

Compilation of sequences of tRNA genes

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INTRODUCTION

In this compilation of tRNA genes the sequences have been aligned and displayed as has been done in the case of the tRNA sequences (Fig. 1 in preceding paper). The nucleotides preceding nucleotide residue 1 and the nucleotides following nucleotide residue 73 and the intervening sequences (see footnotes) have been excluded from the compilation. The compilers would welcome any information regarding missing material or erroneous presentation.

Acknowledgements: We thank Mrs. H. Geißler and Mr. R. Jung for skillful assistance and the Fonds der Chemischen Industrie for financial support.

	AMINOACYL STEM								D STEM								D LOOP								ID STEM								ANTIC. STEM								ANTIC. LOOP								ANTIC. STEM							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45											
A L A N I N E																																																								
0010	G G G C C C T T A G C T C A G C T G G G								A G A G C C G C C T G C C T T T G C A C								G C C A G G								A G A G C C G C C T G C C T T T G C A C								G C C A G G								A G A G C C G C C T G C C T T T G C A C								G C C A G G							
0025	G G G G T A T A G T A T A T T G G T								A G T A C A G C A A T C T T G C T C A T T G C								A T T G C								A G T A C A G C A A T C T T G C T C A T T G C								A T T G C								A G T A C A G C A A T C T T G C T C A T T G C								A T T G C							
0050	G G G G C C T A G C T C A G A T G G T								A G A G C C G C T C G C T T A G C A T G C G A G								G C G A G								A G A G C C G C T C G C T T A G C A T G C G A G								G C G A G								A G A G C C G C T C G C T T A G C A T G C G A G								G C G A G							
0051	G G G C C C T A G T T T A C T G G T								A A A A C G C C A T T T G C A T A T C G T								A T C C G T								A A A A C G C C A T T T G C A T A T C C G T								A T C C G T								A A A A C G C C A T T T G C A T A T C C G T								A T C C G T							
0052	G G G G T A T A G C T C A G T T G G T								A G A G C C G C T G C C T T T G C A A G G C A G								A G G C A G								A G A G C C G C T G C C T T T G C A A G G C A G								A G G C A G								A G A G C C G C T G C C T T T G C A A G G C A G								A G G C A G							
0053	G G G A T A T A G C T C A G T T G G T								A G A G C C G C T G C C T C T T G C A T G C C G G								A G G C A G								A G A G C C G C T G C C T C T T G C A T G C C G G								A G G C A G								A G A G C C G C T G C C T C T T G C A T G C C G G								A G G C A G							
0054	G G G C T A T A G T A A T T G G T								G A A A C G A C T G C C T T G C A T G C A T T								A G G C A G								G A A A C G A C T G C C T T G C A T G C A T T								A G G C A G								G A A A C G A C T G C C T T G C A T G C A T T								A G G C A G							
0055*	G A G C A T T A G C T T A T T A								A A G C A G T T G A T T G C A T T A A C								A G G C A G								A A G C A G T T G A T T G C A T T A A C								A G G C A G								A A G C A G T T G A T T G C A T T A A C								A G G C A G							
0056	G G G A T A T A G C T C A G T T G G T								A G A G C C T C C G C T C T T G C A C G G C G G								A G G C A G								A G A G C C T C C G C T C T T G C A C G G C G G								A G G C A G								A G A G C C T C C G C T C T T G C A C G G C G G								A G G C A G							
0096*	G A G G C T T A G C T T A T T A								A A G C A A T T G A T T T G C A T T C A A T								A G G C A G								A A G C A A T T G A T T T G C A T T C A A T								A G G C A G								A A G C A A T T G A T T T G C A T T C A A T								A G G C A G							
0097*	A A G G C C T A G C T T A T T A								A A G T G G C T G A T T T G C C G T T C A G T								A G G C A G								A A G T G G C T G A T T T G C C G T T C A G T								A G G C A G								A A G T G G C T G A T T T G C C G T T C A G T								A G G C A G							

0010 K. LOUGHEEY, E. LUND, J.E. DANIELSON (1982) NUCL. ACIDS RES. 10, 1607-1623

0025 M.R. GREEN, M.F. GRIMM, R.R. CORNIST, R.A. COLLINS (1981) J. BIOL. CHEM. 256, 2027-2034

0050 O. BRACERUCHELE, D. LANSOW, G.I. HALL, K.U. SPRACKUE (1979) CELL 19, 1217-1229

0051 E.G. KOSCHEL, C.M. LAZARUS, M. BAGAK, H. KUERTZEL (1981) CELL 23, 628-633

0052 L. GRAP, H. KOSCHEL, E. STUTE (1980) NATURE 286, 908-910;

E.M. OGDON, JR., K.E. RUSSELL, J.R. DODD, R.B. HALLICK (1980) J. BIOL. CHEM. 255, 10997-11003

0053 W. KOCH, K. EDWARDS, H. KOSCHEL (1981) CELL 25, 203-213

0054 S.G. BONITZ, A. TROGLOFF (1980) J. BIOL. CHEM. 255, 9075-9081

0055 P. CAMPATORE, C. DE BENEDETTO, G. GRONLERA, R. GALLERANI, A.N. KRUM, M. ROLITTO, C. LAMAVE, G. PEPE, C. QUAGLIARIELLO, C. SACCOONE, E. SBERA (1982) NUCL. ACIDS RES. 10, 3279-3289

0056 F. TAKATA, M. SEKIURA (1981) CURR. GEN. 4, 191-196

0096 M.J. BIBB, R.A. VAN EYKEN, C.T. WRIGHT, M.W. WALBERG, D.A. CLAYTON (1981) CELL 26, 167-180

0097 S. ANDERSON, A.T. BANKIER, B.G. BARRELL, M.E.L. DEBRUIJN, A.R. COULSON J. DROUOT, I.C. EPSON, D.P. HIERLICH, B.A. ROE, F. SAMGER, P.H. SCHREIBER, A.J.E. SMITH, R. STADLER, I.G. YOUNG (1981) NATURE 290, 457-465

COMPARE J. MOL. BIOL. 156 (1982) 706

EXTRA ARM		TP STEM	TP LOOP	TP STEM	AMINOACYL STEM																									
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44	46	A	C	E	G	I	K	M	O	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76						
A L A N I N E		0010	A	G	G	T	C	A	G	C	G	G	T	C	G	A	T	C	C	G	C	T	A	G	G	C	T	C	C	A
0025	T	T	C	T	A	G	G	T	T	C	A	A	A	T	C	C	T	T	G	T	A	T	C	T	C	C	A			
0050	A	G	G	T	A	C	G	G	G	A	T	C	G	A	T	A	C	C	G	G	C	C	C	C	C	C	A			
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0096/0 ALIGNMENT IS ARBITRARY
0097/0 ALIGNMENT IS ARBITRARY

0053/36 AFTER RESIDUE 36, 37 OR 38 INTERVENING SEQUENCE
0055/0 ALIGNMENT IS ARBITRARY
0056/37 INTERVENING SEQUENCE AFTER THIS POSITION

	AMINOACYL STEM								D STEM								D LOOP								ID STEM	ANTIC. STEM	ANTIC. LOOP	ANTIC. STEM																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43														
	G	A	G	G	A	T	T	A	G	C	T	T	A	A	T	T	A		A	A	G	T	G	G	T	T	G	A																													
0099*	*****																																																								
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BOVINE*																																																									
MITO																																																									
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0120	G	T	C	C	C	G	C	T	G	T	G	T	A	A	T		G	G	A	T	A	G	C	A	T	A	C	G	A	T	C	T	C	T	A	A	G	T	T	G																	
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0120	I.G. YOUNG (1982) J. MOL. BIOL. 156, 683-717																																																								
0130	G.P. MARRARA, G. PIZZARETTI, W.B. MCCLAIN (1981) PROC. NATL. ACAD. SCI. 78, 889-892																																																								
0150	R.E. BAKER, A. EIGEL, D. VOROTNIK, H. FELDMAN (1982) EMBO JOURNAL 1, 291-296																																																								
0150	M.C. MARTIN, D. MILLER, J. HARTLEY, P. MORVILAN, J.E. DONNELSON (1980) CELL 19, 339-343																																																								
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	S.G. BOMITE, A. TERGODOLOFF (1980) J. BIOL. CHEM. 255, 9075-9081																																																								
	E.M. ONOZCO, JR., R.B. HALLICK (1982) J. BIOL. CHEM. 257, 3265-3275																																																								
	P. CAMPATORE, C. DE BENEDETTO, G. GRIMALTA, R. GALLEGANI, A.M. KIDOM, M. BOLZROP, C. LAMAVE, G. PEPE, C. QUAGLIARIELLO, C. SACCO, E. SBISA (1982) NUCL. ACIDS RES. 10, 3279-3289																																																								
	R. GROSSKOPF, H. FELDMAN (1981) CURR. GEN. 4, 151-158																																																								

	EXTRA ARM						TF STEM	TF LOOP	TF STEM	AMINOACYL STEM																
	45	47	B	D	F	H	J	L	N	P	49	51	53	55	57	59	61	63	65	67	69	71	73	75		
	44	46	A	C	E	G	I	K	M	O	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	
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0099	T	G	A								T	T	A	A	G	G	T	G	A	G	T	T	C	C	T	A
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0120	C	G	G								T	C	C	T	G	G	T	T	C	G	A	T	C	C	A	A
0130	A	G	A	T							T	C	C	A	G	G	T	T	C	A	A	G	T	C	C	T
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0153	A	G	A	T							T	A	T	A	G	G	T	T	C	G	A	C	T	C	C	T
0154	A	T	A	T							T	C	C	A	T	G	G	T	T	C	A	A	T	C	A	T
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0156	A	G	A								T	A	T	G	A	T	A	T	A	A	T	A	T	A	C	C
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0099/0 ALIGNMENT IS ARBITRARY P. PARRELL, D. SOELL (1981) PROC. NATL. ACAD. SCI. 78, 6657-6661
 0152/0 FOR DELETION MARKS SEE: S. SHARP, D. DEFRANCO, T. DINGENSBAUM, 0156/0 ALIGNMENT IS ARBITRARY

	AMINOACYL STEM								D STEM				D LOOP				D STEM				ANTIC. STEM				ANTIC. LOOP				ANTIC. STEM																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
ARGININE cont.																																													
0159	A. NIDULANS																																												
	MITO																																												
0196*	MOUSE*																																												
	MITO																																												
0197*	HUMAN*																																												
	MITO																																												
0199*	BOVINE*																																												
	MITO																																												
A S P A R A G I N E																																													
0230	EUCLENA GRACILIS																																												
	CHLORO																																												
0241	A. NIDULANS																																												
	MITO																																												
0250	D. MELANOASTER																																												
	MITO																																												
0251	TOBACCO																																												
	CHLORO																																												
0252*	BAT*																																												
	MITO																																												
0253*	BAT*																																												
	MITO																																												

