	—[58]	—[59]	—[60]
Ref. No.	*43*	*43*	*44*	*45*	*31*	*46*

(*continued*)

TABLE 2 (*continued*)

Residues per 1000 residues							
77	**78**	**79**	**80**	**81**	**82**	**83**	**84**
265	101	97	70	77	82	79	85
32	90	76	51	98	103	82	81
82	78	67	55	41	42	50	100
61	84	88	67	41	45	58	86
31	46	43	41	22	24	30	47
92	64	61	64	117	104	130	27
51	57	65	99	166	158	121	116
45	59	52	92	299	266	176	90
192	93	101	117	24	32	73	89
0	111	125	118	31	47	73	110
0	25	14	15	tr[d]	6	11	—
0	tr[d]	18	0	7	—	1	1.4
50	60	50	23	20	24	21	51
36	45	50	22	18	26	43	40
17	22	21	8	29	25	12	36
25	35	40	14	6	11	23	25
20	33	36	31	5	7	17	16
—	—	—	—	—	—	—	—
—[61]	—[62]	—[63]	—[64]	—[65]	—[66]	—[67]	—[68]
47	*47*	*48*	*49*	*50*	*50*	*51*	*52*

(*continued*)

TABLE 2 (*continued*)

	Residues per 1000 residues					
Protein Index No.:	**85**	**86**	**87**	**88**	**89**	**90**
Glycine	63	55	51	111	134	71
Alanine	69	63	60	111	59	76
Valine	82	74	75	69	60	42
Leucine	82	73	55	83	79	38
Isoleucine	71	61	67	44	44	17
Proline	66	65	79	49	69	128
Serine	105	122	135	63	71	169
Threonine	103	116	112	61	70	232
Aspartic acid	56	66	60	90	103	40
Glutamic acid	95	98	112	106	116	43
Half-cystine	—	—	7.0	7.0	25	13
Methionine	16	12	17	25	11	6.0
Lysine	47	41	43	56	34	*32*
Arginine	56	49	48	44	24	35
Histidine	39	43	41	21	16	20
Phenylalanine	24	29	15	38	32	22
Tyrosine	26	26	25	21	26	16
Tryptophan	—	6[70]	—	—	ND[10]	—
Amide ammonia	—[69]	195	—[71]	—[72]	—[73]	—[74]
Ref. No.	*53*	*54*	*31*	*55*	*59*	*60*

(*continued*)

TABLE 2 (*continued*)

Residues per 1000 residues							
91	**92**	**93**	**94**	**95**	**96**	**97**	**98**
149	39	42	41	44	40	122	61
63	65	74	79	77	67	130	87
68	42	39	41	41	43	53	64
92	32	24	24	29	29	37	59
41	29	23	25	24	25	10	28
71	119	131	128	126	111	120	95
56	228	230	234	220	249	131	106
53	320	341	336	328	319	98	161
98	20	17	19	26	24	64	70
118	36	27	28	34	36	83	87
15	—	—	—	—	—	5	30
15	—	—	—	—	—	8	3
38	14	10	10	12	9	22	41
46	10	14	11	14	12	39	34
22	27	22	20	20	21	38	23
32	15	6	4	7	—	17	30
33	5	0	0	0	3	16	21
—	—	—	—	—	—	—	—
[75]	[76]	[77]	[78]	[79]	[80]	[81]	[82]
61	*63*	*63*	*63*	*63*	*63*	*64*	*66*

(*continued*)

TABLE 2 (*continued*)

	Residues per 1000 residues					
Protein Index No.:	**99**	**100**	**101**	**102**	**103**	**104**
Glycine	177	29	107	95	102	56
Alanine	20	14	48	58	113	151
Valine	19	14	53	49	69	99
Leucine	20	33	50	57	114	91
Isoleucine	12	9	33	34	25	8.8
Proline	269	31	88	90	65	113
Serine	66	37	91	101	78	53
Threonine	15	39	91	71	38	67
Aspartic acid	55	34	91	80	59	82
Glutamic acid	224	25	127	94	118	126
Half-cystine	0	ND[10]	21	—	51	37
Methionine	0	ND[10]	21	11	4.2	—
Lysine	5	30	36	86	6.7	44
Arginine	46	16	53	32	51	13
Histidine	12	12	28	17	34	12
Phenylalanine	8	21	22	46	24	36
Tyrosine	9	9	38	44	30	10
Tryptophan	—	—	—	—	20	1.4
Amide ammonia	—[83]	—[84]	—[85]	—	—[86]	—[87]
Ref. No.	*67*	*70*	*71*	*72*	*73*	*73*

(*continued*)

TABLE 2 (*continued*)

Residues per 1000 residues							
105	**106**	**107**	**108**	**109**	**110**	**111**	**112**
88	181	91	104	84	34	102	85
38	107	96	96	68	42	67	56
32	59	44	55	64	37	55	84
30	35	52	63	76	68	66	64
14	19	33	34	25	45	54	65
65	34	120	87	43	87	55	60
190	114	127	110	79	29	83	63
34	49	210	112	76	88	75	88
244	199	46	72	109	134	88	95
153	123	63	82	84	174	119	116
—	—	—	—	84	13	—	—
5	3	3	10	21	2.7	tr[d]	17
37	38	26	45	27	104	84	59
27	15	35	43	45	36	54	49
15	9	26	27	27	11	29	23
13	9	10	33	31	35	32	34
14	5	10	28	38	39	31	37
—	—	—	—	17	12	—	—
—[88]	—[89]	—[90]	—[91]	—[92]	—[93]	—	—
74	*74*	*75*	*75*	*78*	*79*	*80*	*80*

(*continued*

TABLE 2 (*continued*)

	Residues per 1000 residues					
Protein Index No.:	**113**	**114**	**115**	**116**	**117**	**118**
Glycine	80	87	82	46	175	291
Alanine	70	89	78	71	101	192
Valine	55	54	58	29	39	128
Leucine	76	65	100	—	31	62
Isoleucine	39	43	48	21	19	20
Proline	65	66	57	94	31	126
Serine	129	120	73	94	137	12
Threonine	85	220	63	63	113	14
Aspartic acid	110	53	103	103	143	8.4
Glutamic acid	96	72	90	52	137	18
Half-cystine	8.4	19	20	—	27	17
Methionine	tr[d]	—	8.8	—	6	1.9
Lysine	59	27	71	—	17	11
Arginine	38	25	44	—	17	14
Histidine	25	18	21	—	5	9.3
Phenylalanine	29	23	51	—	2	44
Tyrosine	35	19	37	—	2	17
Tryptophan	—	—	—	—	—	—
Amide ammonia	—[94]	—[95]	—[96]	—[97]	—[98]	—[99]
Ref. No.	*81*	*82*	*83*	*85*	*86*	*47*

(*continued*)

TABLE 2 (*continued*)

Residues per 1000 residues							
119	**120**	**121**	**122**	**123**	**124**	**125**	**126**
85	74	88	56	100	86	121	60
79	70	99	38	65	49	76	33
83	69	61	72	89	70	49	73
108	91	77	43	74	80	54	104
61	47	54	31	44	31	45	39
52	63	112	154	46	40	9.8	36
64	85	124	104	69	81	69	74
61	67	76	265	43	90	81	76
93	99	44	46	89	102	133	127
82	98	118	42	90	98	167	91
10	7	8.7	43	16	91	—	31
31	14	6.0	13	12	15	—	11
70	55	31	22	90	21	72	69
38	46	40	22	70	38	75	75
28	27	14	14	25	28	8.1	41
50	44	30	20	39	35	40	40
6.1	33	14	15	44	34	11	20
—	—	—	—	ND[10]	14	—	—
—[100]	—[101]	—[102]	—[103]	—[104]	—	—	—[105]
87	*88*	*46*	*89*	*90*	*93*	*94*	*95*

