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Compilation of DNA sequences of *Escherichia coli* (update 1991)

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ABSTRACT

We have compiled the DNA sequence data for *E.coli* available from the GENBANK and EMBL data libraries and over a period of several years independently from the literature. This is the third listing replacing and increasing the former listing roughly by one fifth. However, in order to save space this printed version contains DNA sequence information only. The complete compilation is now available in machine readable form from the EMBL data library (ECD release 6). After deletion of all detected overlaps a total of 1 492 282 individual bp is found to be determined till the beginning of 1991. This corresponds to a total of 31.62% of the entire *E.coli* chromosome consisting of about 4,720 kbp. This number may actually be higher by some extra 2,5% derived from lysogenic bacteriophage lambda and various DNA sequences already received for statistical purposes only.

INTRODUCTION

Within this sequence supplement issue we were able to publish a compilation of DNA sequences of *Escherichia coli* both in 1989 and 1990 and asked our colleagues from all over the world for additions and corrections [1,2]. Ever since the number of newly published *E.coli* sequence data increased substantially (see Table 1). Thus we were able to add and correct a number of entries. According to our data a total of 1 492 282 bp is sequenced till January 1991. At least one third of the nucleotides is published twice. The data presented here may serve as a basis for encouragement to our colleagues to either send us their unpublished, mostly flanking material or to determine additionally the sometimes very small gaps towards known neighbouring sequences. This may finally help to produce the *Escherichia coli* K12 DNA sequence as the first complete sequence of a living organism. This compilation is available in its complete form quarterly from EMBL data library together with their current release on tape (ECD). It may also be received on CD-ROM together with a service stand alone program for quick database search and direct access to collected sequences.

PREVIOUS AND SUPPORTING EFFORTS

The most famous collection of *E.coli* data is the linkage map compiled by B.Bachmann [3]. These data were recently updated and we tried to follow this update as much as possible. Three other groups [4–8] started a program to fit the DNA sequence data directly onto the physical map compiled by Y.Kohara et al. [9]. We preferred the genetic map positions rather then the physical map coordinates, since we try to include genetic data as well. In general one may obtain the physical data simply by multiplying the genetic 'map' data by a factor of 47.2. This operation needs to pay attention to a large inversion within the Kohara restriction map, which however is considered in two other cosmidbanks [10,11]. In order to be prepared for merging our data with those regarding the Kohara map data directly [4–8] we have compared our data and paid attention to all of these collection as far as possible. Only the unpublished material (about 68 000 bp) available exclusively to us, to K.Rudd or to B.Baum (both Bethesda, MD) is not included into the collection presented here, but may be available on personal request. Additions and corrections of several colleagues are indicated in the main list within the comment column (see Table 1 for abbreviations).

PERFORMED COMPILATION

The general scope of this collection is to allow a compilation of all uncoordinated sequence information to finally end up with a complete Escherichia coli nucleotide sequence data bank, including all sequenced mutants. In order to give a visual impression about the availability of sequence information of *E.coli* DNA we include an appropriate figure. This Figure 1 is printed automatically on a high resolution printer and is to scale as far as possible. The extent of the black bars represents the mainly sequenced areas. All sequences with more then 2000 contiguous basepairs are shown. The final print may not give enough resolution, thus the comparison with the main list is strongly recommended.

Besides the pure sequence information some specified additions are introduced, mostly if restriction maps could be found in the original paper. We used B.Bachmann's genetic map data to sort the sequences roughly by a tenth of a minute. Fine assortment was by a hundredth of a minute, if the sequences overlap. A

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hundredth of a minute corresponds to 472 bp, which seems to be a sufficient resolution. If the sequences were mapped in either of the compilations using the Kohara map [4–8], we preferred to use their assignment including the respective orientation.

Note, the given map coordinate may vary somehow within different issues of this collection, due to increasing number of recognized overlaps. If the numbers are not consecutive within collected entries, you may find the missing entries within the electronic ECD data bank only. Numbers higher then 100 within this line refer to DNA sequences, which could not be localized within the chromosome yet. The numbers refer to the following type of information:

101–126	Unlocalized structural genes in alphabetical order
>200	Insertion sequences in quasi numerical order (e.g. 200.05 is IS5; 201.50 is IS150)
>300	tRNAs filed as RNA sequences and unlocalized tRNA genes in alphabetical order of the corresponding amino acids
>400	unlocalized RNAs
>500	reviews and summaries (neglected here)

The gene symbols are either according to the Bachmann list or to the respective paper. Several symbols have been changed in the past for different reasons. Thus the given entry names within the EMBL or GenBank entries differ sometimes from the given gene symbol. These differences are indicated as much as possible mostly using the '=' symbol in the last position of the name column pointing to the comment column. If more then two gene symbols are necessary to describe the content either of a single or a condensed entry, the '&' symbol points to the comment column, in order to indicate that this area consists of more than two genes. Thus the two columns should be read as one consecutive item. We tried to use each gene symbol at least once in the first position. Since a fairly compressed form had to be used within this databank, some terms and abbreviations had to be used and are explained in Table 1.

This third edition of ECD contains a major increase of information by adding the exact coordinates for the performed overlaps. In order to make the calculations transparent, we preferred to keep all references with contributions to the respective area. In future issues we may only be able to quote one reference per data bank entry. However, the full set of information will always be provided on the electronic ECD version. Structural information besides the DNA sequence data and some other functional data, e.g. restriction map data, functional analysis data, sequence corrections or sequenced mutations are now also only in the electronic ECD version. Most tRNA sequences are compiled together with their respective anticodon sequence. For crossreferences to the tRNA collection [12] see our previous listing [1]. Most ribosomal operons are not fully sequenced within their 16S and 23S RNA genes. Thus the compiled sequences are sometimes only analogs. Insertion sequences are compiled using the known copy number within *E.coli* K12 strain W3110 [13,14]. A future issue of this collection may contain this information at the respective genetic locus.

Strains other then *E.coli* K12 are indicated. However, the respective sequence data are not included in the final calculation. Names not found within the Bachmann list or not genetically defined within the original paper are abbreviated but explained with the full name. Undetermined or open reading frames (urf or orf) are indicated mostly according to the original paper and the resulting protein size. Regions with no specific genetic function are marked as intergenic or flanking regions. Some reviews on the genetic or functional structure as well as on cosmid banks are included, but neglected here.

The accession number column gives the first accession number for any EMBL entry. This number remains constantly with the quoted nucleotide sequence. It is therefore the most important cross reference. According to the general databank policies the accession number will even be part of any condensed entry after removing overlaps. Thus an EMBL EC entry may be found via different accession numbers, but each accession number points to one individual EC entry only. If the EMBL-accession number differs from the GenBank accession number, the GenBank accession number is given in the comment column.

The EMBL column gives the EMBL entry name for the given reference, usually beginning with the identification EC..... . The respective GenBank entry name usually begins with ECO..... , and is given in the respective column. This may be used to find *Escherichia coli* sequences directly either within the EMBL databank or GenBank. However, this identification may also point to plasmid borne and other sequences (for a list of these entries see the previous listing [1]).

Note, that the EC or ECO entry name may have been changed between different database releases, especially due to compressing overlapping sequences or to changing preliminary names (usually the respective accession number). Numbers in brackets after the name point to the position of this reference within the list of references of the respective GenBank/EMBL entry. Incorporation of these numbers is still incomplete. In order not to depend on these changes the respective invariant accession number is always given in the accession number column.

There are now five columns giving different types of numbers of basepairs:

1) The basepair ('bp') column gives the number of basepairs found in the reference quoted. The number is mostly consistent with the respective number given in the EMBL or GenBank entry. If it is clear from the original text, that the given sequence information is used as illustration only and not originally determined here, the entry within this column is 0. If the text allows to complete restriction sites the flanking nucleotides are added, or if it allows to recognize vector sequences, these sequences are omitted. Thus the given number may differ from the EMBL or GenBank entry. This is mostly indicated in the comment column.

2) The 'offset' column is a control number for ascending order in the map column and describes the number of nucleotides collected up to the previous entry.

3) The 'from' column defines the address number of the nucleotide to begin with in the respective collection.

4) The 'to' column defines the respective nucleotides to terminate the respective collection. If the *from* number is higher then the *to* number our program automatically inverses the sequence.

5) The total column gives the number of basepairs added to a total number after deletion of all repeats and overlaps from different entries. This number is given only once per added area in the first entry after a sort by the genetic map position. Data from strains other than *E.coli* K12 are ignored in this calculation. If there is no overlap to other entries the numbers given in the bp and total column are identical. Adding up all entries in this column we arrive at the actual number of sequenced basepairs of the entire *E.coli* genome. The actual number of total basepairs sequenced up to January 1991 is 1 492 282 bp = 31.6%

In order to distinguish between the different entries, e.g.for this printed version of the data base, an additional one letter column (*) is included as well. **T** defines the start of a completely collectable entry. **P** defines the start of an entry only partially collectable. **F** defines an entry missing in the EMBL data base. **C** defines any collectable entry other then the starting one. **B**, **J**, **U**, and **W** define entries from strains other then *E.coli* K12. The article column line gives the references for the quoted sequence information in a fairly condensed format and indicates the volume and first page of each entry, only. The appropriate year is added in a special year column to allow the calculation of an annual index given in Table 2. A list of abbreviations for the respective journals is given in Table 3.