0159 R. HETTERER, E.G. KOECHL, W. BASAR, H. KUBITZEL (1982) NUCL. ACIDS RES. 10, 4793-4794

0196 M.J. BIER, R.A. VAN EYSEN, C.T. WRIGHT, M.W. WALSBERG, D.A. CLANTON (1982) CELL 26, 187-190

0197 S. ANDERSON ET AL. (1981) NATURE 290, 467-468

0199 S. ANDERSON, M.R.L. DESMULDER, A.R. COUGSON, I.C. EPSTEIN, F. SAMKIN, I.G. YOUNG (1982) J. MOL. BIOL. 156, 689-717

0230 E.M. ORNICO, JR. R.B. HALLICK (1982) J. BIOL. CHEM. 257, 3265-3275

0241 R. HETTERER, E.G. KOECHL, W. BASAR, H. KUBITZEL (1982) NUCL. ACIDS RES. 10, 4793-4794

0250 B. BOVERMAN, S. SHARP, E. YANODA, D. SOELL (1980) CELL 19, 889-895

0251 A. KATO, H. SHINDA, M. KUSUDA, M. SUGIURA (1981) NUCL. ACIDS RES. 9, 5601-5607

0252 P. CAMPTORSE, C. DE REUDETTO, G. GRONLJEN, R. CALLEGRANI, A.M. KROON, M. BOUTROP, C. LANAIVE, G. PEPE, C. GORGIALELLO, C. SACCONI, E. BELLA (1982) NUCL. ACIDS RES. 10, 3279-3289

0253 R. GROSSKOPF, H. FELDMANN (1981) CURR. GEN. 4, 191-196

EXTRA ARM		TF STEM	TF LOOP	TF STEM	AMINOACYL STEM
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46	50 A	52	58	64	70
48	54 C	56	60	66	72
	56 D				74
	58 E				76
	60 F				
	62 G				
	64 H				
	66 I				
	68 J				
	70 K				
	72 L				
	74 M				
	76 N				

0252/O ALIGNMENT IS ARBITRARY
 0253/O ALIGNMENT IS ARBITRARY

0196/O ALIGNMENT IS ARBITRARY
 0197/O ALIGNMENT IS ARBITRARY
 0199/O ALIGNMENT IS ARBITRARY

	AMINOACYL STEM								D STEM				D LOOP				D STEM				ANTIC. STEM				ANTIC. LOOP				ANTIC. STEM															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
ASPARAGINE cont.																																												
0296*	MOUSE*																																											
	MITO																																											
0297*	HUMAN*																																											
	MITO																																											
0299*	BOVINE*																																											
	MITO																																											
A S P A R T I C A C I D																																												
0301	E. COLI																																											
0351	ASPERGILLUS NIDULANS																																											
	MITO																																											
0352	GAU RAT																																											
0353	YEAST																																											
0354	YEAST																																											
	MITO																																											
0355*	BAT*																																											
	MITO																																											
0357	S. POMBE																																											

0296 M. J. BIER, R. A. VAN EYSEN, C. T. WRIGHT, M. W. WALSBURG, D. A. CLAYTON (1981) CELL 26, 157-180

0297 S. ANDERSON ET AL. (1981) NATURE 290, 457-465

0299 S. ANDERSON, M. E. L. DESHAYES, A. R. COULSON, I. C. EPERON, F. SANGER, I. G. YOUNG, (1982) J. MOL. BIOL. 156, 693-717

0301 R. A. YOUNG (1979) J. BIOL. CHEM. 254, 12725-12731

0351 H. G. KORNBERG, C. M. LAZARUS, W. BASAK, E. KURZYNSKI (1981) CELL 23, 625-633

0352 T. SEKIYA, Y. KIKUCHI, S. WISHIMURA (1981) NUCL. ACIDS RES. 9, 2239-2250;

0357 K. SHIBUYA, S. MOCHIZU, T. SEKIYA (1982) NUCL. ACIDS RES. 10, 4441-4448

0353 O. SCHMIDT, J. WAO, R. ODEN, J. SECKHAM, E. SAKANO, J. ABELSON, D. SORELL (1980) NATURE 287, 750-752

0354 S. G. BOMITZ, A. TENGLOFF (1980) J. BIOL. CHEM. 255, 9075-9081

0355 F. CHATVORZE, C. DE BENEDETTO, G. GADALETA, R. GALISIANI, A. M. KIDOM, M. BOUZYOP, C. LAMARVE, G. PEPE, C. QUIGLIARIELLO, C. SACCOMI, E. SESTA (1982) NUCL. ACIDS RES. 10, 3279-3289

0357 J. WAO, S. APPEL, J. SHARP, S. SHARP, H. YAMADA, D. SORELL (1982) NUCL. ACIDS RES. 10, 487-500

EXTRA ARM		TP STEM	TP LOOP	TP STEM	AMINOACYL STEM
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44	46 A C E G I K M O	50 52 48	54 56 58 60	62 64 66 68 70 72	74 76

ASPARAGINE cont.					
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0297	T G T T	T G T G G T T T A A G T	C C C A T T G G T C T A G	*****	
0299	G T T T	C G T G G G G T G G A G	C C C A C C A G T C T A G	*****	

A S P A R T I C A C I D					
0301	G G G T	C G C G G G T T C G A G T	C C C G T C C G T T C C C	*****	
0351	T T T A	T G C C G G T T C A A G T	C C G G C C T A C C C G	*****	
0352	A G A	C G G G G T T C G A T T	C C C G A C G G G A G	*****	
0353	A G A	T C G G G T T C A A T T	C C C G T C G C G G A G	*****	
0354	A G G A	T G T C A G T G C A A A T	C T G A T T A G A T T C G	*****	
0355	A G T	T A T A G A C T A A A	T C T A T A T A T C T T A	*****	
0357	C A G	C C C G G T T C G A A T	C C C G A G G A G A G	*****	

0296/0 ALIGNMENT IS ARBITRARY
 0297/0 ALIGNMENT IS ARBITRARY
 0299/0 ALIGNMENT IS ARBITRARY

0355/0 ALIGNMENT IS ARBITRARY
 0355/55 IS REPORTED TO BE C IN R. GROSSKOPF, H. FELOWAN (1991) CURR. GEN.
 4, 151-158

	AMINOACYL STEM								D STEM				D LOOP				D STEM				ANTIC. STEM				ANTIC. LOOP				ANTIC. STEM																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
ASPARTIC ACID cont.																																													
0396*	A A G A T A T T A G T A A A A T C C A A																																												

0397*	A A G G T A T T A G A A A A A C C C A																																												

0399*	G A G G T G T T A G T A A A A C A																																												

C Y S T E I N E																																													
0451	G G A G A T G T T G T T T T A A G G T T A A A C T A T T A G A T T G C C A A A T C T A C T																																												

0452*	A G C C T T A A G T G A T T A																																												

0453*	A G C C T T A A G T G A T T A																																												

0496*	G G T C T T A A G T G A T T A																																												

0497*	A G C T C C G A G T G A T T T																																												

0499*	A G C C T G T G T G A A T T T																																												

0396 M.J.BISS, R.A.VAN ETTEN, C.T.WRIGHT, M.W.WALBERG, D.A.CLAYTON (1981) 0452 P.CAMMAROSE, C.DE BENEDETTO, G.GADALETA, R.GALLERANI, A.M.KROON, M.BOITROP, C.LAMARCA, G.PEPE, C.QUILIGRIELLO, C.SACCONE, E.SBISA (1982) NUCL. ACIDS RES. 10, 3279-3289

0397 S.ANDERSON ET AL. (1981) NATURE 290, 457-465

0399 J.G.YOUNG (1982) J.MOL.BIOL. 156, 693-717

0451 J.L.BOS, K.A.OSINGA, G.VAN DER BOEST, P.BOSCH (1979) NUCL. ACIDS RES. 6, 3255-3266

0497 R.E.BERLANT, C.FRETELIA, G.MACINO, A.TZOGIOLOFF (1980) J. BIOL. CHEM. 255, 1086-1097

0499 S.ANDERSON ET AL. (1981) NATURE 290, 457-465

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0496 M.J.BISS, R.A.VAN ETTEN, C.T.WRIGHT, M.W.WALBERG, D.A.CLAYTON (1981) CELL 26, 157-180

	TP STEM	TP LOOP	TP STEM	AMINOACYL STEM
EXTRA ARM				
45 47 B D P H J L N P	49 51 53	55 57 59	61 63 65	67 69 71 73 75
44 46 A C E G I K M O	50 52	54 56 58 60	62 64	66 68 70 72 74 76

0396 A A T	T A T A G A T C A A T A A T C T A T A T A T A T C T T A			
0397 A A T	T A T A G C C T A A A T C C T A T A T A T C T T A			
0399 A G T	T A C A A G T G A A A G T C C T G T A C A C C T C A			

ASPARTIC ACID cont.				
0451 T A T	T A A G A G T T C G A T T C T C T T C A T C T C T T			
0452 A G G	T G T A G A G A A T C T C C T C T A C T A G G C C T T			
0453 A G G	T G T A A G A A T C T C C T C T A C T A G G C C T T			
0496 A G G	T C T A G A G A A A T C T C T A C T A G A C T T			
0497 A G A	A G C A G C T T C A A A C C T G C C G G C C T T			
0499 A G A	A G C A G C T T C A A T T C T G C C G G C C T T			

C Y S T E I N E				
0396/0 ALIGNMENT IS ARBITRARY				
0397/0 ALIGNMENT IS ARBITRARY				
0399/0 ALIGNMENT IS ARBITRARY				
0452/0 ALIGNMENT IS ARBITRARY				
0453/0 ALIGNMENT IS ARBITRARY				
0496/0 ALIGNMENT IS ARBITRARY				
0497/0 ALIGNMENT IS ARBITRARY				
0499/0 ALIGNMENT IS ARBITRARY				

0453/0 ALIGNMENT IS ARBITRARY
 0496/0 ALIGNMENT IS ARBITRARY
 0497/0 ALIGNMENT IS ARBITRARY
 0499/0 ALIGNMENT IS ARBITRARY

	AMINOACYL STEM								D STEM				D LOOP				D STEM				ANTIC. STEM				ANTIC. LOOP				ANTIC. STEM															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
G L U T A M I N E																																												
0501	PHAGE T4																																											
0510	E. COLI																																											
0520	E. COLI																																											
0551	ASPERGILLUS NIDULANST																																											
0552	YEAST																																											
0553*	RAT*																																											
0556*	D. MELANOCASTER*																																											
0587	RATTUS NORVEGICUS																																											
0596	MOUSE																																											
0597*	HUMAN*																																											
0599	BOVINE																																											
	MITO																																											