(*continued*)

TABLE 2 (*continued*)

	Residues per 1000 residues					
Protein Index No.:	**127**	**128**	**129**	**130**	**131**	**132**
Glycine	20	244	92	116	42	88
Alanine	137	72	78	89	102	51
Valine	102	54	76	70	96	68
Leucine	83	22	78	79	104	73
Isoleucine	5	10	56	51	80	46
Proline	117	50	54	tr[4]	94	22
Serine	157	82	69	63	39	62
Threonine	130	17	72	62	21	66
Aspartic acid	74	130	95	96	98	142
Glutamic acid	44	129	89	109	132	138
Half-cystine	0	5	tr[4]	tr[4]	25	19
Methionine	0	19	20	tr[4]	4.9	10
Lysine	26	16	32	85	45	70
Arginine	33	10	33	61	39	44
Histidine	62	4	14	33	20	17
Phenylalanine	1	22	53	44	45	57
Tyrosine	8	51	50	34	2.1	38
Tryptophan	—	18	—[108]	—[108]	—[108]	—
Amide ammonia	—[106]	—[107]	—[109]	—[110]	—[111]	—[112]
Ref. No.	*96*	*97*	*98*	*98*	*98*	*98*

(*continued*)

TABLE 2 (*continued*)

Residues per 1000 residues							
133	**134**	**135**	**136**	**137**	**138**	**139**	**140**
79	112	145	49	50	89	89	57
61	54	61	29	32	58	57	73
76	47	36	74	74	58	62	44
55	49	48	112	111	65	60	36
34	31	27	41	40	23	23	16
24	35	38	38	30	69	72	121
62	118	146	71	79	153	161	142
82	131	154	86	83	176	175	190
83	95	84	126	130	61	58	90
100	132	107	91	91	133	134	112
63	42	12	32	32	—	—	—
15	7.3	6.9	9	8	—	7	9
92	58	40	72	70	28	22	53
15	35	23	75	72	37	35	16
15	36	31	38	40	23	22	41
61	21	25	37	38	19	16	—
49	20	10	20	20	10	8	—
33	—	—	—	—	—	—	—
—	—[113]	—[114]	—	—	—[115]	—[116]	—[117]
99	*100*	*100*	*95*	*95*	*101*	*101*	*102*

(*continued*)

TABLE 2 (*continued*)

	Residues per 1000 residues					
Protein Index No.:	**141**	**142**	**143**	**144**	**145**	**146**
Glycine	85	83	54	73	106	85
Alanine	67	133	46	71	56	55
Valine	48	56	39	57	60	60
Leucine	74	86	52	90	96	89
Isoleucine	62	60	29	68	60	66
Proline	50	36	47	62	5	46
Serine	69	44	69	77	78	92
Threonine	64	50	69	80	45	72
Aspartic acid	129	105	71	128	139	117
Glutamic acid	128	134	79	101	133	113
Half-cystine	—	15	12	—	11	15
Methionine	*12*	14	13	12	8	5
Lysine	64	85	38	27	80	58
Arginine	31	35	25	66	27	43
Histidine	22	15	13	14	16	20
Phenylalanine	45	35	24	38	43	33
Tyrosine	26	16	19	36	36	34
Tryptophan	—	—	—	—	—	—
Amide ammonia	—[118]	—	—[118]	—	—	—[119]
Ref. No.	*103*	*104*	*105*	*107*	*108*	*108*

(*continued*)

TABLE 2 (*continued*)

Residues per 1000 residues							
147	**148**	**149**	**150**	**151**	**152**	**153**	**154**
95	66	63	71	84	74	70	100
67	50	51	71	114	124	114	59
52	71	62	54	80	85	94	89
74	89	95	51	104	122	120	130
35	58	56	36	35	40	36	14
42	46	52	58	27	24	34	—
66	52[120]	57[120]	—	71[120]	67	44	50
50	*53*[120]	48[120]	70	88[120]	63	54	—
130	117	123	105	94	109	124	—
119	108	112	123	97	104	105	125
—	15	—	—[121]	13	1	1	—
30	24	27	*42*	9	8	8	8
51	66	52	31	35	43	59	95
56	50	56	36	48	49	35	26
42	62	71	54	24	33	41	116
49	53	49	50	54	44	52	62
40	31	45	51	23	10	13	22
—	—	—	11	9	8	8	—
—	—	—	—	—	—	—	—
109	*110*	*110*	*111*	*112*	*113*	*113*	*114*

(*continued*)

TABLE 2 (*continued*)

	Residues per 1000 residues					
Protein Index No.:	**155**	**156**	**157**	**158**	**159**	**160**
Glycine	55	63	93	108	30	33
Alanine	100	114	107	81	42	41
Valine	95	92	97	81	47	47
Leucine	126	101	121	130	93	91
Isoleucine	37	22	6	16	99	104
Proline	30	6	7	2	50	44
Serine	74	72	23	57	91[120]	88[120]
Threonine	62	8	61	36	35[120]	35[120]
Aspartic acid	79	77	118	96	103	107
Glutamic acid	90	96	73	89	124	131
Half-cystine	—	—	—	—	12	12
Methionine	4	18	10	5	7.8	7.0
Lysine	72	83	73	74	123	124
Arginine	26	43	50	37	16	15
Histidine	74	108	66	98	15	14
Phenylalanine	53	77	62	59	67	68
Tyrosine	25	26	27	25	27	26
Tryptophan	—	—	—	—	13	13
Amide ammonia	—	—	—	—	—	—
Ref. No.	*114*	*114*	*114*	*114*	*115*	*115*

(*continued*)

TABLE 2 (*continued*)

Residues per 1000 residues							
161	**162**	**163**	**164**	**165**	**166**	**167**	**168**
34	52	101	67	79	103	108	60
55	91	112	116	114	145	149	132
56	82	69	57	76	153	162	87
114	84	122	109	83	172	169	126
62	52	28	43	45	12	6.6	45
54	40	35	34	39	45	43	45
85[120]	66[120]	51	38	64	88	89	21
21[120]	45[120]	29	45	41	59	50	41
106	83	108	126	120	116	117	89
118	106	101[122]	67[122]	100	127	136	82
14	8.2	16	9	28	—	—	—
20	29	19	11	tr[d]	9.0	8.8	12
90	85	67	82	40	111	108	71
43	53	40	32	59	31	31	36
12	24	40	52	40	97	99	69
84	50	55	75	46	84	84	61
20	34	6	28	19	32	23	23
14	18	—	—	—	—	—	—
—	—	—	—	—[123]	—[124]	—[124]	—
115	*115*	*116*	*116*	*117*	*118*	*118*	*119*

(*continued*)

TABLE 2 (*continued*)

	Residues per 1000 residues					
Protein Index No.:	**169**	**170**	**171**	**172**	**173**	**174**
Glycine	85	68	85	62	75	78
Alanine	139	81	83	102	102	72
Valine	87	57	74	25	20	70
Leucine	97	88	95	22	24	95
Isoleucine	56	76	54	12	14	40
Proline	34	44	48	94	97	67
Serine	69	34	44	53	60	58
Threonine	41	37	46	24	21	55
Aspartic acid	103	105	92	112	101	84
Glutamic acid	53	100	110	173	179	122
Half-cystine	9.3	—	11	—	—	15
Methionine	9.3	12	22	24	20	18
Lysine	81	89	73	191	196	42
Arginine	23	54	54	39	15	51
Histidine	71	86	25	13	21	29
Phenylalanine	46	42	41	31	31	51
Tyrosine	33	35	31	23	23	41
Tryptophan	—	—	—	—	—	12
Amide ammonia	—	—[125]	—[125]	—	—	—[126]
Ref. No.	*119*	*119*	*119*	*120*	*120*	*121*