DATA DISTRIBUTION IN MACHINE READABLE FORM

This compilation is available as a flat file (ECD) from the EMBL data library and is automatically distributed with the each release the EMBL data library. In addition, this compilation is available together with a stand alone service program on the CD-ROM version of the EMBL data library, but this version is also available on disk on request from Gieβen. Both versions including the service program are available from the EMBL file server [15]. Using this program one may assemble the entire nucleotide sequence directly from the CD-ROM or may extract each single or collected entry individually.

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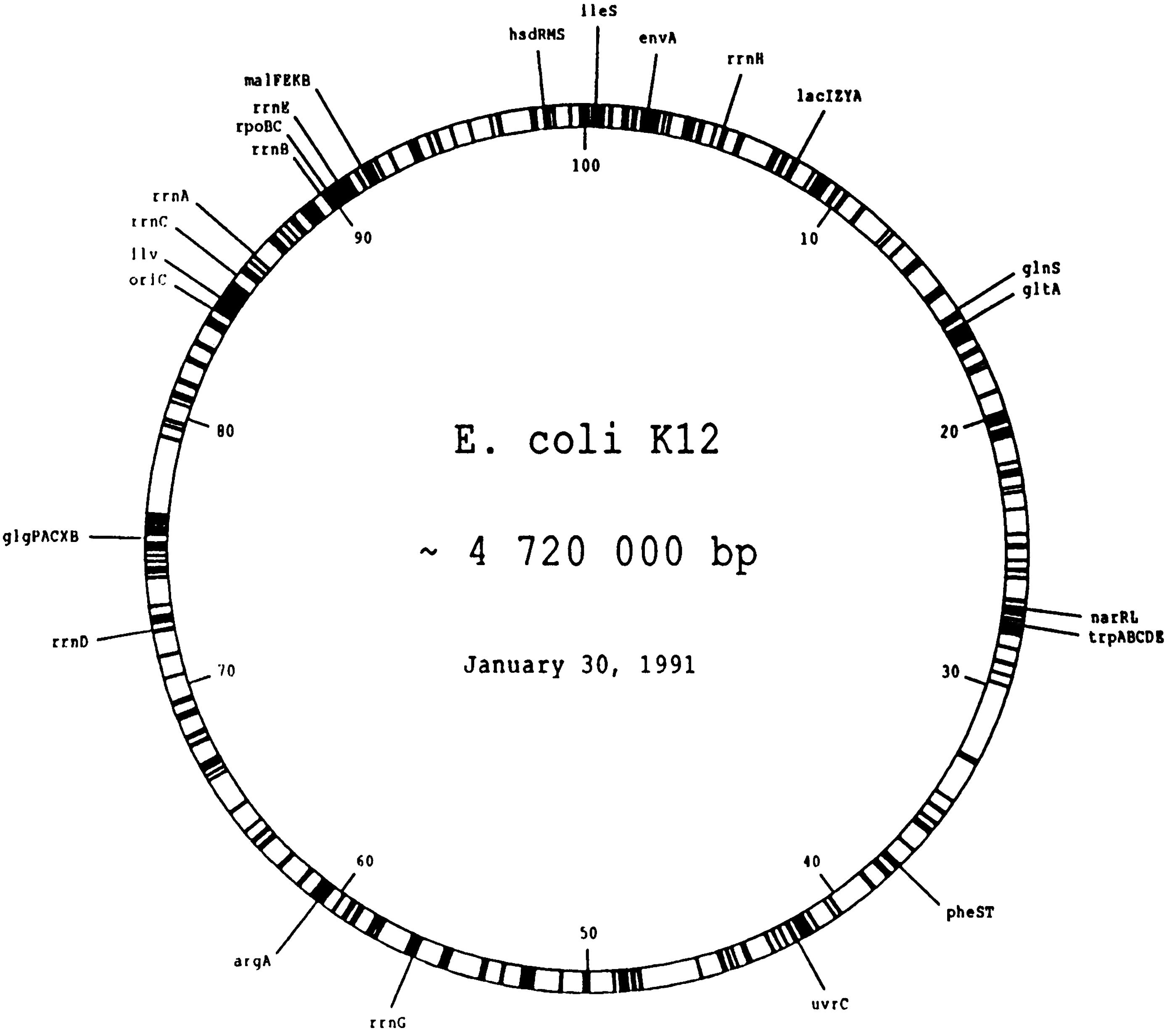

Fig.1 The sequenced areas within the circular chromosome of *Escherichia coli* K12. The sequenced areas are calculated in percent of the total chromosome according to the main list. All sequences exceeding 2000 bp are shown as in scale black bars at the respective genetic map position. Some prominent markers are included as well.

Table 1. Databank cross references and abbreviations. Some differences between the two databases or repeated entries, as well as accession numbers given in most recent papers are indicated directly.

Gb	points to a difference mostly in the accession number between GenBank and EMBL databanks [see also AC line].
GbNew	is introduced, if the actual issue of GenBank data bank may not contain this more recent entry. However, caused by a certain difference in updating these entries, they may already be incorporated into the most actual GenBank version. They are always available using the EMBL/GenBank file server.
KR	indicates entries primarily found by K. Rudd [3]
BB	acknowledges the contribution of Bobby Baum, 6607 Pyle Road Bethesda, Maryland 20817, USA. Entries marked by BB are added [new] or corrected [length, map location, overlap] using a listing compiled by Bobby Baum. His collection may be available as Ec.lis file via the National Biomedical Research Foundation (USA).
MK	[Manfred Kröger] and
HD	[Peter Rice or other colleagues at EMBL] point to unresolved differences to the databases found by these individuals.
char	characterization of genetic elements
comp	comparison with other organisms
corr	correction of published data
func	functional description
gap	small undetermined gaps
map	restriction or genetic map data
mut	sequenced mutations
prom	characterized promoter sequences
regul	characterized regulatory sequences
summ	summation or review
unpub	unpublished material quoted in the respective article or in the database

Table 2. Annual growing of the *E.coli* DNA-sequence information. This table represents all included sequence information. The final number for total information exceeds the actual number of sequenced nucleotides (1 492 282 bp) roughly by one third.

Year	annual entries	total entries	annual information (bp)	total information (bp)
1967	1	1	600	600
1968	2	3	205	805
1969	4	7	349	1154
1970	3	10	249	1403
1971	10	20	841	2244
1972	5	25	426	2670
1973	6	31	434	3104
1974	4	35	205	3309
1975	9	44	820	4129
1976	7	51	530	4659
1977	9	60	1116	5775
1978	21	81	6670	12445
1979	41	122	20077	32522
1980	55	177	36222	68744
1981	75	252	115712	184456
1982	93	345	81382	265838
1983	125	470	131753	397591
1984	137	607	178844	576435
1985	155	762	159183	735618
1986	170	932	246432	982050
1987	148	1080	203457	1185507
1988	179	1259	248349	1433856
1989	194	1453	285993	1719849
1990	229	1682	326875	2046724
1991	11	1693	26507	2073231

Table 3. List of abbreviations for journals

ABB	Archives of Biochemistry and Biophysics
AcMB	Archives of Microbiology
AdER	Advances in Enzyme Regulation
AgrB	Agricultural Biochemistry (Tokyo)
AEMb	Applied Enviromental Microbiology
AnMi	Annales of Microbiology
ANYA	Annales of New York Academy of Science
BBA	Biochemica Biophysica Acta
BBRC	Biochemical Biophysical Research Communications
BChF	Biochemie (France)
BiCh	Biochemistry (USA)
BInt	Biochemistry International
BiRp	Bioscience Report
BJ	Biochemical Journal (UK)
Bioo	Bioorganic Chemistry (UdSSR)
CJMi	Canadian Journal of Microbiology
CRC	Carlsberg Research Communication
CSHQ	Cold Spring Harbour Symposium of Quantitave Biology
Cell	Cell
DANs	Doklady Akademia Nauk (UdSSR)
DNA	DNA
EJB	European Journal of Biochemistry
EMBO	EMBO Journal
FEBS	FEBS Letters
FedP	Federation Proceedings
FEMS	FEMS Microbiological Letters
G	Genetics
GAnT	Gene Analysis Techniques
Gene	Gene
JBCh	Journal of Biological Chemistry
JBac	Journal of Bacteriology
JBio	Journal of Biochemistry (Japan)
JCBc	Journal of Cellular Biochemistry
JGMi	Journal of General Microbiology
JMAG	Journal of Molecular and Applied Genetics
JMB	Journal of Molecular Biology
MBE	Molecular Biology and Evolution
MGG	Molecular General Genetics
MiRV	Microbiological Reviews
MoMB	Molecular Microbiology
N	Nature
NAR	Nucleic Acids Research
NNB	Nature New Biology
PNAS	Proceedings of the National Academy of Science (USA)
Prot	PROTEINS: Structure, Function and Genetics
PSDA	Protein Sequences and Data Analysis
Scie	Science
Unpub.	unpublished material quoted in the databanks
ZNfC	Zeitschrift für Naturforschung Part C (Biological Sciences)