0501 K. FUKUDA, J. ABELSON (1980) J. MOL. BIOL. 139, 377-391
 0510 M. MAEJIMA, E. OZeki, Y. SHIMURA (1981) CELL 23, 239-249
 0520 M. MAEJIMA, E. OZeki, Y. SHIMURA (1981) CELL 23, 239-249
 0551 E.G. KOECHER, C.M. LAZARUS, M. BASAK, E. KUMETZEL (1981) CELL 23, 625-633
 0552 R.E. BERLAMI, S.G. BOMITZ, G. CORUZZI, M. MORBERA, A. TZAGOLOFF (1980) NUCL. ACIDS RES. 8, 5017-5030
 0553 P. CHAMPAGNE, C. DE BENEDETTO, G. GRADALETA, R. GRILIERANI, A.M. KROON, M. ROZANOP, C. LANAVE, G. PEPE, C. QUARILARIELLO, C. SACCOONE, E. SBISA (1982) NUCL. ACIDS RES. 10, 3279-3289
 0587 D.O. CLARY, J.M. CODOARD, S.C. MARTIN, C.M.-R. FAUROM, D.R. WOLFFENBUELE (1982) NUCL. ACIDS RES. IN PRESS
 0596 M.J. BIBB, R.A. VAN ETTER, C.T. WILGERT, M.W. WILBERG, D.A. CHATTON (1981) CELL 26, 167-180
 0597 S. ANDERSON ET AL. (1981) NATURE 290, 457-465
 0599 S. ANDERSON, M.H.L. DREBBIJN, A.R. COULSON, I.C. EFERSON, F. SANGER, I.G. YOUNG (1982) J. MOL. BIOL. 156, 683-717

		EXTRA ARM					TP STEM	TP LOOP	TF STEM	AMINOACYL STEM													
45	47	B	D	F	H	J	L	N	P	49	51	53	55	57	59	61	63	65	67	69	71	73	75
44	46	A	C	E	G	I	K	M	O	50	52	54	56	58	60	62	64	66	68	70	72	74	76

G L U T A M I N E																							
0501	G A T G C A A G G T T C G A G T C C T T T A T T C C C A C																						
0510	C A T T C C T G G T T C G A A T C C A G G T A C C C C A C																						
0520	C A T T C C G A G G T T C G A A T C C T C G T A C C C C A C																						
0551	T A T T C G G T G T T C G A G T C G C C C C A A C A T A A																						
0552	A G T T C T T T G T T C G A A T C A A G C G A T T C A A																						
0553	A G G T G T A G G T T C A A T T C C T A T T G T C C T A G																						
0556	T A G A A T A G T T T A A T T C T A T T A A A T A T A A																						
0587	A C G T C T A G G T T C A A T T C C T A T T G T C C T A G																						
0596	A A G T C T A G G T T C A A T T C C T A T T G T C C T A G																						
0597	A C G G A T G G G T T C G A T T C T C A T A G T C C T A G																						
0599	A C G G A T G G G T T C G A T T C C T A T A G T T C T A G																						

0597/0 ALIGNMENT IS ARBITRARY

0553/0 ALIGNMENT IS ARBITRARY
0556/0 ALIGNMENT IS ARBITRARY

AMINOACYL STEM	D STEM				D LOOP	D STEM				ANTIC. STEM	ANTIC. LOOP				ANTIC. STEM																									
	1	2	3	4		8	9	10	11		12	13	14	15		16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
G L U T A M I C A C I D																																								
0630	*****													3	YEAST	T C C G A T A T A G T G T A A C	GGCT	A T C A C A T C A C G C	C T T T C A C	C G T G G																				
0651	*****													3	D. MELANOASTER	T C C C A T A T T G T C T A G T	GGTT	A G G A T A T C C G G C	C T C T C A C	C C G G A																				
0652	*****													3	S. CEREBISIAE MITO	G A C C T T A T C T C T A A T	GGTT	A C G A C A T C A C C T	C T T C A T	G T T G A																				
0653	*****													3	ASPERGILLIUS NIDULANS MITO	A C C C A A T G T C A A G A T	GGTT	A G A C A T A A C A T	T T T C A C T	T G T T A																				
0654	*****													3	GAG RAT	T C C T G G T G T C T A G T	GGTT	A G G A T T C G G C G	C T C T C A C	C G C C G																				
0655	*****													3	EUGLENA GRACILIS	G C C C A T C G T C T A G A	GGCTA	G G A C A T C T C C C	C T T C A C	G G A G G																				
0656	*****													3	CHLORO MITO	G T T C T A T A G T T G A A T T A	GGCT	C A A C G A T G A T	T T T C A T	G T C A T																				
0670	*****													3	D.MELANOASTER	T C C C A T A T G G T C T A G T	GGCT	A G G A T A T C T G G C	T T T C A C	C C A G A																				
0696*	*****													3	MOUSE*	G T T C T G T A G T T G A A T T A	GGCT	C A A C G A T G A T	T T T C A T	G T C A T																				
0697*	*****													3	HUMAN*	G T C T G T A G T T G A A A T A	GGCT	C A A C G A T G G T	T T T C A T	A T C A T																				
0699*	*****													3	BOVINE*	G T C T G T A G T T G A A T G A	GGCT	C A A C G A T G G T	T T T C A T	A T C A T																				

- 0630 A. RICKEL, J. OJAVE, E. FELDMANN (1981) NUCL. ACIDS RES. 9, 2961-2970
- 0651 E.A. BOBRACE, M. SILBERKLANG, B.J. MC CARTHY (1980) CELL 21, 169-178
- 0652 P.G. MORRISON, A. YERAGOLLOFF (1980) FEBS LETT. 113, 52-54
- 0653 E.G. KOSCHEL, C.H. LAZARUS, H. NARAK, H. KURZWEIL (1981) CELL 23 625-633
- 0654 T. SEKITA, Y. KUCHINO, S. NISHIMURA (1981) NUCL. ACIDS RES. 9, 2239-2250;
- K. SHIBATA, S. MODOCHI, S. NISHIMURA, T. SEKITA (1982) NUCL. ACIDS RES. 10, 4441-4448
- 0655 M.J. HOLLINGSWORTH, R.B. HALLICK (1982) J. BIOL. CHEM. IN PRESS
- 0656 COERTZ, FELDMANN (UNPUBLISHED) IN: R. GROSSKOPF, E. FELDMANN (1981) CURR. GEN. 4, 191-195
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- 0696 M.J. BIES, R.A. VAN EYTEM, C.T. WRIGHT, M.M. WALSBURG, D.A. CLAYTON (1981) CELL 26, 167-180
- 0697 S. ANDERSON ET AL. (1981) NATURE 290, 457-465
- 0699 S. ANDERSON, M.E.L. DEBRULJIN, A.R. COUTLSON, E.C. EPERON, F. SANCKER, I.G. YOUNG (1982) J. MOL. BIOL. 156, 683-717

EXTRA ARM		TP STEM	TP LOOP	TP STEM	AMINOACYL STEM
45 47 B D P H J L N P	49 51 53	55 57 59	61 63 65	67 69 71	73 75
44 46 A C E G I K M O	48	54 56 58 60	62 64	66 68 70 72	74 76
G L U T A M I C A C I D					
0630	A G A	C C G G G	T T C G A C T	C C C C G	T A T C G G A G
0651	A G G	C C G G G	T T C A A T T	C C C G G	T A T C G G A A
0652	T A A	T A T C G G	T T C G A T T	C C G A T	T A A C G T T A
0653	G T G	C G G A G	T T C A A T C	C T C C C	T T G C G T T C
0654	C G G	C C G G G	T T C G A T T	C C G G T	C A G G G A A
0655	C A A	C G G G A	T T C G A A T	T C C C C	T G G G G T A
0656	T A G	T C A C A G	T T A A A T G	C C G T G	T A C A A A T A
0670	A G G	C C G G G	T T C G A T T	C C C G G	T A T C G G A A
0696	T G G	T C G C A G	T T G A A T G	C T G T G	T A G A A A T A
0697	T G G	T C G T G G	T T G T A G T	C C G T C	C G A G A A T A
0699	T A G	T C A T C G	T T A G A T T	C C A T G	T A A C A A T A

0651/4 TANDEN GENE II HAS T
 0654/4 IN REPEATING UNITS C
 0654/63 IN REPEATING UNITS DELETION MUTATIONS

0696/0 ALIGNMENT IS ARBITRARY
 0697/0 ALIGNMENT IS ARBITRARY
 0699/0 ALIGNMENT IS ARBITRARY

	AMINOACYL STEM	D STEM	D LOOP	D STEM	D LOOP	D STEM	ANTIC. STEM	ANTIC. LOOP	ANTIC. STEM
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42								
	*****	*****	*****	*****	*****	*****	*****	*****	*****
0701	PHAGE T4	G C G G A T A T C G T A T A A T	GGT	A A T T A C C T C A G A C T T C C A A T C T G A					
0720	E. COLI	G C G G C A T C G T A T A A T	GGCT	A T T A C C T C A G C C T T C C A A G C T G A					
0751	YEAST	A T A G A T A T A A G T A A T T	GGT	A A A C T G A T G T C T T C C A A A C A T T					
0752	MITO	A S P E R G I L L U S N I D U L A N S A T G A C T A T A A G T A A T A	GGT	A G A C T G T T C G T C T T C C A A A C G A A					
0753	MITO	A S P E R G I L L U S N I D U L A N S A C G G C T A T A A G T T A A T	GGT	A G A C T A C T T A G C T A C C A C T A A G					
0754	GGA RAT	G C G T T G G T G T A T A G T	GGTG*	A G C A T A G C T G C C T T C C A A G C A G T					
0756	MITO	G C G G G T A T A G C T C A G T T	GGT	A G A G C G T G G T C C T T C C A A G T C C A					
0757*	CHILORE RAT*	A C T C C C T T A G T A T A A C A		A T A C A A C T G A C T T C C A A T C A G T					
0785	MITO	G C A T C G G T G G T T C A G T	GGT	A G A A T G C T C G C C T C C C A C G C G G					
0796*	MITO	A C T C C C T T A G T A T A T T A		A T A T A A C T G A C T T C C A A T T A G T					

G L Y C I N E

0701 K. FURUDA, J. ANELSON (1980) J. MOL. BIOL. 139, 377-391

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0752 R. G. KOSCHEL, C. M. LAZARUS, M. BASAK, B. KUBATZEK (1981) CELL 23, 625-633

0753 R. G. KOSCHEL, C. M. LAZARUS, M. BASAK, B. KUBATZEK (1981) CELL 23, 625-633

0754 T. SEKITA, Y. KUCHINO, S. NISHIMURA (1981) NUCL. ACIDS RES. 9, 2239-2250

K. SHIBUYA, S. NOGUCHI, S. NISHIMURA, T. SEKITA (1982) NUCL. ACIDS RES. 10, 4441-4446

0756 M. J. BOLLINGSWORTH, R. B. HALLICK (1982) J. BIOL. CHEM. IN PRESS

0757 P. CHAMPATORE, C. DE BENOISTO, G. GADALETA, R. GALLERANI, A. M. KRUM, M. BOLZANO, C. LANAVE, G. PEZZE, C. QUALIGARIELLO, C. SACCONE, E. SBISA (1982) NUCL. ACIDS RES. 10, 3279-3289