(continued)

TABLE 2 (*continued*)

Residues per 1000 residues						
175	**176**	**177**	**178**	**179**	**180**	**181**
168	97	4.6	118	38	12	123
101	—[127]	69	84	30	10	66
18	4	4	26	61	16	75
16	6	11	37	88	52	29
12	4	8.3	28	41	37	28
—	123	76	52	168	274	61
60	131	0.2	116	29	21	113
107	3	2.2	55	18	12	101
154	—[127]	21	71	15	12	142
120	327	60	106	342	411	122
—	—	—	—	28	9	28
—	—	tr[4]	11	11	6	11
13	9	—	64	10	2	10
100	—[127]	—	95	28	17	29
83	—[127]	728	72	16	7	19
6	2	12	22	47	80	19
43	2	5.9	43	25	25	23
—	—	—	—	—	—	—
—	—	—	—	—	—	—[128]
122	*123*	*124*	*125*	*126*	*126*	*127*

(*continued*)

TABLE 2 (*continued*)

	Residues per 1000 residues				
Protein Index No.:	**182**	**183**	**184**	**185**	**186**
Glycine	100	81	116	134	40
Alanine	111	84	58	95	39
Valine	65	59	17	153	78
Leucine	101	90	65	73	88
Isoleucine	50	44	5	28	42
Proline	54	55	187	tr[4]	35
Serine	68	70	127	30	49[120]
Threonine	53	50	34	30	51[120]
Aspartic acid	90	96	91	126	128
Glutamic acid	113	150	40	119	93
Half-cystine	7.4	—	4	—	17
Methionine	22	14	103	—	22
Lysine	54	66	20	tr[4]	81
Arginine	52	56	14	—	69
Histidine	16	21	29	tr[4]	28
Phenylalanine	16	30	26	tr[4]	57
Tyrosine	27	28	19	—	53
Tryptophan	—	—	—	—	31
Amide ammonia	—	—	—[129]	—[130]	—
Ref. No.	*128*	*129*	*130*	*131*	*132*

[1]103 residues of hydroxyproline.

[2]Carbohydrate composition expressed as molar ratio to *N*-acetylgalactosamine:*N*-acetylneuraminic acid, 1.01; galactose plus mannose, 0.14; fucose, trace.

[3]Carbohydrate composition as μmol/100 mg: hexose, 41.7; amino sugar, 8.6.

[4]tr = traces.

[5]35.3 residues of hydroxyproline. Carbohydrate composition in mol per 100 mol monosaccharides: rhamnose, 3.4; arabinose, 46.1; xylose, 1.3; mannose, 0; galactose, 16.6; glucose, 2.5, galacturonic acid, 30.1. This is the analysis of the chlorite-soluble glycoprotein. Analyses for depectinated cell-wall material, insoluble residue after chlorite extraction, and three DEAE-Sephadex separated fractions can be found in ref. 5, Tables 1 and 3.

[6]60 residues of hydroxyproline. Carbohydrate composition in percent: arabinose, 52; mannose, 3; galactose, 14; glucose, 31. This is the analysis for the glycoprotein isolated from peak 1 of Sephadex G-200 chromatography. The analyses of other glycoprotein fractions isolated by other methods of solubilization and extraction can be found in ref. 6, Tables 1–5 and 7–8.

[7]This is the analysis of peak I fraction from Sephadex-G-200. The analyses of peak II and peak III material can be found in Table 1 of ref. *7*.

[8]The analysis of the "digitated" form can be found in Table 1 of ref. *7*.

[9]Carbohydrate composition as μmol/mg: mannose, 52.1; glucose, 5.1; galactose, 2.5; glucosamine, 1.3.

[10]ND = not detected.

[11]118 residues of hydroxyproline. Carbohydrate composition as relative content of compound (%): galactose, 41.8; arabinose, 34.5; rhamnose, 4.4; uronic acid, 13.0.

[12]198 residues of hydroxyproline. Carbohydrate composition as relative content of component (%): galactose, 40.6; arabinose, 23.2; rhamnose, 7.6; uronic acid, 16.0.

[13]238 residues of hydroxyproline. Carbohydrate composition (%): galactose, 41; arabinose, 28; rhamnose, 5; uronic acid, 20.

[14]0.3% iron.

[15]Carbohydrate composition as μmol/g dry wt: mannose, 222; galactose, 128; glucose, 11; *N*-acetylglucosamine, 45.

[16]Carbohydrate composition as μmol/g dry wt: mannose, 230; galactose, 119; glucose, 33; *N*-acetylglucosamine, 52.

[17]Carbohydrate composition as μmol/g dry wt: mannose, 222; galactose, 133; glucose, 36; *N*-acetylglucosamine, 44.

[18]Carbohydrate composition as μmol per mg: glucosamine, 1.36; mannose, 1.20; galactose, 0.64; fucose, 0.10; sialic acid, 0.40.

[19]Carbohydrate composition as molar ratios: mannose, 3.00; *N*-acetylglucosamine, 3.40; galactose, 1.60; sialic acid, 1.00; fucose, 0.25; glucose, less than 0.1; xylose, less than 0.1; (total carbohydrate, 40 wt%).

[20]Carbohydrate composition as molar ratios: mannose, 3.00; *N*-acetylglucosamine, 3.24; galactose, 1.64; sialic acid, 1.03; fucose, less than 0.4; glucose, 0.4; xylose, 0.3; (total carboydrate, 15 wt%).

[21]Carbohydrate composition as molar ratios: mannose, 3.00; *N*-acetylglucosamine, 3.84; galactose, 1.75; sialic acid, 1.24; fucose, less than 0.4; glucose, 1.5; xylose, 0.3; (total carbohydrate, 15 wt%).

[22]None or traces found.

[23]Values for serine and threonine corrected.

[24]19.7 residues of hydroxyproline and 10.9 residues of hydroxylysine. Carbohydrate composition expressed as molar ratios: uronic acid/hexosamine, 0; neutral sugars/hexosamine, 2.16; sialic acid/hexosamine, 0.30. Amino acid analysis of collagenase-soluable component of beef heart valve can be found in ref. *21*.

[25]Carbohydrate composition as mols per 28K(K = 1000): glucosamine, 2.6; mannose, 2.7; fucose, 0.8; galactose, 1.0; sialic acid, 0.8; glucose, trace.

[26]Carbohydrate composition as mols per 13K: glucosamine, 2.1; mannose, 1.5; fucose, 0.3; sialic acid, trace; glucose, 0.8.

[27]Carbohydrate composition as percent (in Table II of ref. *23* these numbers are unnamed): sialic acid, 13.9; amino sugar, 33.2; neutral sugar, 30.6.

[28]Less than one residue of hydroxyproline and zero residues of hydroxylysine. Carbohydrate composition as percent: hexuronic acid, 0.6; glucosamine, 2.8; galactosamine, 1.7; galactose, 1.9; mannose, 0.6; glucose, 0.4; fucose, 0.3, sialic acid, 0.2; also sulfate, 2.1; phosphate, 0. An analysis for glycoprotein B ($MgCl_2$ extract) can be found in ref. *24*.

[29]Carbohydrate composition as percent w/w: mannose, 0.2; galactose, 15.2; glucosamine, 0.6; galactosamine, 15.0; *N*-acetylneuraminic acid, 18.4. Another analysis can be found in ref. *26*.

[30]In Table 1 of ref. *27*, alanine is listed twice. I have assumed that one of these values is for valine. Carbohydrate composition as w/w %: glucosamine, 8.0; galactosamine, 0; fucose, 0; mannose, 6.6; galactose, 9.5; *N*-acetylneuraminic acid, 11.9.