map	name	comment	bp	*	offset	from	to	total	journal	vol	page	year	EMBL	AccNr	GenBank
0.01	thrA	operator new BB	349	P	1	1	123	6045	JBCh	257	3896	1982	-	-	-
0.02	thrABC	-	208	C	124	1	5922	0	PNAS	76	1706	1979	ECTHR	J01706	ECOTHR
0.25	dnaKJ	promoter corr BB	182	T	1	1	179	3541	PNAS	82	2679	1985	ECDNAKA	M10420	ECODNAKA
0.26	dnaK	corr BB	1920	C	180	1	1917	0	PNAS	81	848	1984	ECDNAK	K01298	ECODNAK
0.27	dnaKJ	mut corr BB	1623	C	2097	179	1623	0	JBCh	261	1778	1986	ECDNAJK	M12544	ECODNAJK
0.31	gef	cell killing new KR	780	P	1	1	780	780	MoMB	3	1463	1989	X17311	X17311	-
0.34	ant,rpsT	& ileS,lspA,dapB,carAB KR	1349	P	1	1	1349	17033	JBCh	263	10408	1988	ECANTAPA	J03879	ECOANTAPA
0.35	rpsT	-	2881	C	1350	2631	557	0	NAR	14	6965	1986	ECRPSTB	V00345	ECORPST
0.37	ileS,rpsT	also ECORPSTB	1806	C	3424	1	1806	0	JBCh	260	5616	1985	ECRPSTA	M10428	ECORPSTA
0.38	ileTS	part. aa-sequence only	2169	F	5230	1	2169	0	Scie	226	1315	1984	-	-	-
0.41	lspA	corr BB	1138	C	7399	1	912	0	FEBS	173	264	1984	ECLIPEP	X00776	ECOLSPA
0.46	lsp,orf	orf 149,316,304,dapB	2696	C	8311	1	2559	0	NAR	19	180	1991	ECLSPDAP	X54945	-
0.47	dapB	-	1281	C	10870	1	938	0	JBCh	259	14829	1984	ECDAPB	M10611	ECODAPB
0.50	carA	-	5227	C	11808	1	5227	0	PNAS	81	4139	1984	-	J01597	ECOCARAB
0.90	folA,apaGH	& ksgA,pdxA,surA J01609	1200	P	0	1	971	4465	NAR	8	2255	1980	ECFOLX	V00276	ECOFOLA
0.93	apaHG,ksgA	-	2396	C	972	2396	1	0	MGG	205	515	1986	ECAPAH	X04711	ECOAPAH
0.95	pdxA,surA	-	1469	F	3369	1081	1	0	JBac	171	4767	1989	-	-	-
1.40	araCBAD	corr BB	1172	T	1	1172	1	9016	JMB	154	649	1982	ECARAX	V00259	ECOARACK
1.41	araC	E.coli B J01641 in Gb	1162	B	1173	105	1	0	NAR	8	5267	1980	ECARAC	V00256	ECOARABOP
1.42	araB	-	254	C	0	0	0	0	JBCh	253	6931	1978	-	J01641	ECOARABOP
1.44	araC	-	180	C	0	0	0	0	PNAS	77	3346	1980	-	J01641	ECOARABOP
1.45	araBC	E.coli B J01641 in Gb	175	B	1278	67	1	0	PNAS	78	752	1981	ECARACZ	V00257	ECOARABOP
1.49	araDAB	E.coli B	4478	B	1345	118	3154	0	Gene	47	231	1986	ECARAABD	M15263	ECOARAABD
1.53	polB	= dinA MK	4666	C	4381	31	4666	0	NAR	18	7185	1990	ECPOLBDA	M35371	ECOPOLBDA
1.77	leuAP	-	306	T	1	306	39	6083	JMB	149	579	1981	ECLEUA	J01642	ECOLEUA
1.78	leuP	overlap HD,BB	855	C	269	855	282	0	JBac	166	1113	1986	ECLEUP	M12891	ECOLEUP
1.79	leuO	analog to lysR	960	C	842	1	956	0	PNAS	85	6602	1988	ECLYSR	M21150	ECOLEUO
1.80	ilvHI	-	389	C	1797	1	302	0	JBac	163	186	1985	ECILVIHP	M10738	ECOILVIHP
1.81	ilvIH	-	2323	C	2099	1	2323	0	NAR	11	5299	1983	ECILVIH	X01609	ECOILVIH
1.82	shl	next to orfB, Hind3 id?	1820	C	4422	159	1820	0	JBac	172	4696	1990	ECSHL	M35034	ECOSHL
2.10	orfB	& pbpB,mur,fts,ddl,envA	1500	P	1	1	1228	22099	NAR	18	2813	1990	ECPBPBRR	X52063	-
2.11	pbpB	= ftsI	2759	C	1229	1	2759	0	MGG	191	1	1983	ECPBPB	K00137	ECOPBPB
2.13	murE,ftsI	& murF	1656	F	3988	485	1551	0	CJMi	35	1051	1989	-	-	-
2.14	murF	-	1491	C	5053	1	1242	0	NAR	17	5379	1989	ECMURF	X15432	X15432
2.17	orfY,murD	-	2608	C	6295	1	968	0	NAR	18	1058	1990	ECMUROY	X51584	X51584
2.18	murD,ftsW	corr in ECMURD okay	1629	C	7263	1	1629	0	NAR	18	183	1990	ECMURD	X17609	X17609
2.19	ftsW	-	1497	C	8892	279	1351	0	JBac	171	6375	1989	ECFTSW	M30807	ECOFTSW
2.21	murGC,ddl	ftsW, murGC, ddl	2745	C	9964	1	2476	0	NAR	18	4014	1990	ECMURGC	X52644	-
2.22	ddl	& ftsQAZ,envA,secA,mutT	1152	C	12440	1	844	0	JBac	167	809	1986	ECDDLFTS	M14029	ECODDLFTS
2.24	ftsQAZ	-	2490	C	13284	1	2000	0	JMB	184	399	1985	ECFTSQA	X02821	ECOFTSQAZ
2.25	ftsAZ	or sulB; corr BB	1870	C	15284	1	1500	0	Gene	36	241	1985	ECFTSQAB	M10429	ECOFTSQAB
2.30	envA,secA	-	2048	C	16784	1	1025	0	JBac	169	5408	1987	ECENVAA	M19211	ECOENVAA
2.31	secA	-	3811	C	17809	1	3423	0	JBac	170	3404	1988	ECSECA	M20791	ECOSECA
2.32	mutT, secA	wrong BB	867	C	21232	1	867	0	MGG	206	9	1987	ECMUTT	X04831	ECOMUTT
2.41	guaC	new BB	1991	T	1	1	1991	1991	BJ	255	35	1988	ECGUAC	M33020	ECOGUAC
2.50	ampDE,aroP	& aceEF,lpd	1983	T	1	1	1983	11343	MoMB	3	1091	1989	ECAMPDE	X15237	X15237
2.52	aroP	-	1440	C	1984	1299	1	0	NAR	18	653	1990	ECAROP	X17333	X17333
2.53	aroP	-	585	C	3283	508	1	0	JBac	169	386	1987	ECAROPRA	M15312	ECOAROPRA
2.54	aceE,orf	corr BB	3780	C	0	0	0	0	EJB	133	155	1983	ECACEX	V00253	ECOACE
2.55	aceEF	-	2040	C	3791	188	7740	0	EJB	133	481	1983	ECACEX	V01498	ECOACE
2.56	lpd	corr BB	2100	C	0	0	0	0	EJB	135	519	1983	ECACEX	V01498	ECOACE
2.90	speED	prom	820	T	1	1	2792	2792	JBac	171	4457	1989	ECSPDE	J02804	-
2.91	speED	corr BB	1882	C	0	0	0	0	JBCh	262	16037	1987	ECSPDE	J02804	ECOSPDE
3.00	pcnB	bad ref Em bad ref Gb	1542	T	1	1	1542	1542	JBac	171	1254	1989	ECPCNB	M20574	ECOPCNB
3.10	gcd	glucose dehydrogenase	2635	T	1	1	2635	2635	JBac	172	6308	1990	ECGLDE	X51323	X51323
3.60	dksA	-	1273	T	1	1	1273	1273	JBac	172	2055	1990	ECDKSA	M34945	ECODKSA
3.69	mrcB	& (ponB),fhuADCB;	2758	T	1	1	2757	9195	EJB	147	437	1985	ECPONB	X02163	ECOPONB