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0796 M. J. BIES, R. A. VAN ETTEN, C. T. WRIGHT, M. M. WALBERG, D. A. CLAYTON (1981) CELL 26, 167-180

EXTRA ARM		TP STEM	TP LOOP	TP STEM	AMINOACYL STEM
45	A	49	55	61	67
47	B	51	57	63	69
48	C	52	58	64	70
46	D	50	56	62	68
44	E	48	54	60	66
43	F	47	53	59	65
42	G	46	52	58	64
41	H	45	51	57	63
40	I	44	50	56	62
39	J	43	49	55	61
38	K	42	48	54	60
37	L	41	47	53	59
36	M	40	46	52	58
35	N	39	45	51	57
34	O	38	44	50	56
33	P	37	43	49	55
32	Q	36	42	48	54
31	R	35	41	47	53
30	S	34	40	46	52
29	T	33	39	45	51
28	U	32	38	44	50
27	V	31	37	43	49
26	W	30	36	42	48
25	X	29	35	41	47
24	Y	28	34	40	46
23	Z	27	33	39	45
22	aa	26	32	38	44
21	ab	25	31	37	43
20	ac	24	30	36	42
19	ad	23	29	35	41
18	ae	22	28	34	40
17	af	21	27	33	39
16	ag	20	26	32	38
15	ah	19	25	31	37
14	ai	18	24	30	36
13	aj	17	23	29	35
12	ak	16	22	28	34
11	al	15	21	27	33
10	am	14	20	26	32
9	an	13	19	25	31
8	ao	12	18	24	30
7	ap	11	17	23	29
6	aq	10	16	22	28
5	ar	9	15	21	27
4	as	8	14	20	26
3	at	7	13	19	25
2	au	6	12	18	24
1	av	5	11	17	23
0	aw	4	10	16	22
	ax	3	9	15	21
	ay	2	8	14	20
	az	1	7	13	19
	ba	0	6	12	18
	bb		5	11	17
	bc		4	10	16
	bd		3	9	15
	be		2	8	14
	bf		1	7	13
	bg		0	6	12
	bh			5	11
	bi			4	10
	bj			3	9
	bk			2	8
	bl			1	7
	bm			0	6
	bn				5
	bo				4
	bp				3
	bq				2
	br				1
	bs				0
	bt				
	bu				
	bv				
	bw				
	bx				
	by				
	bz				
	ca				
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	fj				
	fk				
	fl				
	fm				
	fn				
	fo				
	fp				
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	gw				
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	kv				
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	AMINOACYL STEM								D STEM				D LOOP				ID STEM				ANTIC. STEM				ANTIC. LOOP				ANTIC. STEM																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44		
HISTIDINE cont.																																														
0897*	HUMAN*																																													
	MITO																																													
0899*	BOVINE*																																													
	MITO																																													
I S O L E U C I N E																																														
0901	E. COLI																																													
0902	PHAGE T4																																													
0903	B. SUBTILIS																																													
0951	EUGLENA GRACILIS																																													
	CHLORO																																													
0952	D. MELANOGASTER																																													
0953	ASPERGILLUS NIDULANS																																													
	MITO																																													
0954	AUY MAXS																																													
	CHLORO																																													
0955*	RAT*																																													
	MITO																																													

0897 S. ANDERSON ET AL. (1981) NATURE 290, 467-465
 0899 S. ANDERSON, M.R.L. DE BRUIJN, A.R. COULSON, I.C. EPSTEIN, F. SANGER, I.G. YOUNG (1982) J. MOL. BIOL. 156, 689-717
 0901 T. SHIKITA, S. WASHIMURA (1979) NUCL. ACIDS RES. 6, 575-592
 0902 K. FUKUDA, J. ARISAWA (1980) J. MOL. BIOL. 139, 377-391
 0903 K. LOCHMERT, E. LUND, E. DANIELSSON (1982) NUCL. ACIDS RES. 10, 1607-1624
 0951 L. GRAY, H. KOBESSSEL, E. STUYVE (1980) NATURE 286, 908-910
 0952 E.M. ONOZUO, JR., K.E. KUSHLOW, J.R. DODD, R.B. HALLICEK (1980) J. BIOL. CHEM. 255, 10997-11003
 0953 B. ROYERMAN, S. SEARF, E. YAMADA, D. SOELL (1980) CELL 19, 889-895
 R.R. ROBINSON, M. DAVIDSON (1981) CELL 29, 251-259
 0954 W. KOCHI, K. EDWARDS, H. KOBESSSEL (1981) CELL 25, 209-213
 COMPARE P. GUILLERNAUT, J.H. WEIL (1982) NUCL. ACIDS RES. 10, 1653-1659
 0955 P. CAMFAYORE, C. DE BERNISTO, G. GALASSA, R. GALLERANI, A.M. KRDOM, M. ROYTOP, C. LANAVE, G. PEPE, C. GURGIARIELLO, C. SACCOSE, S. BRISA (1982) NUCL. ACIDS RES. 10, 3279-3289

EXTRA ARM		TF STEM	TF LOOP	TF STEM	AMINOACYL STEM
45	B	49	55	61	67
47	D	51	57	63	69
48	F	53	59	65	71
44	A	50	54	62	68
46	C	52	56	64	70
48	E	54	58	66	72
49	G	56	60	68	74
51	I	58	62	70	76
53	K	60	64	72	
55	L	62	66	74	
57	N	64	68	76	
59	O	66	70		
61	P	68			
63		70			
65		72			
67		74			
69		76			
71					
73					
75					
76					

	TF STEM	TF LOOP	TF STEM	AMINOACYL STEM
0897 C A A	C A G A G G C	C T T A C G A	C C C C T	T A T T A C C
0899 C A A	T A G A A A C	T C A T T A C	T T C T	T A T T A C C
	*****	*****	*****	*****
I S O L E U C I N E				
0901 A G G T	C G T G G T	T T C A A G T	C C A C T	C A G G C C T A
0902 A G G T	T A C C A G T	T C A A A T	C T G T T	C T G G G T C A
0903 A G G T	C G T G G T	T T C G A G T	C C A C T	C A G G C C C A
0951 A G G T	C G T A G T	T T C A A G T	C T A G C	A T G G C C C T
0952 A G G T	C G G G G T	T T C G A T C	C C C T C	A T G G C C C A
0953 T G T	T C A G T G	T T C G A G T	C A C T G	A A G A A T C A
0954 A G G T	C T C T G G T	T T C A A G T	C C A G G	A T G G C C C A
0955 A T A A	T A G A G G T	T T T A A A T	C C T C T	T A T T T C T A
	*****	*****	*****	*****

0897/0 ALIGNMENT IS ARBITRARY
 0899/0 ALIGNMENT IS ARBITRARY
 0902/64 IS REPORTED TO BE G III: G.P. MUSEKADA, G. PLUNKETT, W.B. MCCLEATH (1981) 0955/0 ALIGNMENT IS ARBITRARY
 PROC. NATL. ACAD. SCI. 78, 989-992
 0954/38 AFTER RESIDUE 38 INTERVENING SEQUENCE

	AMINOACYL STEM			D STEM			D LOOP			D STEM			ANTIC. STEM			ANTIC. LOOP			ANTIC. STEM																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
ISOLEUCINE cont.																																												
0956	D. MELANOGASTER																																											
	MITO																																											
0960	TOBACCO																																											
	CHLORO																																											
0987*	RATTUS NORVEGICUS*																																											
	MITO																																											
0996*	MOUSE*																																											
	MITO																																											
0997*	HUMAN*																																											
	MITO																																											
0999*	BOVINE*																																											
	MITO																																											
LEUCINE																																												
1001	PHAGE T4																																											
1010	1 E. COLI																																											
1014	E. COLI																																											
1040	3 YEAST																																											
1050	EULENA GRACILIS																																											
	CHLORO																																											

0956 D.O. CLARK, J.M. GODDARD, S.C. WARTIS, C.M.-R. FAUROM, D.R. WOLSTEN-
HOLME (1982) NUCL. ACIDS RES. IN PRESS

0960 F. TAKAIWA, M. SUGIURA (1982) NUCL. ACIDS RES. 10, 2665-2676

0967 D.R. WOLSTENHOLM, C.M.-R. FAUROM, J.M. GODDARD (1982) GENE IN PRESS

0996 M.J. BIRB, R.A. VAN ETTEN, C.T. WELCH, M.W. WALSH, D.A. CLAYTON (1981) CELL 26, 157-180

0997 S. ANDERSON ET AL. (1981) NATURE 290, 467-468

0999 S. ANDERSON, M.E.L. DEBRIJN, A.R. COULSON, I.C. EPERON, F. SANGER, I.G. YOUNG (1982) J. MOL. BIOL. 156, 693-717

1001 K. FUKUDA, J. ABELSON (1980) J. MOL. BIOL. 139, 377-391

1010 G. DUESTER, R.K. CAMPEN, W.M. HOLMES (1981) NUCL. ACIDS RES. 9, 2121-2139

1014 M. MANOJITHA, H. OZEKI, Y. SHIMURA (1981) CELL 23, 239-249

1040 D.W. STAMMING, A. VERBORG, W.J. RUTTER (1981) PROC. NATL. ACAD. SCI. 78, 5963-5967

1050 E.M. OROZCO, JR., R.B. HALLICK (1982) J. BIOL. CHEM. 257, 3265-3275

EXTRA ARM		TP STEM	TP LOOP	TP STEM	AMINOACYL STEM
45 47 B D F H J L N P	49 51 53	55 57 59	61 63 65	67 69 71	73 75
44 46 A C E G I K M O	50 52 48	54 56 58 60	62 64 66 68 70 72	74 76	
ISOLEUCINE cont.					
0956 A T T A	T D C A G T T	T T	T C T G C A T T C A T T D		
0960 A G G T	C T C T G G T T C A A G T		C C A G G A T G C C C A		
0987 A T A A	T A G A G G T T A A A T		C C T C T T A T T C T A		
0996 A T T A	T A G A G G T T C A A G C		C C T C T T A T T C T A		
0997 A T A A	T A G G A G C T T A A A C		C C C C T T A T T C T A		
0999 A T A A	T A G A G C T T C A A A C		C C T C T T A T T C T A		
L E U C I N E					
1001 C G G A A T G A T T T C C T	T G T G G G T T C G A G T		C C C A C T T C T C G C A		
1010 T G T C C T A C G G A C G	T G G G G T T C A A G T		C C C C C C T C G C A		
1014 C G C C G C A A G G T G	T C G A G T T C A A G T		C T C C C T C C G C A		
1040 T A T C G T A A G A T G	C A G A G T T C G A A T		C T C T T A G C A A C C A		
1050 T G T C T T T A T G A T G	T G A G A G T T C G A G T		C T C T C T G C C T G T A		