[31]Carbohydrate composition as percent: sialic acid, 4; hexosamine, 3; neutral sugar, 14.

[32]Carbohydrate analyses as g per 100 g: uronic acid, 1.3; total hexosamine, 2.9; galactosamine 1.8; total hexose, 2.2; glucose, 0.50; galactose, 0.80; mannose, 0.65; fucose, 0.23. This glycoprotein was obtained from a tissue homogenate. Analyses for two glycoproteins obtained from magnesium chloride extracts can be found in ref. *29*.

[33]These are soluble collagenase-resistant fractions.

[34]These are insoluble collagenase-resistant fractions.

[35]Carbohydrate composition as μmols per 100 mg protein: hexoses, 526; mannose, 13.6; galactose, 492; glucose, 20.9; fucose, 5.4; hexosamines (expressed as *N*-acetyl derivatives), 476; glucosamine, 339; galactosamine, 137; sialic acids (expressed as *N*-acetylneuraminic acid); 189.

[36]Carbohydrate composition as mol/10,000 g protein: fucose, 2.5; ribose, 5.8; mannose, 6.7; galactose, 9.5; glucose, 8.2; *N*-acetylglucosamine, 10.9; *N*-acetylgalactosamine, 2.0; sialic acid, 5.5. These values are for material prepared using lithium diiodosalicylate extract. Analyses for material prepared using 75% ethanol extract can be found in Tables V and VI of ref. *32*.

[37]Carbohydrate composition as μmol/100 mg protein; mannose, 1.22; galactose, 7.16; fucose, trace, *N*-acetylglucosamine, 1.25; *N*-acetylgalactosamine, 5.02; sialic acid, 9.17. Analyses for two glycoproteins isolated from beef duodenal mucosa can be found in ref. *35*.

[38]Hydroxyproline, 0 residues; hydroxylysine, 0 residues.

[39]Residues per 1000 total residues: allo-hydroxylysine, 21; hydroxylysine, 20; 4-hydroxyproline, 35. 4.3 g ammonia/100 g dry wt.

[40]Residues per 1000 total residues: allo-hydroxylysine, 3.8; hydroxylysine, 7.6; 3-hydroxyproline, traces; 4-hydroxyproline traces. 1.6 g ammonia/100 g dry wt.

[41]Residues per 1000 total residues: allo-hydroxylysine, 2.5; hydroxylysine, 3.1; 3-hydroxyproline, 0; 4-hydroxyproline, traces. 1.5 g ammonia/100 g dry wt.

[42]Residues per 1000 total residues: allo-hydroxylysine, 0; hydroxylysine, 0; 3-hydroxyproline, 0; 4-hydroxyproline, traces.

[43]Residues per 1000 total residues: allo-hydroxylysine, traces; hydroxylysine, 1.3; 3-hydroxyproline, 0; 4-hydroxyproline, 12.3. 1.4 g ammonia/100 g dry wt.

[44]Carbohydrate composition as residues per 1000 amino acid residues: fucose, 9, galactose, 48; mannose, 46; *N*-acetylglucosamine, 77; *N*-acetylgalactosamine, 14; sialic acid, 29 (gas–liquid chromatography), 22 (Warren method).

[45]Carbohydrate composition as mol/mol protein: mannose, 39; galactose, 93; fucose, 14, glucosamine, 71; galactosamine, 38; sialic acids, 36; (mol wt, 100,000).

[46]Carbohydrate composition as mol/mol protein: mannose, 36; galactose, 50; fucose, 5; glucosamine, 57; galactosamine, 9; sialic acids, 19; (mol wt, 59,000).

[47]Carbohydrate composition as mol/mol protein: mannose, 10; galactose, 30; fucose, 2; glucosamine, 28; galactosamine, 5; sialic acids, 8; (mol wt, 20,000).

[48]Carbohydrate composition as percent of dry weight: fucose, 14.31; galactose, 15.71; *N*-acetylgalactosamine, 30.10; *N*-acetylglucosamine, 23.49.

[49]Carbohydrate composition as percent of dry weight: fucose, 5.75; galactose, 7.73; *N*-acetylgalactosamine, 8.73; *N*-acetylglucosamine, 8.65.

[50]Carbohydrate composition as percent of dry weight: fucose, 4.77; galactose, 5.99; *N*-acetylgalactosamine, 5.80; *N*-acetylglucosamine, 11.46.

[51]Carbohydrate composition as percent: hexose, 5.1; glucuronate, 3.0; glucosamine, 1.4; galactosamine, 4.8; sialic acid, 0.5; hydroxyproline, 0.8; hydroxylysine, 0–0.01% dry wt.

[52]Carbohydrate composition as percent: hexose, 7.1; glucuronate, 1.7; glucosamine, 0.5; galactosamine, 1.5; sialic acid, 0.4; hydroxyproline, 0.7, hydroxylysine, 0–0.01% dry wt.

[53]Hydroxyproline is not present and traces (less than 0.2 residues) of isodesmosine and desmosine present.

[54]Carbohydrate composition as weight percent: galactose, 15.8; mannose, 12.1; fucose, 4.0; *N*-acetylglucosamine, 5.9; *N*-acetylgalactosamine, 3.7; sialic acid, 0; total, 43.9.

[55]Carbohydrate composition as weight percent: galactose, 12.6; mannose, 3.1; fucose, 0; *N*-acetylglucosamine, 19.8; *N*-acetylgalactosamine, 14.0; sialic acid, 0; total, 49.5.

[56]Corrected for hydrolytic losses.

[57]Carbohydrate composition as g/100 g dry wt: sialic acid, 39.2; *N*-acetylgalactosamine, 16.2; galactose, 5.3; fucose, 1.6.

[58]Carbohydrate composition as g/ 100 g: glucosamine, 2.3; galactosamine, 0.7; sialic acid, 1.7; fucose, 0.77; xylose, 0.22; mannose, 1.27; galactose, 1.34; glucose, 0.30.

[59]Carbohydrate composition as mg/100 mg protein: hexoses, 17.2; mannose, 0.90; galactose, 15.5, glucose, 0.76; fucose, 0.29; hexosamines, 21.2; glucosamine, 2.7; galactosamine, 18.5, sialic acids, 28.3.

[60]Carbohydrate composition as g/100 g: carbohydrate, 53.8; fucose, 0.62; mannose, 0.41; galactose, 8.96; *N*-acetylgalactosamine, 8.83; *N*-acetylglucosamine, 1.24; sialic acid, 33.73

[61]This is the analysis of the water soluble fraction. Hydroxylysine, 2.3; hydroxyproline, 0.

[62]This is the analysis of the water-insoluble fraction. Hydroxylysine, traces; hydroxyproline, 0.

[63]This is the analysis of material obtained from the following treatment: extract with NaCl, organic solvents, guanidine HCl, and collagenase. The residue was extracted with NaOH and then analyzed. After trypsin treatment analysis was done and can be found in Table 5, ref. *48*. This same treatment was done to the aortic tissue of a 63-yr old person and these analyses can be found in Table 5 of ref. *48*.

[64]These values are lowest ones cited. A range of values is given for all amino acids in Table 2 of ref. *49*. Carbohydrate composition as mole percent: fucose, 6–18; mannose, 24–30; galactose, 25–33; *N*-acetylglucosamine, 25–31; *N*-acetylgalactosamine, 0. The amino acid results do not add up to 1000 residues.

[65]Carbohydrate composition as gram percent: fucose, 8.6; galactose, 28.7; *N*-acetylgalactosamine, 10.8; *N*-acetylglucosamine, 25.6; *N*-acetylneuraminic acid, 3.9; sulfate, 1.21. An analysis of another bronchial mucus glycoprotein from a cystic fibrotic can be found in ref. *50*, Tables III and IV.