3.70	fhuCD		identical with 3.71	1900	C	2758	470	4607	0	JBac	169	3844	1987	ECFHUA	M12486	ECOFHUACD
3.71	fhuA		-	2902	C	0	0	0	0	JBac	165	181	1986	ECFHUA	M12486	ECOFHUACD
3.73	fhuB		overlap BB	2563	C	6896	264	2563	0	MGG	204	435	1986	ECFHUB	X04319	ECOFHUB
3.78	dgt,orf	&	htrA dGTP hydrolase	2760	T	1	1	2514	4369	PNAS	87	2740	1990	ECDGTP	M31772	ECODGTP
3.79	htrA		loc BB	1855	C	2515	1	1855	0	NAR	16	10053	1988	ECHTRA	X12457	ECOHTRA
3.85	dapD		-	1182	T	1	1	1182	1182	JBCh	259	14824	1984	ECDAPD	K02970	ECODAPD
3.91	cds		-	1259	T	1	1	1259	1259	JBCh	260	12078	1985	ECCDS	M11330	ECOCDS
3.97	map	&	rpsB,tsf overlap BB	1197	T	1	1197	1	3255	JBac	169	751	1987	ECMAP	M15106	ECOMAP
3.98	tsf,rpsB		J01684 in Gb	2192	C	1198	135	2192	0	NAR	9	4163	1981	ECRPSB	V00343	ECORPSBTS
4.00	RRF		maps 2-6 min	831	T	1	1	831	831	JBCh	264	20054	1989	ECRRFX	J05113	ECORRFX
4.10	sKp(firA)		E.coli B acc.BB	679	B	1	1	237	0	Gene	67	117	1988	ECSKP	M21118	ECOSKP
4.11	firA		overlap with skp Ec.B	1459	C	1	1	1459	1459	JBac	173	334	1990	ECFIRA	X54797	-
4.25	dnaE	&	polC,rnhB,lpxAB	1522	T	1	1	6627	6627	JBac	169	5727	1987	ECLPXA	M18265	ECOLPXA
4.26	dnaE,polC		-	4350	C	0	0	0	0	JBac	169	5735	1987	ECLPXA	M18266	ECOLPXA
4.27	lpxA,dnaE		-	1350	C	0	0	0	0	JBac	170	1268	1988	ECLPXA	M19334	ECOLPXA
4.80	proS	=	drpA MK	2795	T	1	1	2795	2795	N	347	203	1990	X55518	X55518	-
4.81	drpA		global RNA synthesis f.	2791	C	0	0	0	0	JBac	172	281	1990	ECDRPA	M32357	ECODRPA
5.10	rrnH		operon incl. analogs	478	T	1	1	431	5777	Cell	17	225	1979	ECRGNX1	J01700	ECORGNX1
5.11	rrsH 16S		analog J01695 in Gb	1441	C	432	1519	2959	0	JMB	148	107	1981	ECRRNBZ	V00348	ECORGNB
5.12	alaV ileV		intergenic region	545	C	1873	1	438	0	JBCh	254	3264	1979	ECRGNX2	K00763	ECORGNX2
5.14	rrlH		analog J01695 in Gb	2903	C	2311	3501	6403	0	JMB	148	107	1981	ECRRNBZ	V00348	ECORGNB
5.15	rrfH,aspU		J01698 in Gb	600	C	5214	36	600	0	NAR	8	3809	1980	ECRNA8	V00336	ECORGNF
5.28	mutD,rnh		-	1592	T	1	1	1592	1593	JMB	190	113	1986	ECMUTD	X04027	ECOMUTD
5.72	pepD,gpt	&	proAB	2325	T	1	2311	228	8710	JBac	172	4641	1990	ECPEPD01	M34034	ECOPEPD
5.74	gpt,49kD		-	2253	C	2084	1	2253	0	Gene	32	243	1984	ECGPTA	M13422	ECOGPTA
5.79	phoE,crl		J01662 in Gb	1980	C	4337	1873	541	0	JMB	163	513	1983	ECPHOE	V00316	ECOPHOE
5.80	proAB,thrW		mut	3041	C	5670	1	3041	0	NAR	12	6337	1984	ECPROAB	X00786	ECOPHOEA
6.10	hns		-	1380	T	1	1	1380	1380	MGG	212	199	1988	ECHNS	X07688	ECOHNS
6.15	attp22		S.typh.seq?	320	T	1	1	320	320	JBCh	260	4468	1985	STP22ATB	M10894	STYP22ATB
6.51	argF		-	300	T	1	1	300	1406	EMBO	1	853	1982	ECARGFPR	M24185	ECOARGFPR
6.52	argF		X00759 in Gb	310	C	301	261	310	0	Gene	16	119	1981	ECARGF	V00260	ECOARGF
6.53	argF		-	1183	C	351	129	1183	0	NAR	12	6277	1984	ECARGF01	X00759	ECOARGF
6.85	mvrA		map position 88.40 ? BB	981	T	1	1	981	981	JBac	170	2136	1988	ECMVRA	M19644	ECOMVRA
7.09	fecIRA	&	fecBCDE	4074	P	1	1	2563	9822	JBac	172	6749	1990	-	-	-
7.10	fecABCDE		-	2645	C	2564	2	2418	0	JBac	170	2716	1988	ECFEC	M20981	ECOFEC
7.11	fecBCDE		-	4842	C	4982	1	4839	0	JBac	171	2626	1989	M26397	M26397	M26397
7.50	betTIBA	&	orf betaine aldeh. dehy	7412	T	1	1	7412	7412	Unpub			1990	ECBET	X52905	-
7.89	cynTSX		-	2633	T	1	1	1429	8951	JBCh	263	14769	1988	M23219	M23219	M23219
7.92	lacA		J01636 in Gb	1832	C	1430	1829	160	0	PNAS	82	6414	1985	ECLACA	X51872	ECOLAC
7.93	lacY		J01636 in Gb	1500	C	3100	1500	61	0	N	283	541	1980	ECLACY	V00295	ECOLAC
7.94	lacZ		J01636 in Gb	3078	C	4540	3078	1	0	EMBO	2	593	1983	ECLACZ	V00296	ECOLAC
7.95	lac		prom	101	C	7618	99	5	0	PNAS	80	6157	1983	ECLACPO	K01073	ECOLACPO
7.96	lacZ		-	147	F	7712	17	43	0	Scie	187	27	1975	-	J01636	ECOLAC
7.97	lacI		J01636 in Gb	1113	C	7738	1	1113	0	N	274	765	1978	ECLACI	V00294	ECOLAC
7.99	lacI		-	81	F	8857	1	48	0	N	274	762	1978	-	J01636	ECOLAC
8.00	lacI		sequence 5'to promoter	45	F	8905	1	45	0	Gene	48	119	1986	-	-	-
8.20	hemB		-	1907	T	1	1	1907	1907	Gene	75	177	1989	M24488	M24488	M24488
8.65	sbmA		near phoA	1992	T	1	1	1992	1992	Unpub.			1991	ECSBMA	X54153	ECOSBMA
8.70	phoAR	&	orf 106	2715	T	1	1	2715	2715	Gene	44	121	1986	ECPHOAA	M13345	ECOPHOAA
8.85	proC		annouced as unpublished	225	P	1	1	225	1193	NAR	10	7701	1982	unpub	unpub	unpub
8.86	proC		ECPROC in Em?	968	C	226	1	968	0	NAR	10	7701	1982	ECOC	J01665	ECOPROC
8.94	aroLM		-	810	T	1	1	810	2077	BJ	237	427	1986	ECAROL	X04064	ECOAROL
8.95	aroLM		-	2021	C	811	755	2021	0	JBac	165	233	1986	ECAROLM	M13045	ECOAROLM
9.00	araJ		old araFG J01586 in Gb	380	T	1	1	384	380	JMB	156	53	1982	ECARAF	V00258	ECOARAFGP
9.10	phoR	&	phoB,orf-45,sbcC	1972	T	1	1972	1	7864	JMB	192	549	1986	ECPHORG	X04704	ECOPHORG
9.11	phoBR		-	976	C	1973	1	966	0	JMB	190	37	1986	ECPHOB	X04026	ECOPHOB
9.13	sbcC		-	5125	C	2939	200	5125	0	NAR	17	8033	1989	ECSBCC	X15981	X15981
9.31	secDF,orf		-	4435	T	1	1	4435	4435	EMBO	9	3209	1990	ECSECDF	X56175	-
9.40	tsx		-	1477	T	1	1477	1	1477	Gene	96	59	1990	-	M57685	M57685