0960/37 INTERVENING SEQUENCE AFTER THIS POSITION
 0987/0 ALIGNMENT IS ARBITRARY
 0996/0 ALIGNMENT IS ARBITRARY

0987/0 ALIGNMENT IS ARBITRARY
 0999/0 ALIGNMENT IS ARBITRARY
 1040/37 AFTER RESIDUE 37 INTERVENING SEQUENCE

	AMINOCYL STEM	D STEM	D LOOP	ID STEM	ANTIC. STEM	ANTIC. LOOP	ANTIC. STEM
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 A 20 B 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43						
1051	GGTTGTTT ***** **	GGCCGAGC	GGTCTAAGCC	AGGCC	CCTGA	TTCAA ^o CTCAGG	
1052	ASPERGILLUS NIDULANS MITO ***** **	TCCGAGTGCTGG	AATTGGTA	GACAGT	CTTAG	CTTAA ^o CTTAA ^o G	
1053	ASPERGILLUS NIDULANS MITO ***** **	TGGGTAATGCTGA	AATAAGGTA	AACAGG	TTCCG	CTTAGGA ^o CGGA	
1054	HUMAN MITO ***** **	GTAAGAATGCGAG	AGCCCGTA	ATCCCA	TAAAA	CTTAA ^o AACTTTA	
1055	UUU D. MELANOCASTER MITO ***** **	GTCAGGATGCCCG	AGC	GGTCTAAGCC	CCAGA	CTCAA ^o TCTGG	
1059*	RAT MITO ***** **	ATTAGGGTGGCAG	AGCCAGTA	ATTGCG	TAGA	CTTAA ^o AACTTGG	
1060	WAYS MITO ***** **	GGGATAATGGCGA	AATCGGTA	GACGCT	ACGGA	CTTAA ^o AACTCCGT	
1074	YEAST MITO ***** **	GCTATTGTTGGG	AATTGGTA	GACACG	ATACT	CTTAA ^o AGTGTAT	
1084	RAT MITO ***** **	ACTTTATAGGAT	AGAGTA	ATCCA	TGGT	CTTAGGA ^o ACCAA	
1086	XENOPUS LAEVIS MITO ***** **	GTCAGGATGCCCG	AGC	GGTCTAAGCC	CTGCG	CTCAGGTCCAG	
1095*	MOUSE MITO ***** **	ACTTTATAGGAT	AATAGTA	ATCCA	TGGT	CTTAGGA ^o ACCAA	

LEUCINE cont.

1061 A. VERRAS, M. QUIROGA, J. ZALDIVAR, W.J. RUTHER, P. VALENZUELA (1979)
 J. BIOL. CHEM. 254, 12206-12209

1062 E.G. KOECHER, C.M. LAZARUS, M. SASAKI, E. KUERTZEL (1981) CELL 23, 625-633

1063 E.G. KOECHER, C.M. LAZARUS, M. SASAKI, E. KUERTZEL (1981) CELL 23, 625-633

1064 I.C. EPSON, S. AMERSON, D.P. WIERLICH (1980) NATURE 286, 460-467

1065 AMERSON ET AL. (1981) NATURE 290, 457-465

1066 R.R. ROBINSON, M. DAVIDSON (1981) CELL 23, 251-259

1069 G. SACCOPE, P. CAMPTORRE, G. GRADALETA, R. GALLERANI, C. LANAVE, G. PERE
 A.M. KRON (1981) NUCL. ACIDS RES. 9, 4139-4148
 A. STEINMETZ, E.J. GUBINS, L. BOORAD (1982) NUCL. ACIDS RES. 10, 3027-3037
 S. BERLANI, S.G. BONITZ, G. CORUZZI, M. NORBERG, A. VERGATOLOFF (1980) NUCL. ACIDS RES. 8, 5017-5030
 R. GROSSKOPF, E. FELDMANN (1981) CURR. GEN. 4, 191-196
 G. BALI, H. ROFFERTER, M.L. BIRNOSTEIL (1981) NATURE 294, 626-631
 M.J. BISS, R.A. VAN ETTEN, C.T. WRIGHT, M.W. WALBERG, D.A. CLAYTON (1981) CELL 26, 167-180

EXTRA ARM		TP STEM	TP LOOP	TP STEM	AMINOACYL STEM
45 47 B D F H J L N P	44 46 A C E G I K M O	49 51 53	55 57 59	61 63 65	67 69 71 73 75
-----	-----	50 52	54 56 58 60	62 64	66 68 70 72 74 76
LEUCINE cont.					
1051	T A T C G T A A G A T C	C A A G A G	T T C G A A T	C T C T T A G C A A C C A	*****
	:::::	-----	-----	-----	*****
1052	T G A C G C A A G T C G	T A A C G G	T T C G A A T	C G T T T C T C G G A T A	*****
	:::::	-----	-----	-----	*****
1053	T A G T C A A A C T T	T G C A A G	T T C A A G T	C T T G T T A C C C G T A	*****
	:::::	-----	-----	-----	*****
1054	C A G T	C A G A G G	T T C A A T T	C C T C T C T T A A C A	*****
	:::::	-----	-----	-----	*****
1056	T C C T C T C T G A G G G	C G T G G G	T T C G A A T	C C C A C T T C T G A C A	*****
	:::::	-----	-----	-----	*****
1059	T T C C	C A G A G G	T T C A A A T	C C T C T C C C T A A T A	*****
	:::::	-----	-----	-----	*****
1060	C G A C T T T A A G T C G	T G A G G G	T T C A A G T	C C C T C T A T C C C C A	*****
	:::::	-----	-----	-----	*****
1074	T A C T T A C A G T A	T G A A G G	T T C A A G T	C C T T T A A A T A G C A	*****
	:::::	-----	-----	-----	*****
1084	A A A	C T T G G	T G C A A C T	C C A A A T A A A A G T A	*****
	:::::	-----	-----	-----	*****
1086	T C T C C C C T G G A G G	C G T G G G	T T C G A A T	C C C A C T T C T G A C A	*****
	:::::	-----	-----	-----	*****
1095	A A A	C T T G G	T G C A A A T	C C A A A T A A A A G T A	*****
	:::::	-----	-----	-----	*****

1051/37 AFTER RESIDUE 37 INTERVENING SEQUENCE
 1056/37 AFTER RESIDUE 37 INTERVENING SEQUENCE
 1059/0 ALIGNMENT IS ARBITRARY

1060/37 AFTER RESIDUE 37 INTERVENING SEQUENCE
 1095/0 ALIGNMENT IS ARBITRARY

	AMINOACYL STEM	D STEM	D LOOP	D STEM	D STEM	ANTIC. STEM	ANTIC. LOOP	ANTIC. STEM
	1 2 3 4 5 6 7	8 9 10 11 12 13	14 15 16 17 18 19 20	21 22 23 24 25	26 27 28 29 30 31	32 33 34 35 36 37	38 39 40 41 42	
1096*	A T T A G G G T G G C A G A G C C	A G G A A A T T G C C T A A G A G A C T T A A A						
1097*	A C T T T A A A G A T A C A G C T	A T C C A T T G G T C T T A G G C C C C A A						
1098	G T T A G G T G C A G A G C C G G T A	A T T G C A T A A A A C T T A A A C T T T T A						
1099*	A C T T T T A A G G A T A G T A G T T T	A T C C G T T G G T C T T A G G A A C C A A						
	*****	*****						
L Y S I N E								
1151	G C C C G G C T A G C T C A G T C G G T	A G A G C A T G A G A C T C T T A A T C T C A						
1152	A S P E R G I L L U S N I D U L A N G A G A C T T T A G T T A T	A A A C A T A T G A C T T T T A A T C A T T						
1153	G C C C G G A T A G C T C A G T C G G T	A G A G C A T T G G A C T T T T A A T C C A A						
1154	G A G A A T A T G T T T A T	A A A C A G T T G T C T T T T A A G C A A C						
1155*	C A T T G C G A G C C T T A G	A G C G T T A A C C T T T T A A G T T A A						
	*****	*****						

LEUCINE cont.

1096 M.J. SIBB, R.A. VAN ETTEN, C.T. WRIGHT, M.W. WALBERG, D.A. CLAYTON (1981) CELL 26, 157-160

1097 S. ANDERSON ET AL. (1981) NATURE 290, 457-465

1098 S. ANDERSON, M.H.L. DESBRIEN, A.R. COULSON, I.C. EPSON, F. SANGER, I.G. YOUNG, J. MOL. BIOL. 196, 683-717

1099 S. ANDERSON, M.H.L. DESBRIEN, A.R. COULSON, I.C. EPSON, F. SANGER, I.G. YOUNG (1982) J. MOL. BIOL. 156, 683-717

1151 D. DEFRANCO, O. SCHMIDT, D. SOEHL (1980) PROC. NATL. ACAD. SCI. USA 77, 3265-3268

B. ROVENANSKI, S. SRAMP, H. YAMADA, D. SOEHL (1980) CELL 19, 889-896

H.G. KORSCHTEL, C.M. LAZARUS, M. BAJAK, E. KUSPFELZEL (1981) CELL 23, 625-633

D. DEFRANCO, K.B. BURKE, S. HAYASHI, G.M. TURNER, R.C. MILLER, JR., D. SOEHL (1982) NUCL. ACIDS RES. 10, 5799-5805

S.G. BOMIYE, A. YERGOLOFF (1980) J. BIOL. CHEM. 255, 9075-9081

F. CAMPATONE, C. DE BENEDETTO, G. GRANATA, R. GALLERANI, A.M. KRDOM, M. ROLITTO, C. IANAVE, G. PIFE, C. QUAGLIARIELLO, C. SACCOMA, E. SBLEA (1982) NUCL. ACIDS RES. 10, 3275-3289

	EXTRA ARM				TF STEM	TF LOOP	TF STEM	AMINOACYL STEM																											
	45	47	B	D	F	H	J	L	N	P	49	51	53	55	57	59	61	63	65	67	69	71	73	75											
	44	46	A	C	E	G	I	K	M	O	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76										
1096	A	C	C	T	T	G	T	T	C	C	C	C	A	G	G	T	T	C	A	A	A	T	C	C	C	T	A	A	T						
1097	A	A	A								T	T	T	G	G	T	G	C	A	A	C	T	C	C	A	A	T	A	A	A	G	T			
1098	T	A	T	C							C	A	G	A	T	T	C	A	A	T	C	C	T	C	C	T	A	A	C	A					
1099	A	A									A	T	T	G	T	G	C	A	A	C	T	C	C	A	A	T	A	A	A	C	T	A			
1151	G	G	G	T							C	G	T	G	G	G	T	C	G	A	G	C	C	C	A	C	G	T	G	G	G	C	G		
1152	C	T	A	C							T	A	T	A	G	G	T	C	G	A	G	T	C	C	T	A	T	A	G	T	C	T	T	A	
1153	G	G	G	T							C	A	G	G	T	T	C	A	A	G	T	C	C	C	T	G	T	C	G	G	C	C	G		
1154	C	C	A								T	G	T	T	G	T	T	C	A	A	C	T	C	C	A	G	C	T	A	T	T	C	T	C	A
1155	A	G	T	T							A	G	A	C	A	A	C	A	A				A	T	C	T	C	A	C	A	T	G	A		

LEUCINE cont.