[66]Carbohydrate analysis as gram percent: fucose, 8.9 galactose, 26.0; *N*-acetylgalactosamine, 9.6; *N*-acetylglucosamine, 23.7; *N*-acetylneuraminic acid, 1.3; sulfate, 0.8. Analyses of four glycoproteins from bronchial mucus can be found in ref. *50*, Tables I and II.

[67]Carbohydrate composition as grams of anhydro component per 100 grams: fucose, 8; galactose, 21; *N*-acetylglucosamine, 22; *N*-acetylgalactosamine, 9; mannose, 0.6; *N*-acetylneuraminic, 23. Additional analyses of glycoproteins from sputum can be found in Tables 3 and 4 of ref. *51*.

[68]Carbohydrate composition as g/100 g: hexose, 26.4; hexosamine, 25.2; galactosamine, 14.3; sialic acid, 26.9.

[69]This is the analysis of the aggregated form. Carbohydrate composition as g/100 g: neutral sugars, 13.4; acetylhexosamines, 17.3; sialic acid, 22.8; phosphate, 0.4. Neutral sugars as percent: fucose, 1.05; mannose, 1.74; galactose, 8.68; glucose, 0.60. Analysis of the nonaggregated form can be found in Tables I, II, and III of ref. *53*.

[70]Carbohydrate composition as percent of dry weight: sialic acid, 23; hexose, 12; glucosamine, 4.5; galactosamine, 9.5.

[71]Carbohydrate composition as mg/100 mg protein: mannose, 2.7; galactose, 21.4; glucose, 1.8; fucose, 1.7; glucosamine, 9.5; galactosamine, 23.2; sialic acids, 61.4.

[72]An analysis of another glycoprotein, GP-III, can be found in Table II, ref. *55*. Additional analyses of glycoproteins isolated in various ways can be found in refs. *56–58*.

[73]As residues per thousand: hydroxyproline, 14; hydroxylysine, 9; allohydroxylysine, 4.

[74]Carbohydrate composition as nmol/mg: fucose, 319; *N*-acetylglucosamine, 448; *N'*-acetylgalactosamine, 461; galactose, 741; *N*-acetylneuraminic acid, 348; sulfate, 720.

[75]4-Hydroxyproline, 17.4 residues per 1000 residues. Carbohydrate composition as mg/100 mg protein: sialic acid, 3.02; glucosamine, 2.21; hexoses, 6.51; mannose, 2.87; galactose, 2.49; fucose, 1.12. Additional analysis can be found in ref. *62*.

[76]Carbohydrate composition as g/100 g: fucose, 9.9; galactose, 26.4; *N*-acetylglucosamine, 16.8; *N*-acetylgalactosamine, 16.6; neuraminic acid, 0.8; hexosamines, 34.9.

[77]Carbohydrate composition as g per 100 g: fucose, 9.3; *N*-acetylglucosamine, 17.1; *N*-acetylgalactosamine, 13.1; neuraminic acid, 0.8; hexosamines, 30.8.

[78]Carbohydrate composition as g/100 g: fucose, 11.4, galactose, 30.3; *N*-acetylglucosamine, 15.8; *N*-acetylgalactosamine, 16.3; neuraminic acid, 0.8; hexosamines, 34.0.

[79]Carbohydrate composition as g/100 g: fucose, 12.2; galactose, 28.4; *N*-acetylglucosamine, 17.8; *N*-acetylgalactosamine, 13.1, neuraminic acid, 1.3; hexosamines, 31.7.

[80]Carbohydrate composition as g/100 g: fucose, 4.8; galactose, 30.9; *N*-acetylglucosamine, 17.9; *N*-acetylgalactosamine, 13.7; neuraminic acid, 1.3; hexosamines, 33.5.

[81]Carbohydrate composition as mg/100 mg protein: fucose, 7.0; galactose, 38.8; mannose, not detected; *N*-acetylglucosamine, 21.0; *N*-acetylgalactosamine, 15.9; sialic acid, 16.9; uronic acid, not detected. Another analysis of a similar glycoprotein can be found in ref. *65*. Analysis of milk fat globule membrane can be found in refs. *64* and *65*.

[82]Carbohydrate composition as percent: sialic acid, 6.3; fucose, 10.2; galactose, 26.4; *N*-acetylglucosamine, 11.4; *N*-acetylgalactosamine, 10.9: An analysis for another glycoprotein can be found in ref. *66*.

[83]Additional analyses of similar material may be found in refs. *68* and *69*.

[84]Carbohydrate composition as mol%: mannose, 1.4; fucose, 2.4; galactose, 25; glucose, 2.6; *N*-acetylneuraminic acid, 13; glucosamine, 9.2; galactosamine, 8.1. Both sets of data, amino acid analysis and carbohydrate analyses, are based on 100 mol% as the sum of the amino acid contribution of 35.3 mol% and carbohydrate contribution of 61.7 mol%.

[85]Total carbohydrate as weight percent of total isolated fraction, 4.10. This glycoprotein has been identified with cold-insoluble globulin (*71*).

[86]11.1% carbohydrates.

[87]24.6% carbohydrates.

[88]Carbohydrate composition as percent of total material recovered by analysis: hexose, 2.05; sialic acid, 4.22; hexosamine, 3.16; phosphorous 1.80. An analysis of another anionic glycoprotein (AGP3) can be found in Table 1 of ref. *74*.

[89]Carbohydrate composition as percent of total material recovered by analysis: hexose, 14.1; fucose, 5.11; sialic acid, 1.50. Analyses of additional less-acidic glycoproteins (LAG) can be found in Table 1 of ref. *74*.

[90]14% glucosamine and 11% galactosamine by weight.

[91]13% glucosamine and 4% galactosamine by weight. Analyses of similar glycoprotein fractions can be found in refs. *76* and *77* which also has analyses for cystic fibrosis secretions.

[92]Carbohydrate composition as percent of dry weight: hexose, 11.7; fucose, 0.8; *N*-acetylhexosamine, 11.2; sialic acid, 4.4; (ash, 2.3; protein, 67.6).

[93]10.5 residues of hydroxyproline. Carbohydrate composition as g/100 g protein: fucose, 0.4; mannose, 2.4, galactose, 1.4; glucose, 0.8; glucosamine, 1.8; galactosamine, 0.5; sialic acid, 5.9.

[94]Carbohydrate composition as percent of total carbohydrates: fucose, 6.1; mannose, 20.5; galactose, 24.8; sialic acid, 18.8; *N*-acetylglucosamine, 23.6; *N*-acetylgalactosamine, 6.3.

[95]Carbohydrate composition as percent: L-fucose, 11; D-galactose, 19.0; *N*-acetyl-D-galactosamine, 18.0; *N*-acetyl-D-glucosamine, 15.0; sialic acid, 10.0; (sulfate, 1.0).

[96]Carbohydrate composition as μg/mg glycoprotein: fucose, 17.40; mannose, 18.00; galactose, 20.60; glucose, 10.00; *N*-acetylglucosamine, 40.30; *N*-acetylgalactosamine, 40.30; sialic acids, 1.84. These results are for a 3 d culture of cells. Data for 6, 15, 21, and 30 d culture can be found in Table II of ref. *83*. Additional analyses of similar material can be found in ref. *84*.

[97]This is a partial analysis.

[98]This is one of several analyses of glycoprotein prepared by different methods. Additional analyses can be found in Table 5 of ref. *86*.

[99]Hydroxylysine, 4.8; hydroxyproline, 11.1. This is the analysis of one of a number of analyses given in Table 7 of ref. *47* of fractions of a urea extract.

[100]Carbohydrate composition as percent of dry weight: hexoses, 9.4; fucose, 1.7; sialic acid, 2.1; hexosamines, 3.3; uronic acids, 0.9.