9.60	pgpA		length BB	704	T	1	7	711	704	JBac	170	5110	1988	M23546	M23546	M23546
9.72	bolA	morphogene		1597	P	1	1	899	3482	EMBO	8	3923	1989	ECBOLA	X17642	X17642
9.74	trigger fa	ctor	loc acc KR	1809	F	900	1	1346	0	JBac	172	5555	1990	-	-	-
9.75	clpP	-		1236	C	2246	1	1236	0	JBCh	265	12536	1990	ECCLPAA	M31045	ECOCLPAA
9.80	lon	conflict with 9.83		2812	T	1	1	6	3334	Bioo	14	408	1988	ECLONA	M38347	ECOLONA
9.82	lon	-		3002	C	7	1	3002	0	JBCh	263	11718	1988	ECLON	J03896	ECOLON
9.84	HU-1(hupB)	-		460	C	3009	134	460	0	MGG	201	360	1985	ECHUPB	X16540	X16540
10.10	cyoABCDE	-		5813	T	1	1	5813	5813	JBCh	265	11185	1990	ECCYOA	J05492	ECOCYOA
10.20	ffs =	4.5 S RNA		764	T	1	1	764	764	JMB	178	509	1984	ECRNA45	X01074	ECOSGK
10.41	nusB	-		683	T	1	1	683	683	NAR	12	4987	1984	ECNUSB1	X00681	ECONUSB
10.87	apt,dnaX &	orf12,recR,hptG,adk		0	T	1	1	6820	6820	JBac	172	6042	1990	ECAPTADK	M38777	ECOAPTADK
10.90	dnaZX	-		2218	C	0	0	0	0	NAR	14	6541	1986	ECAPTADK	M38777	ECOAPTADK
10.91	dnaZX	-		2775	C	0	0	0	0	NAR	14	8091	1986	ECAPTADK	M38777	ECOAPTADK
10.92	recR,orf12	-		1329	C	0	0	0	0	NAR	17	6781	1989	ECAPTADK	M38777	ECOAPTADK
10.93	htpG	-		2235	C	0	0	0	0	PNAS	84	5177	1987	ECAPTADK	M38777	ECOAPTADK
10.94	adk	-		1055	C	0	0	0	0	NAR	13	7139	1985	ECAPTADK	M38777	ECOAPTADK
11.35	ushA	-		1819	T	1	1	1819	1819	NAR	14	4325	1986	ECUSHA	X03895	ECOUSHA
11.70	rhsD	start region		400	T	1	1	400	400	JBac	171	636	1989	ECRHSD1	M21764	ECORHSD1
11.71	rhsD	core region		140	T	1	1	140	140	JBac	171	636	1989	ECRHSD2	M21768	ECORHSD2
11.72	rhsD			589	T	1	1	589	589	JBac	172	446	1990	ECRHSD	M29719	ECORHSD
12.14	purEK	-		2449	T	1	1	2449	2449	JBac	171	198	1989	ECPURE01	M19657	ECOPUREK
12.34	dnaY orf	cryptic prophage qsr'		2520	T	0	1	968	3237	MGG	220	325	1990	X51662	X51662	-
12.38	argU,IS3	cr.phage = M27155 in Gb		2269	C	0	1	2269	0	JBac	171	6197	1989	ECINTD01	M31074	ECOINTDLP
12.45	cysS	-		2194	T	1	1	2194	2194	NAR	19	265	1991	ECCYSSG	X56234	ECOCYSSG
12.60	nmpC	-		1303	T	1	1	1611	1611	JBCh	261	12723	1986	ECEPNMPC	M13457	ECOEPNMPC
12.61	nmpC	-		1608	C	0	0	0	0	Unpub.			1986	ECEPNMPC	M13457	ECOEPNMPC
12.85	M5 protein	ompT;E.coli JM83		753	T	0	0	0	3323	NAR	15	3924	1987	ECM5	Y00138	ECOM5
12.86	appY = M5	-		1874	C	1	1291	1	0	JBac	171	1683	1989	ECAPPYAA	M24530	M24530
12.87	ompT	poor overlay		2035	C	1292	2032	1	0	NAR	16	1209	1988	ECOMPT1	X06903	ECOOMPT1
12.98	envY	next to ompT		945	T	1	1	945	945	NAR	17	800	1989	ECENVY	X13548	ECOENVY
13.60	entD &	fepA,fes,entF	new BB	943	T	1	941	1	4908	MoMB	3	757	1989	X17426	X17426	-
13.62	fepA	-		2624	C	942	2470	271	0	JBCh	261	10797	1986	ECFEPAA	M13748	ECOFEPAA
13.63	fepA,fes &	entF; prom		1997	C	3142	231	1997	0	JBCh	263	18857	1988	ECFE6	J04216	ECOFE6
13.69	orf,fepB &	entCEBA,p15,orf		2177	T	1	2177	1	7743	JBac	171	5443	1989	ECFEPB	M29730	ECOFEPB
13.70	entC	-		1400	C	2178	419	1655	0	JBac	171	775	1989	M24142	M24142	M24142
13.72	entCE		new BB	1655	C	3415	119	1655	0	FEMS	59	15	1989	M27490	M27490	M27490
13.73	entEBA &	P15,orf5		3249	C	4952	458	3249	0	JBac	171	791	1989	M24148	M24148	M24148
14.01	rnsA	ribonuclease I		1206	T	1	1	1206	1206	Gene	95	1	1990	ECRIBI34	M55687	-
14.90	pbpA =mrdA	penicillin bind	D00001	2936	T	1	1	2936	6642	EJB	160	231	1986	ECPBPA	X04516	ECOPBPA
14.91	rodA =mrdB	-		1260	C	2937	89	1260	0	JBac	171	558	1989	ECRODA	M22857	ECORODA
14.92	rlpA	-		1408	C	4109	111	1408	0	JBac	169	5692	1987	ECRLPA	M18276	ECORLPA
14.93	dacA &	rlpA,rodA,pbpA;	mut	689	C	5407	362	1597	0	FEBS	165	185	1984	ECDACAG	X00273	ECODACA
15.10	rlpB	-		938	T	1	1	285	3902	JBac	169	5692	1987	ECRLPB	M18277	ECORLPB
15.11	leuS	-		3618	C	1	286	3618	0	NAR	15	10199	1987	ECLEUS	Y00869	ECOLEUS
15.50	tRNA met &	leu gln1 gln2		1100	T	1	1100	1	12152	Cell	23	239	1981	ECTGOP	J01713	ECOTGOP
15.54	asnB	-		3080	C	1101	2861	1	0	JBCh	265	12895	1990	ECASNB	J05554	ECOASNB
15.55	nagDCAEB &	glnS	new BB	3619	C	3962	2628	1	0	MoMB	3	505	1989	ECNAGACD	X14135	X14135
15.58	nagEB,glnS		corr	3391	C	6590	226	3391	0	Gene	62	197	1988	ECNAGBE	M19284	ECONAGBE
15.60	glnS	see 15.65 M10187 in Gb		2306	C	9755	190	2306	0	JBCh	257	11639	1982	ECGLNS	V01575	ECOGLNSA
15.64	glnS	filling the gap	BB	65	F	11871	1	65	0	Unpub.			1984	-	-	-
15.65	glnS	see 15.60 M10187 in Gb		280	C	11936	1	280	0	JBCh	257	11639	1982	-	-	-
15.80	fur (iron)		loc BB	868	T	1	1	868	868	MGG	200	110	1985	ECFUR	X02589	ECOFUR
16.00	kdpDE	-		3600	T	1	3600	622	7913	Unpub.			1990	ECKDPDE	M36066	ECOKDPDE
16.01	kdpABC	-		4933	C	2978	4933	1	0	PNAS	81	4746	1984	ECKDPABC	K02670	ECOKDPABC
16.10	rhsC	start region		400	T	1	1	400	400	JBac	171	636	1989	ECRHSC1	M21763	ECORHSC1
16.11	rhsC	3'-end		535	T	1	1	535	535	JBac	172	446	1990	ECRHSC	M29718	ECORHSC
16.21	phr	-		2039	T	1	1	2039	2039	JBCh	259	6033	1984	ECPHRORF	K01299	ECOPHRORF
16.47	gltA,cybA	-		3264	T	1	1	13063	13881	BiCh	22	5243	1983	ECGLTA	J01619	ECOGLTA
16.53	gltA,cybA,	& sdhDAB	corr	3614	C	0	0	0	0	BJ	222	519	1984	ECSDHACD	X00980	ECOSDHACD