LYSINE

1096/0 ALIGNMENT IS ARBITRARY
 1097/0 ALIGNMENT IS ARBITRARY
 1099/0 ALIGNMENT IS ARBITRARY

1155/0 ALIGNMENT IS ARBITRARY
 1156/70 IS REPORTED TO BE T IN R. GROSSKOPF, H. FELOWANN (1981) CURR. GEN.
 4, 151-156

	AMINOACYL STEM								D STEM				D LOOP				ID STEM				ANTIC. STEM				ANTIC. LOOP				ANTIC. STEM																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42									
LYSINE cont.																																																			
1196*																																																			
MOUSE*																																																			
MITO																																																			
HUMAN*																																																			
MITO																																																			
BOVINE*																																																			
MITO																																																			
METHIONINE																																																			
1210																																																			
E. COLI																																																			
1251																																																			
YEAST																																																			
1252																																																			
HUMAN																																																			
1254																																																			
1 ASPERGILLUS NIDULANSO																																																			
MITO																																																			
1255																																																			
2 ASPERGILLUS NIDULANSO																																																			
MITO																																																			
1256																																																			
EUGLENA GRACILIS																																																			
CHLORO																																																			
1296*																																																			
MOUSE*																																																			
MITO																																																			
1297*																																																			
HUMAN*																																																			
MITO																																																			

1196 M.J. BIBB, R.A. VAN EYTEM, C.T. WRIGHT, M.W. WALZBERG, D.A. CLAYTON (1981) CELL 25, 625-633
 1197 S. ANDERSON ET AL. (1981) NATURE 290, 457-465
 1199 S. ANDERSON, M.E.L. DEBRUIJN, A.R. COULSON, I.C. EPERSON, F. SANGER, I.G. YOUNG (1982) J. MOL. BIOL. 156, 689-717
 1210 M. WAKAJIMA, R. DECKI, Y. SUDERA (1981) CELL 23, 239-249
 1251 J. OGAN, E. FELDHAUSEN (1980) MOLEC. ACIDS RES. 8, 1975-1986
 1252 T. SANCOS, M. SANCOS (1981) CELL 23, 699-709
 1254 H.G. KOECHL, C.M. LAZARUS, M. BASAK, H. KUBITZEL (1981) CELL 23, 625-633
 1255 H.G. KOECHL, C.M. LAZARUS, M. BASAK, H. KUBITZEL (1981) CELL 23, 625-633
 1256 M. ROLLINGSWORTH, R.B. WALLICK (1982) J. BIOL. CHEM. IN PRESS
 1296 M.J. BIBB, R.A. VAN EYTEM, C.T. WRIGHT, M.W. WALZBERG, D.A. CLAYTON (1981) CELL 26, 167-180
 1297 S. ANDERSON (1981) NATURE 290, 457-465

EXTRA ARM		TP STEM	TP LOOP	TP STEM	AMINOACYL STEM
45	47 B D F H J L N P	49 51 53	55 57 59	61 63 65	67 69 71 73 75
44	46 A C E G I K M O	50 52 48	54 56 58 60	62 64 66 68 70 72 74 76	

LYSINE cont.					
1196	AGTT	A C A G A C C T T A A A	A T C T C C A T A G T G A		
1197	AGAT	T A G A G A A C C A A C A C	T C T T T A C A G T G A		
1199	AGAT	T C A G A G C C A T A T A	C T C T C C T T G T G A		

METHIONINE					
1210	GGGT	C A C A G G T T C G A A T	C C C G T C G T A G C C A		
1251	AGGT	C G A G A G T T C G A A C	C T C T C T G G A G C A		
1252	AGGT	C C A T C G A T C T A A A	C C A T C C T C T G C T A		
1254	GAA	T C A G A A T T C G A T T	T T C T C C T T T G G C T		
1255	TGAG	T A A T G T T C A A G T	C A T T T A G T C T T A		
1256	TGG	C A C A G G T T C A A A T	C T T G T C T G A G C C A		
1296	AAA	C G T T G G T T T A A A T	C C T T C C C G T A C T A		
1297	AAA	T G T T G G T T A T A C	C C T T C C C G T A C T A		

1196/0 ALIGNMENT IS ARBITRARY
 1197/0 ALIGNMENT IS ARBITRARY
 1199/0 ALIGNMENT IS ARBITRARY

1296/0 ALIGNMENT IS ARBITRARY
 1297/0 ALIGNMENT IS ARBITRARY

	AMINOACYL STEM	D STEM	D LOOP	ID STEM	ANTIC. STEM	ANTIC. LOOP	ANTIC. STEM
	1 2 3 4 5 6 7 8 9 10 12 14 16 A 19 A 21 23 25	11 13 15 17 18 20 B 22 24 26 28 30					
	1299*						
	METHIONINE cont.						
	BOVINE*						
	MITO	AGTAAAGGTCAGCTAATTA		AGCTATCGGG	CGCATACCCGA		
		*****				
	METHIONINE - I N I T I A T O R						
	1351 S. POMBE	TGCCCGCTAGAGACT	GGG	ACTCCD	ACGGG	CTCATAA	CCCCGT

	1352 1 XENOPUS LAEVIS	AGCAGAGTGGCCAGC	GGG	AGCGTG	CTGGG	CCCATAA	CCCCAG

	1354 1 ASPERGILLUS NIDULANS	GCGGTTGATGTAAT	AGT	AACATA	TATGG	CTCATG	CCATA
	MITO	*****					
	1355* RAT*	AGTAAAGTCACTA		AGCTA	TCGGG	CCCATAC	CCCCGA
	MITO	*****					
	1356 YEAST	GCGCCGTGCCACT	GGG	AGCCD	CAGGG	CTCATAA	CCCCTC

	1384 3 D. MELANOGASTER	AGCAGAGTGGCCAGT	GGG	AGCGTG	CTGGT	CCCATAA	CCCCAG

	1385 1,2 D. MELANOGASTER	AGCAGAGTGGCCACT	GGG	AGCGTG	CTGGG	CCCATAA	CCCCAG

1299 S. ANDERSON, M.R.L. DEBUIJN, A.R. COULSON, I.C. EPSON, F. SANGER, HOLZROP, C. LAMAVE, G. PEPE, C. QUALLIGARIELLO, S. SACCORE, E. SEIRA (1982) NUCL. ACIDS RES. 10, 3279-3289

1351 I.G. YOUNG (1982) J. MOL. BIOL. 156, 683-717

1352 J. IINO, O. SCHMIDT, D. SOELL (1980) CELL 21, 509-516

1352 J.E. TELFORD, A. KRISHNAM, R.A. KOSKI, R. GROSSCHUHL, F. MUELLER, 1356 A. VIBRONIS, E. GONZALEZ, P. BULLI, P. VALENZUELA (1982) NUCL. ACIDS RES. 10, 1093-1096

S.G. CLARKE, M. BIRNBAUM (1979) PROC. NATL. ACADE. SCI. USA 76, 1384 J.P. GERZEN, P.C. WENNING, D. SOELL (1981) NUCL. ACIDS RES. 9, 5867-5892

A. KRISHNAM, E. JOFFESTYER, E. DI CAPUA, R. GROSSCHUHL, M.L. BIRNBAUM 1385 S. SEAR, D. DEFRANCO, M. SILBERKLANG, R.A. HOSBACH, T. SCHMIDT, E. KUBLI, (1979) NUCL. ACIDS RES. 7, 1749-1763

E.G. KOEHL, C.M. LAZARUS, M. BASKAK, H. KUSPFEL (1981) CELL 23, 629-633

1385 J.P. GERZEN, P.C. WENNING, D. SOELL (1981) NUCL. ACIDS RES. 9, 5867-5882

EXTRA ARM		TP STEM	TP LOOP	TP STEM	AMINOACYL STEM
45	47 B D P H J L N P	49 51 53	55 57 59	61 63 65	67 69 71 73 75
44	46 A C E G I K M O	50 52 54	56 58 60	62 64 66	68 70 72 74 76

1299	AAA	TGTGGT	TATAT	CCTTCC	CGTACTA
METHIONINE cont.					
METHIONINE - INITIATOR					
1351	AGGT	CCAGGATCGAAA	CCTGG	CGCGCA	*****
1352	AGGT	GATGATCGAAA	CCATC	TCTGCTA	*****
1354	ATA	TTAGGTGCAACT	CCTAA	TCCGCTA	*****
1355	AAA	TGTTGTTAAAC	CCTTC	CCGTACTA	*****
1356	ATG	TCTCGATCGAACC	GAGCGCGCTA	*****	*****
1384	AGGT	CGAGGATCGAAA	CCTTG	TCTGCTA	*****
1385	AGGT	CGAGGATCGAAA	CCTTG	TCTGCTA	*****

1299/O ALIGNMENT IS ARBITRARY 1355/O ALIGNMENT IS ARBITRARY

	AMINOACYL STEM	D STEM	D LOOP	D STEM	D LOOP	D STEM	D STEM	ANTIC. STEM	ANTIC. LOOP	ANTIC. STEM	
	1 2 3 4 5 6 7 8 9 10 11 12 13	14 15 16 17 18 19 20 21	22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42								
	METHIONINE-INITIATOR cont.										
1386	D-MELANOGASTER MITO ***** RATTUS NORVEGICUS* MITO ** ****	A A A A G A T A G C T A A T T A G T A A G G T C A G C T A A C T A *****	A A G C T A C T G G G T T C A T A C A G C T A T C G G G C C C A T A C *****								
	P H E N Y L A L A N I N E										
1451	YEAST MITO ****	G C T T T T A T A G C T T A G T G C G G T T T A G C T C A G T T G G G *****	A A G C C G A T A A A T T G A A G A A A G C C G T C A G A C T G A A G ' A A G A G C G T T A G A C T G A A G A A A G C C G G T C A G T G A A G T *****								
1452	N. CRASSA *****	G C G G T T T A G C T C A G T T G G G *****	A A G C C G T C A G A C T G A A G ' A A G A G C G T T A G A C T G A A G A A A G C C G G T C A G T G A A G T *****								
1453	XENOPUS LAEVIS *****	G C C G A A A T A G C T C A G T T G G G *****	A A G C C G T C A G A C T G A A G T G T T A T G T A G C T T A C C T C T C *****								
1454	ASPERGILLUS NIDULANS MITO *****	C T T G A G A G C C T C A A T T G G T G T T A T G T A G C T T A C C T C T C *****	A A G C C G A T A A A T T G A A G A A A G C C G T C A G A C T G A A G ' A A G A G C G T T A G A C T G A A G A A A G C C G G T C A G T G A A G T *****								
1455	HUMAN MITO *****	G T T A T G T A G C T T A C C T C T C *****	A A G C C A T A C A C T G A A A A A A G C C G C C A G A C T G A A G ' A A A G C A A A G C A C T G A A A A A A G C A A A G C A C T G A A A A *****								
1456	YEAST *****	G C G G A T T T A G C T C A G T T G G G *****	A A G C C G C C A G A C T G A A G ' A A A G C A A A G C A C T G A A A A A A G C A A A G C A C T G A A A A *****								
1457	MOUSE* MITO *****	G T T A A T G T A G C T T A T A T A A C A *****	A A G C A A A G C A C T G A A A A A A G C A A A G C A C T G A A A A A A G C A A A G C A C T G A A A A *****								
1458*	BAT* MITO *****	G T T A A T G T A G C T T A T A A T A *****	A A G C A A A G C A C T G A A A A A A G C A A A G C A C T G A A A A A A G C A A A G C A C T G A A A A *****								