[101]Carbohydrate composition as μg/mg protein: sialic acid, 16.9; hexosamine, 59.3; fucose, 6.7; xylose, 45.0; mannose, 38.0; galactose, 38.7; glucose, 16.7. This is the analysis for glycoprotein separated with concanavalin A–Sepharose 4B. Analyses for lectin-separated glycoprotein and for delipidated plasma membrane can be found in Tables 3 and 4 of ref. *88*.

[102]Carbohydrate composition as g/100 g: fucose, 0; mannose, 0.17; galactose, 6.20; *N*-acetylgalactosamine, 7.00; *N*-acetylglucosamine, 0; sialic acid, 36.25. An analysis for glycoprotein isolated from Yorkshire and Duroc pigs can be found in Table II of ref. *46*.

[103]Carbohydrate composition as percent of weight of freeze-dried glycoprotein: fucose, 4.38; mannose, 0.81; galactose, 12.11; galactosamine, 18.89; glucosamine, 10.35; sialic acid, 18.25; (sulfate, 2.6; protein, 17.95).

[104]Carbohydrate composition as weight percent of carbohydrates: galactose, 8.1; mannose, 28.9; *N*-acetylglucosamine, 35.7; sialic acid, 16.6; fucose, 10.6.

[105]Carbohydrate composition as residues per 100 amino acid residues: fucose, 1.8; mannose, 11.9; galactose, 1.8; glucose, 0.6; glucosamine, 6.3; galactosamine 1.0; sialic acid, 0.2. These results were obtained by gas–liquid chromatography. Similar results obtained by ion-exchange chromatography and fluorescent method, see Table 2 of ref. *95*.

[106]Carbohydrate composition as mol/mol galactosamine: galactosamine, 1; glucosamine, 0.21; galactose, 1.1; mannose, 0.01; fucose, 0.06; *N*-acetylneuraminic acid, 0.57; *N*-acetyl-*O*-acetyl-neuraminic acid, 0.57. An analysis of the total sialoglycoprotein fraction, rSGP, can be found in Table 1, ref. *96*.

[107]Hydroxyproline, 45; hydroxylysine, trace. Carbohydrate composition as μmol/100 mg protein: sialic acid, 0.6; galactose, 2.5; glucose, 3.4; mannose, 5.9; xylose, 1.7; hexosamine, 0.7.

[108]This is described as "crude protein."

[109]Hydroxyproline, 33.5; hydroxylysine 0.61. Carbohydrate composition as gram percent dry weight: hexoses, 9.6; hexosamines, 1.6; fucose, 0.7; sialic acid, traces; glucose, 1.5.

[110]Hydroxyproline, traces; hydroxylysine, traces. Carbohydrate composition as gram percent dry weight: hexoses, 11.6; hexosamines, 4.6; fucose, 1.6; sialic acid, 2.5; glucose 1.4.

[111]Hydroxyproline, 0; hydroxylysine, traces. Carbohydrate composition as g percent dry weight: Hexosamines, 2.5; sialic acid, 2.7; glucose, traces.

[112]This glycoprotein was isolated from a trypsin hydrolysate. Hydroxyproline, 0; hydroxylysine 0. Carbohydrate composition as gram percent dry weight: hexoses, 4.3; hexosamines, 3.4; fucose, 1; sialic acid, 0.7; glucose, 0.

[113]Carbohydrate composition as weight percent of freeze-dried material: galactose, 24.72; fucose, 12.36; glucosamine, 27.38; galactosamine, 6.68; sialic acid, 0.20; (sulfate, 1.85). An analysis of a glycoprotein-1 isolated from homogenate fraction II can be found in Tables I and II of ref. *100*.

[115]Carbohydrate composition expressed as mol/1000 amino acids: glucosamine, 255; galactosamine, 200; galactose, 424; sialic acid, 134; fucose, 60; mannose, 2; glucose, 108.

[116]Carbohydrate composition expressed as mol/1000 amino acids: glucosamine, 275; galactosamine, 245; galactose, 348; sialic acid, 380; fucose, 51; mannose, 5; glucose 125.

[117]Carbohydrate composition as μmol/100 μmol total monosaccharide: fucose, 0.4; glucosamine, 29.5; galactosamine, 2.5. Analyses of additional glycoprotein fractions can be found in Tables 2 of ref. *102*.

[118]The amino acid analysis is based on 100 residues of amino acids plus carbohydrates. Carbohydrate composition as residues per 100 residues of amino acids and carbohydrates: glucosamine, 6.73; galactosamine, 5.05; mannose, 2.30; galactose, 10.26; fucose, 0.46; sialic acid, 5.26. See also ref. *106*.

[119]Carbohydrate composition as percent: glucosamine, 7.6, fucose, 1.1; mannose, 4.8; galactose, 1.5.

[120]Values extrapolated to zero time.

[121]Reported as 2.46 mol% cystine.

[122]These values are listed as "Gly" residues, but from the position in the list I have assumed that they are values for glutamic acid.

[123]Tryptophan is present. This is the analysis for fraction I. An analysis for fraction II can be found in Table 2 of ref. *117*.

[124]These are the values obtained for a 22-h hydrolysate. Values for a 72-h hydrolysate can be found in Table 7 of ref. *118*.

[125]This is the analysis of one sample. An analysis of a second sample can be found in Table 1 of ref. *119*.

[126]Carbohydrate composition as mol% of amino acid residues: galactose, 0.4; mannose, 1.0; fucose, 0.2; *N*-acetylglucosamine, 1.4; *N*-acetylneuraminic acid, 0.1.

[127]Aspartic acid plus alanine, 84; histidine plus urocanic acid, 54; arginine plus ornithine plus citrulline, 153.

[128]Hydroxyproline, 0.

[129]These are the data for isozyme 1. In Table 5 of ref. *130* can be found the analysis of isozyme 2.

[130]Hydroxyproline, 242.

REFERENCES TO TABLE 2

1. Brysk, M. M., and Chrispeels, M. J. (1972), *Biochim. Biophys. Acta* **257,** 421.
2. Asakawa, M. (1974), *Bull. Jap. Soc. Sci. Fish.* **40,** 303.
3. Mescher, M. F., and Strominger, J. L. (1976), *J. Biol. Chem.* **251,** 2005.
4. Molchanov, M. I., Trusova, V. M., and Kotovskaya, A. P. (1976), *Biochemistry (Biokhimiya)* **41,** 1562.
5. O'Neill, M. A., and Selvendran, R. R. (1980), *Biochem. J.* **187,** 53.
6. Brown, R. G., and Kimmins, W. C. (1978), *Phytochemistry,* **17,** 29.
7. Junqua, S., Fayolle, J., and Robert, L. (1974), *Protides Biol. Fluids* **22,** 337.
8. Yang, L. L., and Haug, A. (1979), *Biochim. Biophys. Acta* **556,** 265.
9. Hori, H., and Fujii, T. (1978), *Plant Cell Physiol.***19,** 1271.
10. Hori, H., and Sato, S. (1977), *Phytochemistry* **16,** 1485.
11. Becker, C. G., Dubin, T., and Wiedemann, H. P. (1976), *Proc. Nat. Acad. Sci.* **73,** 1712.
12. Baltz, T., Baltz, D., Pautrizel, R., Richet, C., Lamblin, G., and Degand, P. (1977), *FEBS Lett.* **82,** 93.
13. Olenick, J. G., Travis, R. W., and Garson, S. (1981), *Mol. Biochem. Parasitol.* **3,** 227.
14. Strand, B. C., Schuster, T., Klein, R., and Neubauer, R. H. (1981), *Biochem. Biophys. Res. Comm.* **98,** 1121.
15. Doel, T. R., and Brown, F. (1978), *J. Gen. Virol.* **38,** 351.
16. Krantz, M. J., Lee, Y. C., and Hung, P. P. (1974), *Nature* **248,** 684.
17. Krantz, M. J., Lee, Y. C., and Hung, P. P. (1976), *Arch. Biochem. Biophys.* **174,** 66.
18. Kochert, G., and Yates, I. (1974), *Proc. Nat. Acad. Sci.* **71,** 1211.
19. Wu, A. M., Malinowski, C. E., and Herp, A. (1979), *Biochim. Biophys. Acta.* **581,** 189.
20. Honda, A., Kanke, Y., and Mori, Y. (1977), *J. Biochem., Tokyo* **81,** 1595.
21. Honda, A., Kanke, Y., and Mori, Y. (1975), *J. Mol. Cell. Cardiol.* **7,** 715.
22. Kitamura, K., Suzuki, M., and Uyemura, K. (1976), *Biochim. Biophys. Acta* **455,** 806.
23. Gelman, R. A., and Vered, J. (1976), *Biochim. Biophys. Acta* **427,** 627.
24. Anderson, J. C., and Jackson, D. S. (1972), *Biochem. J.* **127,** 179.
25. Swann, D. A., Slayter, H. S., and Silver, F. H. (1981), *J. Biol. Chem.* **256,** 5921.
26. Swann, D. A., Sotman, S., Dixon, M., and Brooks, C. (1977), *Biochem. J.* **161,** 473.