16.55	sdhB	iron binding	961	C	0	0	0	0	BJ	223	507	1984	ECSDHB	X01070	ECOSDHB
16.56	sucAB,sdhB	J01619 in Gb	3180	C	0	0	0	0	EJB	141	351	1984	ECSUCA	X00661	ECOGLTA
16.57	sucAB	J01619 in Gb	1500	C	0	0	0	0	EJB	141	361	1984	ECSUCB	X00664	ECOGLTA
16.61	sucCD	-	2451	F	0	0	0	0	BiCh	24	6245	1985	-	J01619	ECOGLTA
16.62	sucD	new BB	1285	C	13064	818	1	0	BJ	260	737	1989	ECG30SUC	X15790	X15790
16.65	tRNA lysT	& valT mut	730	T	1	1	730	730	JMB	177	609	1984	ECTRNKV	X04171	ECOTRNKV
16.70	cyd	map unclear corr BB	2901	T	1	1	3845	3845	JBCh	263	13138	1988	ECCYD	J03939	ECOCYD
16.80	tolQRA &	tolAB	1855	T	1	1	1855	5037	JBac	169	2667	1987	ECTOLQRA	M16489	ECOTOLQRA
16.81	tolAB	-	2900	C	1856	200	2668	0	JBac	171	6600	1989	ECTOLAB	M28232	ECOTOLAB
16.82	pal	lipoprotein map acc KR	713	C	4325	1	713	0	EJB	163	73	1987	ECPAL	X05123	ECOPAL
16.90	nadA	new BB	1470	T	1	1	1470	1470	EJB	175	221	1988	ECNADA	X12713	ECONADA
16.95	aroG	-	2107	T	1	1	2107	2107	NAR	10	4045	1982	ECAROG	J01591	ECOAROG
17.01	galETK	- summ HD,BB	139	T	0	0	0	3646	Cell	12	847	1977	-	J01612	ECOGALE
17.05	galETK	mut J01612 in Gb	148	C	1	1	122	0	Gene	21	121	1983	ECGALEP	J01613	ECOGALE
17.08	galTE	-	2070	C	123	1	2070	0	NAR	14	7705	1986	ECGALET	X06226	ECOGALET
17.10	galK	length BB	1634	C	2193	169	1622	0	NAR	13	1841	1985	ECGALK	X02306	ECOGALK
17.23	chlD	new BB	1609	T	1	1	1609	1609	JBac	169	1911	1987	ECCHLJD	M16182	ECOCHLJD
17.44	attb lam &	bioABFCD,uvrB summ BB	260	T	1	1	260	8633	Scie	197	1147	1977	ECLAMATT	J01638	ECOLAMATT
17.45	bioABFCD	-	5793	C	261	89	5793	0	JBCh	263	19577	1988	ECBIO	J04423	ECOBIO
17.48	uvrB	J01722 in Gb	2605	C	5966	48	2605	0	NAR	14	2637	1986	ECUVRB1	X03678	ECOUVRB
17.49	uvrB	-	2400	C	8524	2291	2400	0	NAR	14	2877	1986	ECUVRB2	X03722	ECOUVRB2
18.00	glnHPQ	(mut?) X01583 in Gb ?	3120	T	1	1	3436	3436	MGG	205	260	1986	ECGLNHPQ	X14180	ECOGLNHPQ
18.01	glnHPQ	prom	268	C	0	0	0	0	NAR	15	2777	1987	ECGLNHPQ	X14180	ECOGLNHPQ
18.20	chlEN	-	2492	T	1	1	2492	2492	JBac	170	4097	1988	ECCHLEN	M21151	ECOCHLEN
18.50	grx	-	1147	T	1	1	1147	1147	Gene	43	13	1986	ECGRX	M13449	ECOGRX
18.71	deoR	-	986	T	1	1	986	986	NAR	13	5927	1985	ECDEOR	X02837	ECODEOR
18.94	poxB	M13947 in Gb	1974	T	1	1	1974	1974	NAR	14	5449	1986	ECPOXB	X04105	ECOPOXB
19.00	livR	-	729	T	1	1	501	729	Prot	1	125	1986	ECLIVRA	M36020	ECOLIVRA
19.05	rimK	-	1559	T	1	1	1559	1559	MGG	217	281	1989	ECRIMK	X15859	X15859
19.10	clpA	-	3380	T	1	1	3380	3380	JBCh	265	7886	1990	ECCLPAA	M31045	ECOCLPAA
19.90	orf,pfl	-	1392	T	1	1	1431	4884	JBac	171	2485	1989	M26413	M26413	M26413
19.91	pfl	-	3592	C	1432	140	3592	0	EJB	177	153	1988	ECPFL	X08035	ECOPFL
20.00	serS	-	1854	T	1	1	1854	7578	NAR	15	1005	1987	ECSERS	X05017	ECOSERS
20.01	dmsABC	map approx. 20 HD,Gb	6492	C	1855	769	6492	0	MoMB	2	785	1988	ECDMS	J03412	ECODMS
20.10	infA	-	328	T	1	1	328	328	NAR	15	5157	1987	ECINFA	Y00373	ECOINFA
20.15	tRNA Ser5	new tRNA Ser5 locus	300	T	1	1	300	300	JMB	212	579	1990	X52786	X52786	-
20.24	serC,aroA	new BB	1517	T	1	1	1490	2983	BJ	234	49	1986	ECAROA	M25608	ECOAROA
20.25	aroA	-	1284	C	1491	1	1284	0	FEBS	170	59	1984	ECAROA	X00557	ECOAROA
20.26	aroA	-	1760	C	2775	1552	1760	0	BJ	234	49	1986	ECAROA	M25608	ECOAROA
20.40	trxB	-	1202	T	1	1	1202	1202	JBCh	263	9015	1988	ECTRXB	J03762	ECOTRXB
20.50	rpsA	28 bp difference MK	977	T	1	1	977	3031	MGG	196	135	1984	ECRPSA01	X00785	ECORPSAL
20.52	rpsA	J01682 in Gb	2412	C	978	708	2287	0	NAR	10	1857	1982	ECRSPA	V00352	ECORPSA
20.53	hip (himD)	-	597	C	2556	1	475	0	JMB	183	117	1985	ECHIP	X04864	ECOHIP
20.65	aspC,ompF	& asnS,pcnB,pepB BB	1415	T	1	1415	1	9110	BJ	234	593	1986	ECASPC	X03629	ECOASPC
20.69	ompF	-	1807	C	1416	1531	1	0	NAR	10	6957	1982	ECOMPF	J01655	ECOOMPF
20.73	asnS	- GbNew	2040	C	2947	1968	1	0	Gene	84	481	1989	ECTGASNS	M33145	ECOTGASNS
20.74	pncB	new TP	1490	C	4915	1205	1	0	JBCh	265	17665	1990	ECPNCB	J05568	ECOPNCB
20.75	pepN	-	870	C	6120	296	342	0	EJB	155	565	1986	ECPEPN5	X03709	ECOPEPN5
20.76	pepN	corr	2945	C	6166	1	2945	0	Gene	48	145	1986	-	M15273	ECOPEPN
21.25	pyrD	-	1357	T	1	1	1357	1357	EJB	151	59	1985	ECPYRD	X02826	ECOPYRD
21.65	fabA	only 726 bp acc.BB	979	T	1	1	979	979	JBCh	263	4641	1988	ECFABAA	J03186	ECOFABAA
21.71	ompA,sulA	mut J01654 in Gb	2271	T	1	1	2271	2273	NAR	8	3011	1980	ECOMPA	V00307	ECOOMPA
22.00	helD	helicase V	2821	T	1	1	2821	2821	JBCh	264	8297	1989	ECHELIV	J04726	ECOHELIV
22.10	hyaABCDEF	loc acc KR	6023	T	1	1	6023	6023	JBac	172	1969	1990	ECHYA	M34825	ECOHYA
22.23	serT	= divE ser tRNA	1336	T	1	1	1336	1336	EMBO	3	1103	1984	ECDIVE	X00547	ECOTGS
22.50	agp	glucose-1-phosphatase	1675	T	1	1	1674	1675	JBac	172	802	1990	ECAGPA	M33807	ECOAGPA
22.60	appA	acid phosphatase	700	P	1	1	696	2056	BChF	69	215	1987	ECAPPA	X05471	ECOAPPA
22.61	appA	correction of 22.60	1881	F	697	515	1881	0	JBac	172	5497	1990	-	-	-
22.79	putACP	also ECPUTC M35174	730	T	1	1	2212	2212	MGG	210	364	1987	ECPUTP	X05653	ECOPUTC