1386 D.O. CIARK, J.M. OGDARD, S.C. MARTIN, C.M.-R. FAURON, D.R. WOLSTENHOLME (1982) MOL. ACIDS RES. IN PRESS
 1387 D.R. WOLSTENHOLME, C.M.-R. FAURON, J.M. OGDARD (1982) GENE IN PRESS
 1451 D.L. MILLER, H.C. MARTIN, H.D. PRAM, J.E. DONELSON (1980) J. BIOL. CHEM. 254, 11738-11740
 1452 E. SZELER, C. YEMOFREY (1980) MOL. ACIDS RES. 8, 1033-1042
 1453 F. REISLER, S.G. CHANOKW (1980) CELL. 19, 346-353
 1454 E.G. KORNBLI, C.M. LAZARUS, W. BASAK, H. KUERTZEL (1981) CELL. 23, 625-633
 1455 I.C. EPERON, S. ANDERSON, D.P. NIERLICH (1980) NATURE 286, 460-467
 M. KOBAYASHI, T. SEKI, K. YAGINUMA, K. KOIKE (1981) GENE 16, 297-307
 ANDERSON ET AL. (1981) NATURE 290, 457-465
 1456 P. VALKENBURG, A. VERHOEF, F. WEINBERG, R. BISSOP, W.J. RUTTER (1978) PROC. NATH. ACAD. SCI. USA. 75, 190-194
 1457 M. KOBAYASHI, T. SEKI, K. YAGINUMA, K. KOIKE (1981) GENE 16, 297-307
 1458 M. KOBAYASHI, T. SEKI, K. YAGINUMA, K. KOIKE (1981) GENE 16, 297-307

	EXTRA ARM	TF STEM	TF LOOP	TF STEM	AMINOACYL STEM
	45 47 B D F H J L N P	49 51 53	55 57 59	61 63 65	67 69 71 73 75
	44 46 A C E G I K M O	50 52 48	54 56 58 60	62 64	66 68 70 72 74 76
1386	T T A	T A A G G	T T A T A A T	C C T T T	T C T T T T T A
1387	A A A	T G T G G	T C T A A A C	C C T T C	C C G T A T G A
		---	---	---	-----
	METHIONINE-INITIATOR cont.				
		---	---	---	-----
	P H E N Y L A L A N I N E				
1451	T T A C	A T G T A G	T T C G A T T	C T C A T	T A A G G G C C A
1452	A G G T	C G T G T G	T T C G A T C	C A C A C	A A A C G G C A
1453	A G G T	C C T G G	T T C G A T C	C G G G	T T C G G C A
1454	A G G T	T G T A G	T T C A A G T	C T T A T	C T C G A C C A
1455	A G A	C G G C T	C A C A T	C A C C C	C A T A A C C A
1456	A G G T	C T G T G	T T C G A T C	C A C A G	A A T T C G C A
1457	A G A	T G G A T A	A T T G	T A T C C	C A T A A C C A
1458	A G A	T G G A T T	C A A A	A A T C C	C A T A A C C A

1387/0 ALIGNMENT IS ARBITRARY
 1452/37 AFTER RESIDUE 37 INTERVENING SEQUENCE
 1456/37 AFTER RESIDUE 37 INTERVENING SEQUENCE

1457/0 ALIGNMENT IS ARBITRARY
 1458/0 ALIGNMENT IS ARBITRARY

EXTRA ARM		TF STEM	TF LOOP	TF STEM	AMINOACYL STEM
45	B D F H J L N P	49 51 53	55 57 59	61 63 65	67 69 71
44	A C E G I K M O	50 52 48	54 56 58 60	62 64	66 68 70 72 74 76

PHENYLALANINE cont.					
1459	AGG T	C C C G G	T T C A A T C	C C G G G	T T C G G C C
1496	AG A	T G A T A	A T T C	T A T C C	C A T A A C A
1499	AG A	T G A G T C	T C C C	A A C T C	C A T A A C A

P R O L I N E					
1501	AGG T	C C A A G G	T T C A A A T	C C T T G	T A T G G A G A
1502	AGG T	C C G G G	T T C A A T C	C C G G G	T C G G C C
1551	A A T T	G T A T G	T T C G A A T	C A T A A	T A A C C T G A
1552	A C C T	A G T T A G	T T C G A G T	C T A T C	E T A T C T G A
1596	T G G	T G G G A	G T A G C	T C C T T	C T T C T T G A
1597	T G G	T G G A G T	T A A A G	A C T T T	T C T C T G A

1496/0 ALIGNMENT IS ARBITRARY
 1499/0 ALIGNMENT IS ARBITRARY

1596/0 ALIGNMENT IS ARBITRARY
 1597/0 ALIGNMENT IS ARBITRARY

	AMINOACYL STEM	D STEM	D LOOP	D STEM	D LOOP	D STEM	ANTIC. STEM	ANTIC. LOOP	ANTIC. STEM	
	1 2 3 4 5 6 7	8 9 10 11 12 13	14 15 16 17 18 19 20	21 22 23 24 25 26	27 28 29 30 31 32	33 34 35 36 37 38	39 40 41 42			
1599*	C A G G G A A T A G T T T A A A T A	.....	A A A T A	G A A C T T C A G C C T T T G G G G G G T T G A					
	**** *****									
	PROLINE cont.									
	BOVINE*									
	MITO									
	S E R I N E									
1601	G G A G C G C T G G C A G A G T	.....	A G T	G G T T T A A T G C A C C G G T C T T G A A A A C C G G					

1650	G C A A C T T G C C G A G T	.....	A G T	G G T T A A G G C G A A A C A T T A G A A A T C T T T					
	** *****									
1651	G G A A A A T A C T A T A	.....	A T A	G G T A A G T G A T T A T T G C T A A G T A A T					

1652	G T C A C T A T G T C C G A G T	.....	A G T	G G T T A G G A G T T A G A C T C G A A T C T T A A					

1653	A S P E R G I L L U S N I D U L A N S A G A G A G T G C T G A G T	.....	A G T	G G T A A G G C A C T A G C T T G A G T C T A G T					

1654	A S P E R G I L L U S N I D U L A N S G G A A A G T T T C C A T G	.....	A T G	G G T A G G T A A G A T A T T T G C T A A A T A T T					

1656*	G A G A A A G	.....	A A G	C T C A					

1657*	G A A A A A G	.....	A A G	T A T G					

1599 S. ANDERSON, M.H.L. DEBRUIJN, A.R. COULSON, I.C. EPERON, F. SANKER, 625-633
 I.G. YOUNG (1982) J. MOL. BIOL. 156, 689-717 1654 H.G. KORSCHTEL, C.M. LAZARUS, M. BASAK, H. KUENTZEL (1981) CELL 23,
 1601 K. FURUKA, J. ANDERSON (1980) J. MOL. BIOL. 139, 377-391 626-633
 1650 G.S. PAGE, S.D. BRILL (1981) NUCL. ACIDS RES. 9, 921-934; 1656 M.H.L. DE BRUIJN, P.H. SCHREIER, I.C. EPERON, B.G. BARRELL, E.Y. CHEN,
 R.E. BAKER, A. RIGHEL, D. VOSKOTEL, H. FELDMANN (1982) EMBO JOURNAL 1, P.W. ARNSYONG, J.F.H. WONG, S.A. ROE (1980) NUCL. ACIDS RES. 8,
 291-295 5213-5222
 1651 M.C. MARTIN, D. MILLER, J. HARTLEY, P. MUTHIRAN, J.E. DONELSON (1980) ANDERSON ET AL. (1981) NATURE 290, 457-465
 CELL, 19, 339-343 M.H.L. DE BRUIJN, P.H. SCHREIER, I.C. EPERON, B.G. BARRELL, E.Y. CHEN,
 D.L. MILLER, M.C. MARTIN, S.D. PRIMA, J.E. DONELSON (1979) J. BIOL. CHEM. P.W. ARNSYONG, J.F.H. WONG, S.A. ROE (1980) NUCL. ACIDS RES. 8,
 254, 11735-11740 1657 S. ANDERSON, M.H.L. DEBRUIJN, A.R. COULSON, I.C. EPERON, F. SANKER,
 I.G. YOUNG (1982) J. MOL. BIOL. 156, 689-717
 1652 S.G. BOWTIE, A. TENGLOFF (1980) J. BIOL. CHEM. 255, 9075-9081
 J. MO. O. SCHMIDT, D. BRILL (1980) CELL 21, 509-516
 1653 H.G. KORSCHTEL, C.M. LAZARUS, M. BASAK, H. KUENTZEL (1981) CELL 23,

	AMINOACYL STEM								D STEM				D LOOP				D STEM				ANTIC. STEM				ANTIC. LOOP				ANTIC. STEM																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44												
SERINE cont.																																																								
1658	RAT	T	T	G	A	G	A	A	G	A	C	A	T	A	A	T	G	G	C	T	T	G	A	A	A	T	T	G	G	C	T	T	G	A	A	A	C	C	A	G	T															
1659	YEAST	G	C	A	C	T	A	T	G	C	C	G	A	G	T	G	G	T	A	G	G	C	A	G	A	C	T	C	G	A	A	A	T	C	T	C	T																			
1660	YEAST	G	C	A	C	T	A	T	G	C	C	G	A	G	T	G	G	T	A	G	G	C	A	G	A	C	T	C	T	G	A	A	A	T	C	T	C	T																		
1695*	MOUSE	T	G	A	G	A	A	G	A	C	A	T	A	T	A	T	G	G	T	A	G	G	C	A	G	A	C	T	C	T	G	A	A	A	T	C	T	C	T																	
1696*	MOUSE	A	A	G	A	A	G	A	T	T	G	T																																												
1697*	HUMAN	T	T	G	A	A	A	A	G	T	C	A	T	G	G	A	G	G	C	C	A	T	G	G	C	T	T	G	G	C	T	T	G	A	A	A	C	C	A	G	C															
1699*	BOVINE	T	T	G	A	G	A	G	A	C	A	T	A	G	A	G	G	T	T	A	G	A	T	G	G	C	T	T	G	G	C	T	T	G	A	A	A	C	C	A	T															
	MITO																																																							
T H R E O N I N E																																																								
1701	E. COLI	G	C	T	G	A	T	A	T	G	C	T	C	A	G	T	G	G	T	A	G	A	G	C	C	C	C	T	T	G	T	A	G	D	D	G	T																			
1702	PHAGE T4	G	C	T	G	A	T	A	T	G	C	T	C	A	G	T	A	G	A	G	C	C	C	C	C	C	C	T	T	G	T	A	A	T	G	A	G	G																		
1703	E. COLI	G	C	C	G	A	C	T	A	G	C	T	C	A	G	T	A	G	A	G	C	T	G	G	C	T	T	G	A	A	A	C	C	A	T	A	G	T																		