27. Swann, D. A., and Mintz, G. (1979), *Biochem. J.* **179,** 465.
28. Ashton, B. A., Triffitt, J. T., and Herring, G. M. (1974), *Eur. J. Biochem.* **45,** 525.
29. Janado, M., and Dunstone, J. (1972), *J. Biochem., Tokyo* **71,** 635.
30. Herring, G. M. (1976), *Biochem. J.* **159,** 749.
31. Hudson, B. G., Wegener, L. J., Wingate, J. M., and Carraway, K. L. (1975), *Comp. Biochem. Physiol.* **51B,** 127.
32. Fletcher, M. A., Lo, T. M., Graves, W. R., and Robles, A. M. (1977), *Biochim. Biophys. Acta* **465,** 341.
33. McPherson, J., Sage, H., and Bornstein, P. (1981), *J. Biol. Chem.* **256,** 11330.
34. Kiang, W. L., Krusius, T., Finne, J., Margolis, R. U., and Margolis, R. K. (1982), *J. Biol. Chem.* **257,** 1651.
35. Cetta, G., Pallavicini, G., Calatroni, A., and Castellani, A. A. (1972), *Ital. J. Biochem.* **21,** 275.
36. Dische, Z., and Murty, V. L. N. (1973), *Exp. Eye Res.* **16,** 151.
37. Robert, L., and Comte, P. (1968), *Life Sci.* **7,** 493.
38. Van Dijk, W., Lasthuis, A-M., and Ferwerda, W. (1979), *Biochim. Biophys. Acta* **584,** 121.
39. Okada, Y., and Spiro, R. G. (1980), *J. Biol. Chem.* **255,** 8865.
40. Sachdev, G. P., Fox, O. F., Wen, G., Schroeder, T., Elkins, R. C., and Carubelli, R. (1978), *Biochim. Biophys. Acta* **536,** 184.
41. Shipp, D. W., and Bowness, J. M. (1975), *Biochim. Biophys. Acta* **379,** 282.
42. McCullach, K. G., Derouette, S., and Robert, L. (1973), *Exp. Mol. Pathol.* **18,** 202.
43. Hagopian, A., Limjuco, G. A., Jackson, J. J., Carlo, D. J., and Eylar, E. H. (1976), *Biochim. Biophys. Acta* **434,** 354.
44. Downs, F., and Herp, A. (1977), *Int. J. Peptide Prot. Res.* **10,** 229.
45. Kido, S., Janado, M., and Nunoura, H. (1976), *J. Biochem., Tokyo* **79,** 1351.
46. Fugita, S., and Cleve, H. (1975), *Biochim. Biophys. Acta* **406,** 206.
47. Moczar, M., and Robert, L. (1970), *Atherosclerosis* **11,** 7.
48. John, R., and Thomas, J. (1972), *Biochem. J.* **127,** 261.
49. Svenberg, T., Hammarstrom, S., and Hedin, A. (1979), *Mol. Immunol.* **16,** 245.
50. Lamblin, G., Lhermitte, M., Degand, P., and Roussel, P. (1979), *Biochimie* **61,** 23.
51. Creeth, J. M., Bhaskar, K. R., Horton, J. R., Das, I., Lopez-Vidriero, M-T., and Reid, L. (1977), *Biochem. J.* **167,** 557.
52. Azuma, J., Janado, M., and Onodera, K. (1973), *J. Biochem., Tokyo* **73,** 1127.
53. Javaid, J. I., and Winzler, R. J. (1974), *Biochemistry* **13,** 3635.
54. Verpoorte, J. A. (1975), *Int. J. Biochem.* **6,** 855.
55. Fujita, S., and Cleve, H. (1975), *Biochim. Biophys. Acta* **382,** 172.
56. Blumenfeld, O. O., Gallop, P. M., Howe, C., and Lee, L. T. (1970), *Biochim. Biophys. Acta* **211,** 109.
57. Howe, C., Blumenfeld, O. O., Lee, L. T., and Copeland, P. C. (1971), *J. Immunol.* **106,** 1035.
58. Blumenfeld, O. O., and Zvilichovsky, B. (1972), *Methods Enzymol.* **28,** 245.
59. Carter, W. G. (1982), *J. Biol. Chem.* **257,** 3249.
60. Rose, M. C., Lynn, W. S., and Kaufman, B. (1979), *Biochemistry* **18,** 4030.
61. Sahu, S., and Lynn, W. S. (1979), *Biochem. J.* **177,** 153.