22.80	putP	-	1845	C	0	0	0	0	MGG	208	70	1987	ECPUTP	X05653	ECOPUTP
23.00	tRNA Ser5	2.new tRNA Ser5 locus	1000	T	1	1	1000	1000	JMB	212	579	1990	X52787	X52787	-
23.20	terE	near pyrC	22	F	1	1	22	22	JBac	173	391	1991	-	-	-
23.40	pyrC	D00002 in Gb	2046	T	1	1	2046	2046	EJB	160	77	1986	ECPYRC	X04469	ECOPYRC
23.44	rpmF L32		1191	T	1	1	1191	1191	JBac	171	5707	1989	ECRPMFA	M29698	ECORPMFA
23.50	rimJ	new BB	1220	T	1	1	1220	1220	MGG	209	481	1987	ECRIMJ	X06118	ECORIMJ
24.05	mopA	= groE loc ? BB	595	T	1	1	595	595	JBac	161	446	1985	ECAMS	M11294	ECOAMS
24.30	rne	-	3178	T	1	1	3178	3178	NAR	19	125	1991	ECRNE	X54309	ECORNE
24.71	ptsG	-	1523	T	1	1	1523	4124	JBCh	261	16398	1986	ECPTSG	J02618	ECOPTSG
24.72	fhuE	Fe recep M16186 Gb KR	2900	C	1522	2601	1	0	MoMB	4	427	1990	ECFHUE1	X17615	ECOFHUE
24.80	ndh	J01653 in Gb;loc acc KR	2057	T	1	1	2057	2057	EJB	116	165	1981	ECNDHX	V00306	ECONDH
25.23	icd	-	1248	T	1	1	1568	1568	JBCh	262	10422	1987	ECICD	J02799	ECOICD
25.27	pin1	= att e14 K03521 in Gb	2614	T	1	1	2614	2614	EMBO	4	237	1985	ECPIN1	X01805	ECOPINP
25.35	lit	-	1772	T	1	1	1772	1772	JBac	170	2056	1988	ECLIT	M19634	ECOLIT
25.40	att e14R	- M19689 in Gb?	439	T	1	1	439	439	JBac	170	2040	1988	ECATTE	M19683	ECOATTE
25.60	minB	(minCDE) loc ?	2400	T	1	1	2400	2400	Cell	56	641	1989	ECMINB	J03153	ECOMINB
25.65	umuCD	-	2454	T	1	1	2454	2454	PNAS	82	4336	1985	ECUMUCD	M10107	ECOUMUCD
25.70	fadR	224 bp lambda in Em BB	1070	T	1	1	1070	1070	NAR	16	7995	1988	ECFADR	X08087	ECOFADR
25.90	treA	= osmA	2538	T	1	1	2538	2538	MGG	217	347	1989	ECTREA	X15868	X15868
26.69	prs	next to hemA acc KR	1785	T	1	1	1785	1785	JBCh	261	6765	1986	ECPRS	M13174	ECOPRS
26.70	hemA,pfrA	-	2925	T	1	1	2271	3711	Gene	82	209	1989	ECHEMA	M30785	ECOHEMA
26.73	prfA (RF1)	-	1440	C	2272	1	1440	0	PNAS	82	3616	1985	ECRF1X	M11519	ECORF1X
26.77	kdsA	-	1504	T	1	1	1504	1504	MGG	207	369	1987	ECKDSA	X05552	ECOKDSA
26.98	narRL	-	945	T	0	0	0	13023	NAR	17	1965	1989	-	-	-
27.00	narXL	new BB	3211	C	1	3211	1	0	NAR	17	2947	1989	ECNARXL	X13360	ECONARXL
27.01	narX(R)KG	-	2482	C	3212	599	2482	0	FEBS	252	139	1989	ECNARK	X15996	X15996
27.02	narG	-	509	C	5096	136	509	0	FEBS	177	260	1984	ECNARG1	X01164	ECONARG
27.05	narGHJ	-	5400	C	5471	447	5400	0	MGG	218	249	1989	ECNARGHJ	X16181	X16181
27.07	narHJI	-	1890	C	10425	595	1890	0	JBac	170	1721	1988	ECNARI	M20147	ECONARI
27.24	tyrTV,tpr	K01197 in Gb	1545	C	11721	1	1303	0	JMB	155	83	1982	ECTRNYSU	X04168	ECOTGY1
27.40	adhE	alcohol DH GbNew	2759	T	1	1	2759	2759	Gene	85	209	1989	ECADHEX	M33504	ECOADHEX
27.46	osmZ bglY=	drdX	1380	P	1	1	1380	1380	MGG	224	81	1990	-	X07688	ECOHNS
27.50	oppA	oligopeptide binding	1920	T	1	1	1920	1920	JBCh	265	8387	1990	ECOPPA	J05433	-
27.55	att phi80	overlap 27.58 ??	350	T	1	1	350	350	JBCh	260	4468	1985	ECP80ATB	M10892	ECOP80ATB
27.57	tonB	overlap 27.55 ? summ KR	1291	T	1	1	1697	13540	PNAS	80	5235	1983	ECTONB	K00431	ECOTONB
27.59	tonA, P14	-	653	C	0	0	0	0	Cell	41	577	1985	ECTONB	K00431	ECOTONB
27.60	trp - tonB	intergenic region	3779	C	1698	3641	1	0	G	120	345	1988	ECTRTOI	X13583	X13583
27.61	trpE	-	140	C	5339	7134	0	0	JMB	121	113	1978	ECTGP	J01714	ECOTGP
27.79	trpABCDE	-	7017	C	0	0	0	0	NAR	9	6647	1981	ECTGP	J01714	ECOTGP
27.87	trp 5'end	-	1202	C	12473	1068	1	0	Bioo	10	415	1984	ECTRPZ	M38366	ECOTRPZ
27.90	topA	-	4071	T	1	1	4071	5244	JMB	191	321	1986	ECTOPA	X04475	ECOTOPA
27.91	cysB	-	1840	C	4072	668	1840	0	JBCh	262	5999	1987	ECCYSB	M15041	ECOCYSB
28.00	pgpB	-	1113	T	1	1	1113	1113	JBac	170	5117	1988	M23628	M23628	M23628
28.10	osmB	osmotic. ind. lipoprot.	652	T	1	1	652	652	JBac	171	511	1989	ECOSMB	M22859	ECOOSMB
28.30	terC1	within pyrF	487	T	1	1	488	1674	Cell	55	467	1988	ECTERC1A	M23250	ECOTERC1A
28.31	pyrF	-	1549	C	489	364	1549	1549	JBCh	262	10239	1987	ECPYRF	J02768	ECOPYRF
28.77	tyrR	-	1964	T	1	1	1964	1964	JBCh	261	403	1986	ECTYRR	M12114	ECOTYRR
29.00	prrBCD		3853	T	1	1	3853	3853	EMBO	9	1383	1990	ECPRRBCD	X52284	-
29.43	fnr (nirR)	-	1641	T	1	1641	341	2019	NAR	10	6119	1982	ECFNR	J01608	ECONIRR
29.44	ogt,fnr	summ BB	719	C	1301	718	1	0	NAR	15	9177	1987	ECOGT	Y00495	ECOOGT
29.60	dbpA	-	1668	T	1	1	1668	1668	NAR	18	5413	1990	ECDEADA	X52647	-
29.80	racC,recE	-	2475	T	1	1	2475	2475	JBac	171	2101	1989	M24905	M24905	M24905
31.08	cybB	-	1439	T	1	1	1439	1439	MGG	212	1	1988	ECCYBB	X07569	ECOCYBB
31.10	trg	-	1722	T	1	1	1722	1722	PNAS	81	3287	1984	ECG	K02073	ECOTRG
32.60	rimL	map acc. KR	1248	T	1	1	1248	1248	MGG	217	289	1989	ECRIML	X15860	X15860
32.70	narZYWV	second nar operon	7080	T	1	1	7080	7080	MGG	222	104	1990	ECNARZYW	X17110	-
33.30	sfcA	new KR	1765	F	1	1	1765	1765	G	125	261	1990	-	-	-
33.90	terC3	-	454	T	1	1	454	454	Cell	55	467	1988	ECTERC3A	M23252	ECOTERC3A
34.40	relB	-	2142	T	1	1	2142	2142	EMBO	4	1059	1985	ECRELB	X02405	ECORELB