1658 P. CAMPTORE, C. DE BENEDETTO, G. GADALETA, R. GALLERANI, A. M. KROON, M. ROZASPO, C. LANAVE, G. PEPE, C. QUAGLIARIELLO, C. SACCONE, E. SBLA (1982) *MOLEC. ACIDS RES.* 10, 3279-3289

1659 M.V. OLSON, G.S. PAGE, A. SESTREMAC, P. M. PIPER, M. NORRINGTON, R.B. WEISS, B.D. HALL (1981) *NATURE* 291, 464-467

1695 M.J. BIES, R.A. VAN ETTEN, C.T. WRIGHT, M.W. WALSBURG, D.A. CLAYTON (1981) *CELL* 26, 167-180

1696 M.J. BIES, R.A. VAN ETTEN, C.T. WRIGHT, M.W. WALSBURG, D.A. CLAYTON (1981) *CELL* 26, 167-180

1697 S. ANDERSON ET AL. (1981) *NATURE* 290, 457-465

1699 I.G. YOUNG (1982) *J. MOL. BIOL.* 156, 683-717

1701 K.L. DUESTER, W.N. BOJAMES (1980) *MOLEC. ACIDS RES.* 8, 3793-3807

1702 K. FUKUDA, J. ABEKAWA (1980) *J. MOL. BIOL.* 139, 377-391

1703 J.J. ROSSI, A. LANDY (1979) *CELL* 16, 523-534

L. HUDSON, J. ROSSI, A. LANDY (1981) *NATURE* 294, 422-427

EXTRA ARM		TF STEM	TF LOOP	TF STEM	AMINOACYL STEM
45	B D F H J L N P	49 51 53	55 57 59	61 63 65	67 69 71 73 75
44	A C E G I K M O	50 52 48	54 56 58 60	62 64 56 68 70 72 74 76	
SERINE cont.					
1658	T G T	A G G G G	T C G A A T C	C T T C C	T T T C T T A T
1659	T G G C T C T G C C C G	C G C T G G	T T C A A A T	C C T G C	T G T G T C D
1660	T G G C T C T G C C C G	C C C T G G	T T C A A A T	C C T G C	T G T G T C D
1695	A A T T T T	A G G G G	T T C G A T	C T T C C	T T T C T T A T
1696	G C T	T C C A T G	T T T A A A A	C A T G G	C T T T C T T A
1697	T T T	G G G G G	T T C G A T	C T T C C	T T T T T G T
1699	A G T	A G G G G	T T C G A T T	C C T T C	C T T T C T T A
THREONINE					
1701	G G G T	C C C C A G	T T C G A C T	C T G G G	T A T C A G C A
1702	A T G T	C G C C G	T T C G A T T	C C G T C	A A T C A G C A
1703	A G G T	C A C C A G	T T C G A T T	C C C G T	A G T C G C C A

1658/85 IS REPORTED TO BE T IN R. GROSSKOPF, R. FELDMAN (1981) CURR. GEN. 1696/O ALIGNMENT IS ARBITRARY
 4, 151-158 1697/O ALIGNMENT IS ARBITRARY
 1698/O ALIGNMENT IS ARBITRARY

EXTRA ARM		TF STEM	TF LOOP	TF STEM	AMINOACYL STEM
45	47 B D F H J L N P	49 51 53	55 57 59	61 63 65	67 69 71 73 75
44	46 A C E G I K M O	50 52	54 56 58 60	62 64	66 68 70 72 74 76

THEONINE cont.					
1704	AGGT	C G C A G T	T C G A A T	C T G C C T	A T C A G C A
1710	AGGT	C G C A G T	T C G A A T	C T G C C T	A T C A G C A
1751	TTA	T T A A G T	T C A A A T	C T T A G T	A T T T A C A
1752	AGGT	T G G G G T	T C A A A T	C C C T A T	A T A T A C A
1753	ATA	A A C A A G T	T C G A T A	C T T G T A	C T G G G C T
1754	AACT	C A T C G G T	T C A A A T	C C G A T A	A G G G G C T
1796	AAA	T G A G A T	C T T C	T C T T C T	C A A G A C A
1797	AGA	T G A A A C C T		T T T T C A	A G G G A C A
1799	AGA	A G G A G A C A A C T A A C		C T C C C T A A G A C T	

1801	GTGT	T G G A G T	T C G A G T	C T C T C C	G C C C C T G
1851	ATT	T C T A G T	T C A A A T	C T A A G T	A C T C T T G

1799/0 ALIGNMENT IS ARBITRARY

1796/0 ALIGNMENT IS ARBITRARY
1797/0 ALIGNMENT IS ARBITRARY

EXTRA ARM		TF STEM	TF LOOP	TF STEM	AMINOACYL STEM											
45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	
A	C	E	G	I	K	M	O	L	N	P						
44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76
TRYPTOPHAN cont.																
1852	C A T	T A G G A G T	T C G A A T	C T C T T	T A T C C T T											
1853	T G G T	C A G G G T	T C A A C T	C C C T G	A G G G T C T											
1854	A T G T	A G T A G G T	T C G A A T	C C T A C	A G A G C G C											
1855	T A G	A A A C A	A A C A	A G T T A	A C T T C T T											
1896	A A G	A A A C A	C A C A	A G T T A	A C T T C T G											
1897	C A G	T A A G T	T G C A A	T A C T T	A A T T T C T G											
1899	A A G	C A A G T	A A A T T	T A C T T	A A T T C C T C											
T Y R O S I N E																
1901	C G T C A	T C G A C T T	C G A A G G T	T C G A A T	C C T T C	C C C C A C C A										
1902	C G T C A	C A G A C T T	C G A A G G T	T C G A A T	C C T T C	C C C C A C C A										
1905	T G G T A	G T A C C G T	G T T G G T	T C G A A T	C C A A C T T	A C T T C A										

1853/37 AFTER RESIDUE 37 IMPROVING SEQUENCE
 1855/0 ALIGNMENT IS ARBITRARY
 1896/0 ALIGNMENT IS ARBITRARY
 1897/0 ALIGNMENT IS ARBITRARY
 1899/0 ALIGNMENT IS ARBITRARY

EXTRA ARM		TP STEM	TP LOOP	TP STEM	AMINOACYL STEM											
45	B D F H J L N P	49	51	53	55	57	59	61	63	65	67	69	71	73	75	
44	A C E G I K M O	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76
<p>TYROSINE cont.</p>																
1947	T G C C T A T G A G C C G T	C G A A G G T T C G A T T	C C T T T C T T C C C T A													
	: : : : : :															
1951	A G A T	C G G C G T T C G A C T	C G C C C C G G G A G A													
1952	A G A T	C G G C G T T C G A C T	C G C C C C G G G A G A													
1953	A G G T	C C T G G T T C G A T T	C C G G C T C G A G G A													
1954	A G T T C A T C T T T	C G T G G T T C G A T	C C A G C A C G A C T C A													
1955	A G A	C A G G G T T G A G C	C C C T T T T A C C A													
1958	A G G T	C G T G G T T C G A T T	C C G G C T C G A G G A													
1996	A C A	C A G A G G T T T A A A T	C C T C T T T T A C C A													
1997	A G A	C A G G G G T T A G G	C C T C T T T T A C C A													
1999	A G A	T A G A G G T T T G A C T	C C T C T T T T A C C A													

1996/O ALIGNMENT IS ARBITRARY
 1997/O ALIGNMENT IS ARBITRARY
 1999/O ALIGNMENT IS ARBITRARY

1951/37 AFTER RESIDUE 37 INTERVENING SEQUENCE
 1952/37 AFTER RESIDUE 37 INTERVENING SEQUENCE
 1955/O ALIGNMENT IS ARBITRARY

EXTRA ABM		TF STEM	TF LOOP	TF STEM	AMINOACYL STEM
45	B	49	55	51	67
47	D	51	57	59	69
48	A	50	54	60	66
46	C	52	56	62	68
49	P	53	58	64	70
50	L	55	60	66	72
51	N	57	62	68	74
52	M	59	64	70	76
53	O	61	66	72	
54	J	63	68	74	
55	H	65	70	76	
56	I	67	72		
57	K	69	74		
58	G	71	76		
59	E	73			
60	C	75			
61	A				
62	T				
63	G				
64	G				
65	A				
66	C				
67	C				
68	T				
69	T				
70	T				
71	T				
72	T				
73	T				
74	T				
75	T				
76	T				

	TF STEM	TF LOOP	TF STEM	AMINOACYL STEM
2040	ACGT	CTCGATC	CTGGG	CGAATCA
2051	AGAT	TCGAAC	CCTATA	TTCTTA
2052	GGT	TCAAAT	CACCTA	TTCTTA
2053	AGA	CTAAC	TGAC	CGCTGA
2054	AGGC	TCATCA	CCGG	CGAACA
2055	AGT	ATCAT	ATGAA	CACTGA
2056	AGA	TTTGTG	CAATA	TAAATGA
2059	AGA	ATCAT	ATGAA	CACTTGA
2060	AAGT	CATCA	CTGAT	TATCCCTA
2061	ATGT	CAGCG	CTCGATC	CGCTTCCCTCA

VALINE

2055/0 ALIGNMENT IS ARBITRARY

EXTRA ARM		TP STEM	TP LOOP	TP STEM	AMINOACYL STEM
45	B D P H J L N P	49 51 53	55 57 59	61 63 65	67 69 71 73 75
44	A C E G I K M O	48 50 52	54 56 58 60	62 64 66 68 70 72 74 76	

VALINE cont.					
2063	A A G T	C A T C A G	T T C G A G C	C T G A T	T A T C C C T A
2096	A G A	T T C A T	G A C C A	A T G A A	C A C T G T G A
2099	A G A	C T T O A T	T C A T T	A T G A A	T A T C T G A

2099/0 ALIGNMENT IS ARBITRARY

2096/0 ALIGNMENT IS ARBITRARY