62. Passero, M. A., Tye, R. W., Kilburn, K. H., and Lynn, W. S. (1977), *Proc. Nat. Acad. Sci., USA* **70,** 923.
63. Cote, R. H., and Valet, J. P. (1976), *Biochem. J.* **153,** 63.
64. Shimizu, M., and Yamauchi, K. (1982), *J. Biochem., Tokyo* **91,** 515.
65. Imam, A., Laurence, D. J. R., and Neville, A. M. (1981), *Biochem. J.* **193,** 47.
66. Donald, A. S. R. (1980), *Biochem. J.* **185,** 327.
67. Degand, P., Boersma, A., Roussel, P., Richet, C., and Biserte, G. (1975), *FEBS Lett.* **54,** 189.
68. Aubert, J. P., Boersma, A., Loucheux-Lefebvre, M. H., Degand, P., and Biserte, G. (1975), *FEBS Lett.* **56,** 263.
69. Levine, M. J., Weill, J. C., and Ellison, S. A. (1969), *Biochim. Biophys. Acta* **188,** 165.
70. Lombart, C., Okumura, T., and Jamieson, G. A. (1974), *FEBS Lett.* **41,** 30.
71. Blumenstock, F. A., Saba, T. M., Weber, P., and Laffin, R. (1978), *J. Biol. Chem.* **253,** 4287.
72. Polz, E., Kostner, G. M., and Holasek, A. (1979), *Hoppe-Seyler's Z. Physiol. Chem.* **360,** 1061.
73. Bohn, H., and Winckler, W. (1977), *Blut* **35,** 305.
74. Leaver, A. G., Thomas, M., and Holbrook, I. B. (1977), *Calcif. Tissue Res.* **22** (supplement), 347.
75. Woodward, H., Horsey, B., Bhavanandan, V. P., and Davidson, E. A. (1982), *Biochemistry* **21,** 694.
76. Sachdev, G. P., Myers, F. J., Horton, F. O., Fox, O. F., Wen, G., Rogers, R. M., and Carubelli, R. (1980), *Biochem. Med.* **24,** 82.
77. Boat, T. F., Cheng, P. W., Iyer, R. N., Carlson, D. M., and Polony, I. (1976), *Arch. Biochem. Biophys.* **177,** 95.
78. Fletcher, A. P., Neuberger, A., and Ratcliffe, W. A. (1970), *Biochem. J.* **120,** 417.
79. Bobrzecka, K., Konieczny, L., Rybarska, J., and Krzeminska, E. (1977), *Biochim. Biophys. Acta* **497,** 377.
80. Bernier, I., Dautigny, A., Jolles, J., Columbani, J., and Jolles, P. (1978), *Biochim. Biophys. Acta* **533,** 355.
81. Tsao, D., and Kim, Y. S. (1978), *J. Biol. Chem.* **253,** 2271.
82. Hatcher, W. B., Schwarzmann, G. O. H., Jeanloz, R. W. and McArthur, J. W. (1977), *Biochemistry* **16,** 1518.
83. Johnson, L. D., Warfel, J., and Megaw, J. M. (1978), in *Biology and Chemistry of Basement Membranes,* N. A. Kefalides, ed., Academic Press, NY, pp. 299–308.
84. Johnson, L. D., and Warfel, J. (1976), *Biochim. Biophys. Acta* **455,** 538.
85. Howe, C., Lloyd, K. O., and Lee, L. T. (1972), *Meth. Enzymol.* **28,** 236.
86. Codington, J. F., Sanford, B. H., and Jeanloz, R. W. (1970), *J. Natl. Cancer Inst.* **45,** 637.
87. Carrea, G., Pasta, P., Casellato, M. M., Manera, E., and Lugaro, G. (1976), *Int. J. Biochem.* **7,** 209.
88. King, I., and Tabiowo, A. (1982), *Biochem. J.* **201,** 287.
89. Mantle, M., and Allen, A. (1981), *Biochem. J.* **195,** 267.
90. Roomi, M. W., Ishaque, A., Khan, N. R., and Eylar, E. H. (1978), *Biochim. Biophys. Acta* **536,** 112.
91. Roomi, M. W., and Eylar, E. H. (1978), *Biochim. Biophys. Acta* **536,** 122.
92. Ishaque, A., Roomi, M. W., Szymanska, I., Kowalski, S., and Eylar, E. H. (1980), *Can. J. Biochem.* **58,** 913.

93. Marr, A. M. S., Neuberger, A., and Ratcliffe, W. A. (1971), *Biochem. J.* **122,** 623.
94. Ramirez, G., Haglid, K. G., Karlsson, B., and Ronnback, L. (1974), *FEBS Lett.* **38,** 143.
95. Barchay, A. N., Letarte-Muirhead, M., Willians, A. F., and Faulkes, R. A. (1976), *Nature* **263,** 563.
96. Edge, A. S. B., and Weber, P. (1981), *Arch. Biochem. Biophys.* **209,** 697.
97. Mejer, L. E., and Nobel, N. L. (1976), *Conn. Tissue Res.* **4,** 91.
98. Muh, J. P., Bardos, P., Devulder, B., and Tacquet, A. (1974), *Nephron* **13,** 302.
99. Polz, E., Wurm, H., and Kostner, G. M. (1980), *Int. J. Biochem.* **11,** 265.
100. Spee-Braud, R., Strous, G. J. A. M., and Kramer, M. F. (1980), *Biochim. Biophys. Acta* **621,** 104.
101. Sherblom, A. P., Buck, R. L., and Carraway, K. L. (1980), *J. Biol. Chem.* **255,** 783.
102. Cossey, A., Dimichiel, A., and Dunstone, J. (1979), *Eur. J. Biochem.* **98,** 53.
103. Moczar, M., and Moczar, E. (1976), *Comp. Biochem. Physiol.* **53B,** 255.
104. Robert, L., Fayolle, J., Derouette, S., and Zabriskie, S. (1972), *Transplant. Proc.* **4,** 415.
105. Funakoshi, I., and Yamashina, I. (1976), *J. Biochem., Tokyo* **80,** 1185.
106. Nakajo, S., Nakaya, K., and Nakamura, Y. (1979), *Biochim. Biophys. Acta* **579,** 88.
107. Ueno, S., Funatsu, G., and Funatsu, M. (1977), *Agr. Biol. Chem.* **41,** 1069.
108. Laver, W. G. (1971), *Virology* **45,** 275.
109. Schneider, H. J., Schartau, W., Linzen, B., Lottspeich, F., and Henschen, A. (1980), *Hoppe-Seyler's Z. Physiol. Chem.* **361,** 1211.
110. Takagi, T., and Nemoto, T. (1980), *J. Biochem., Tokyo* **87,** 1785.
111. Rajulu, G. S. (1974), *Symp. Zool. Soc. London* **32,** 347.
112. Dangott, L. J., and Terwilliger, R. C. (1979), *Biochim. Biophys. Acta* **579,** 452.
113. Dangott, L. J., and Terwilliger, R. C. (1981), *Comp. Biochem. Physiol.* **70B,** 549.
114. Dessauer, H. C. (1970), in *Biology of the Reptila,* Vol. 3, C. Gans and T. S. Parsons, eds., Academic Press, NY, pp. 1–65.
115. Bannai, S., Sugita, Y., and Yoneyama, Y. (1972), *J. Biol. Chem.* **247,** 505.
116. Terwilliger, R. C., Garlick, R. L., and Terwilliger, N. B. (1980), *Comp. Biochem. Physiol.* **66B,** 261.
117. Terwilliger, R. C., Terwilliger, N. B., and Schabtach, E. (1980), *Comp. Biochem. Physiol.* **65B,** 531.
118. McIlwaine, I., Rodbard, D., and Chrambach, A. (1973), *Anal. Biochem.* **55** 521.
119. Sherman, I. W., Mudd, J. B., and Trager, W. (1965), *Nature* **208,** 691.
120. Seyedin, S. M., Pehrson, J. R., and Cole, R. D. (1981), *Proc. Natl. Acad. Sci., USA* **78,** 5988.
121. Swedin, B., Mossle, I., and Jornvall, H. (1976), *Acta Chem. Scand.* **B30,** 970.
122. Voorhees, J. J., Chakrabarti, S. G., and Bernstein, I. A. (1968), *J. Inves. Derm.* **51,** 344.
123. Scott, I. R., Harding, C. R., and Barrett, J. G. (1981), *Biochem. Soc. Trans.* **9,** 389.
124. Kilejian, A. (1974), *J. Biol. Chem.* **249,** 4650.
125. Tezuka, T., and Freedberg, I. M. (1974), *J. Invest. Derm.* **63,** 402.
126. Schmitt, J. M. (1979), *Carlsberg Res. Comm.* **44,** 431.

127. Sahu, S., and Lynn, W. S. (1978), *Biochem. J.* **173,** 565.
128. Edwards, P. A., Lemongello, D., Kane, J., Shechter, I., and Fogelman, A. M. (1980), *J. Biol. Chem.* **255,** 3715.
129. Heller, R. A., and Shrewsbury, M. A. (1976), *J. Biol Chem.* **251,** 3815.
130. Gerstner, E., and Pfeil, E. (1972), *Hoppe-Seyler's Z. Physiol. Chem.* **353,** 271.
131. Usui, Y., Yoshida, K., and San Clemente, C. L. (1981), *Can. J. Microbiol.* **27,** 955.
132. Muensch, H., and Yoshida, A. (1977), *Eur. J. Biochem.* **76,** 107.

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