34.50	uxaB	new BB	286	T	1	1	286	286	JGMi	132	697	1986	ECUXAB	M15737	ECOUXAB
34.90	dicAC	& dicBF	968	T	1	1	4440	4440	NAR	14	6821	1986	ECDICABC	X04395	ECOICABC
34.91	dicB	-	1720	C	0	0	0	0	NAR	16	6327	1988	ECDICABC	X07465	ECOICABC
34.92	dic operon	is2 insertion site corr	2129	C	0	0	0	0	NAR	16	10388	1988	ECDICABC	X07465	ECOICABC
35.40	pntAB	-	3240	T	1	1	3240	3240	EJB	158	647	1986	ECPNTAB	X04195	ECOPNTAB
35.69	tus terC2	& fumCA,manA	2416	T	1	1	866	6179	PNAS	86	1593	1989	ECTAU	D90037	ECOTAU
35.74	fumCA	-	2250	C	867	2250	430	0	BJ	237	547	1986	ECFUMC	X04065	ECOFUMC
35.75	fumA	-	2408	C	2717	2408	550	0	NAR	12	3631	1984	ECFUMA	X00522	ECOFUMA
35.76	manA	-	1604	C	4575	1604	1	0	Gene	32	41	1984	ECMANAA	M15380	ECOMANAA
35.82	uidA	-	460	T	0	0	0	2439	MGG	199	101	1985	ECUIDA1	X02395	ECOUIDA1
35.83	uidA	-	2439	C	1	1	2439	0	PNAS	83	8447	1986	ECUIDAA	M14641	ECOUIDAA
35.95	tyrS	-	1275	T	1	1	1275	1275	FEBS	150	419	1982	ECTYRS	J01719	ECOTYRS
36.00	malI	-	1925	T	1	1	1925	1925	JBac	171	4888	1989	ECMALIXA	M28539	M28539
36.20	tRNA Val2	new tRNA Val2A,B locus	300	T	1	1	300	300	JMB	212	579	1990	X52788	X52788	-
36.50	nth	map	780	T	1	1	780	780	BiCh	28	4444	1989	ECNTH	J02857	ECONTH
36.65	sodB	loc BB	970	T	1	1	970	970	JBCh	263	1555	1988	ECSODB	J03511	ECOSODB
36.69	purR	correction for J04212	513	T	1	1	2041	2041	EJB	187	373	1990	ECPURRRP	X51368	X51368
36.70	purR	loc: 1555 kbp map	1497	C	0	0	0	0	JBCh	263	19653	1988	ECPURR	J04212	ECOPURR
36.72	lpp	-	89	T	0	0	0	814	PNAS	75	2190	1978	-	J01645	ECOLPP
36.73	lpp	J01645 in Gb	814	C	1	1	814	0	Cell	18	1109	1979	ECLPPX	V00302	ECOLPP
36.85	aroD	loc BB	1798	T	1	1	1798	1798	BJ	238	475	1986	ECAROD	X04306	ECOAROD
36.95	aroH	J01592 in Gb	779	T	1	1	779	1928	JMB	145	47	1981	ECAROH	V00261	ECOAROH1
36.98	aroH	-	1924	C	780	775	1924	0	Unpub.			1989	ECAROH01	J04221	ECOAROH
37.43	btuDE,himA	& pheST,infC,thrS,rpmI	2600	T	1	3169	378	10765	JBac	167	928	1986	ECBTUCED	M14031	ECOBTUCED
37.47	himA	-	5972	C	2792	5972	5784	0	Unpub.			1985	ECHIMA	K02844	ECOHIMA
37.48	pheST,himA	also M10430	3060	C	2979	7784	1	0	JBac	163	787	1985	ECTHRINF	V00291	ECOTHRINF
37.50	infC,thrS	-	2280	C	0	0	0	0	PNAS	80	6152	1983	ECTHRINF	V00291	ECOTHRINF
37.51	infC,rpmI	length BB	2172	C	0	0	0	0	JMB	171	239	1983	ECTHRINF	V00291	ECOTHRINF
37.70	pfkB	-	409	T	1	1	423	1263	JMB	168	285	1983	ECPFKB	K00128	ECOPFKB
37.71	pfkB	-	1249	C	424	410	1249	0	Gene	28	337	1984	ECPFKBK	K02500	ECOPFKBK
37.90	katE	catalase HPII	3466	T	1	1	3466	3466	Unpub			1990	ECKATE	M55161	-
38.00	celABCDF	cryptic cel operon	4989	T	1	1	4989	4989	G	124	455	1990	ECCELOPE	X52890	-
38.31	xthA	-	1246	T	1	1	1246	1246	Unpub.			1988	ECXTHA	X13002	ECOXTHA
38.50	gdhA map	-	1937	T	1	1	1937	1937	Gene	27	193	1984	ECGDHAK	K02499	ECOGDHAK
38.65	topB,selD		2540	T	1	2540	1	3281	JBCh	264	17924	1989	ECTOPB	J05076	ECOTOPB
38.66	selD	-	1202	C	2541	741	1	0	PNAS	87	543	1990	ECSELD	M30184	ECOSELD
38.70	sppA	-	2252	T	1	1	2252	2252	JBCh	261	9405	1986	ECSPPA	M13359	ECOSPPA
38.75	ansA	& orf1,2	2156	T	1	1	2156	2156	Gene	78	37	1989	ECANSORA	M26934	M26934
38.87	ntr-like	new BB	1493	T	1	1	1493	1493	JBac	169	260	1987	ECNTRLA	M15328	ECONTRLA
39.35	gapDH	-	1523	T	1	1	1523	1523	EJB	150	61	1985	ECGAP	X02662	ECOGAP
39.60	rnd	E.coli D	1354	C	0	0	0	0	NAR	16	6265	1988	ECRND	X07055	ECORND
39.80	pabB	-	1623	T	1	1	1623	1623	JBac	159	57	1984	ECPABB	K02673	ECOPABB
40.20	ptsMPL	-	3179	T	1	1	3188	3179	JBCh	262	5238	1987	ECPTSLPM	J02699	ECOPTSLPM
40.45	argS	length BB	2372	T	1	1	2372	2372	NAR	17	5725	1989	ECARGS	X15320	X15320
41.20	ruvBA	new BB	2685	T	1	1	2685	2685	JBac	170	4322	1988	ECRUVA01	M21298	ECORUVABA
41.46	cheZYBR	& tap,tar,cheWA,MotBA,fla	480	T	0	0	0	12135	JBac	160	36	1984	ECCHEY	K02175	ECOCHEY
41.47	cheRBYZ	-	3063	C	0	3063	21	0	JBac	165	161	1986	ECCHE1	M13462	ECOCHE1
41.49	tap,tar	& cheW J01705 in Gb	3465	C	3043	3465	1	0	Cell	33	615	1983	ECTARX	V01504	ECOCHE2
41.50	cheWA	-	1360	C	6507	1198	1	0	JBac	165	161	1986	ECCHE3	M13463	ECOCHE3
41.51	cheA,motB	& cheW	2190	C	7705	1393	1	0	Unpub.			1990	ECCHEA	M34669	ECOCHEA
41.52	motB	-	974	C	0	0	0	0	JBac	166	244	1986	ECMOTB	M12914	ECOMOTAB
41.53	motA	2005 bp EMBL ?	1076	C	9098	1883	1	0	JBac	159	991	1984	ECMOTAB	J01652	ECOMOTAB
41.54	flbB,flaI	-	1301	C	10987	1154	1	0	JBac	170	1575	1988	ECFLBA	M19439	ECOFLBA
41.80	araFGH	Corr map BB	4200	T	1	4196	1	4210	JMB	197	37	1987	ECARAFGH	X06091	ECOARAFGH
41.82	araFGH	promoter char.	507	F	4197	14	1	0	JMB	215	497	1990	-	-	-
42.00	tyrP	length BB	1935	T	1	1	1947	1947	JBac	170	4946	1988	M23240	M23240	M23240
42.07	uvrC,orf	& psgA X03691 in Gb	120	T	1	1	4549	5954	EMBO	2	2313	1983	ECUVRC	X00189	ECOUVRC
42.08	uvrC	X03691 in Gb	2400	C	0	0	0	0	NAR	12	4593	1984	ECUVRC	X00638	ECOUVRC
42.09	uvrC	-	2939	C	0	0	0	0	NAR	14	2301	1986	ECUVRC	X03691	ECOUVRC

42.11	glyW,pgsA	-	955	C	4550	157	955	0	JBCh	261	1329	1986	ECGLYWA	M12299	ECOGLYWA
42.12	glyW,is1	insertion M14391 in Gb	890	C	5349	285	890	0	BChF	67	1053	1985	ECGLYWG	X03239	ECOTGGA
42.45	hag,rfs	= flbC,fliCD	351	T	0	0	0	2526	JBac	155	74	1983	ECHAGFLG	J01607	ECOHAGFLG
42.46	hag	-	1667	C	0	0	0	0	JBac	168	1479	1986	ECHAG	M14358	ECOHAG
42.47	flbC,hag48	hag48 = wt	2526	F	1	1	2526	0	MGG	216	44	1989	-	-	-
42.73	flaAI	& flaAII,motD (fliM)	1763	T	1	1	1763	2213	JBac	166	1007	1986	ECFLAA	M12784	ECOFLAA
42.74	motD	-	499	C	1764	52	499	0	JBac	171	2728	1989	M26294	M26294	M26294
43.00	dcm,orf	-	3655	T	1	1	3655	3655	NAR	17	5844	1989	ECDCM	X13330	ECODCM
43.09	asnT	tRNA Asn near tRNA Ser2	200	T	1	1	200	200	JMB	212	579	1990	X52790	X52790	-
43.10	serU mut	tRNA ser2	150	T	0	0	0	287	JBac	161	207	1985	ECTGSSD	M10746	ECOTGSSD
43.11	supD	tRNA ser2	287	C	1	1	287	0	Unpub.			1985	ECTGSSD	M10746	ECOTGSSD
43.20	aspV	tRNA Asp(1)	284	T	1	1	284	284	MGG	206	356	1987	ECASPV	X14007	ECOASPV
43.26	alkA	loc 44.7 BB ?	1942	T	1	1	1942	1942	JBCh	259	13730	1984	ECALKA	K02498	ECOALKA
43.30	amn	AMP nucleosidase	1803	T	1	1	1803	1803	BiCh	28	8726	1989	ECAMN	M30469	ECOAMN
43.35	tRNA Asn	2. locus for tRNA Asn	200	T	1	1	200	200	JMB	212	579	1990	X52791	X52791	-
43.40	tRNA Asn	3. locus for tRNA Asn	200	T	1	1	200	200	JMB	212	579	1990	X52792	X52792	-
43.60	sbcB	-	1927	T	1	1	1927	1927	JBCh	262	455	1987	ECSBCB	J02641	ECOSBCB
43.90	hisG	corr J01627 in Gb	708	T	1	1	714	7779	NAR	9	2075	1981	ECHIS1	V00284	ECOHISOP
43.91	hisGDC &	hisBHAFIE corr BB	7390	C	715	316	7390	0	JMB	203	585	1988	ECHISOP	X13462	ECOHISOPA
44.41	gnd	-	1887	T	1	1	1887	2159	Gene	27	253	1984	ECGND	K02072	ECOGND
44.43	gnd	is5 insertion	1013	C	1887	1	272	0	MBE	5	691	1988	ECGNDF	M23181	ECOGNDF
44.60	mrp,metG	-	1506	T	1	1	1094	3712	MGG	223	121	1990	-	-	-
44.61	metG ST	45.6 Bachmann map	1986	C	1095	1	2346	0	EJB	127	449	1982	ECMETG	J01649	ECOMETG
44.63	metG	-	451	C	0	0	0	0	JBac	160	1115	1984	ECMETG	K02671	ECOMETG
44.63	5'end metG	-	347	C	3441	76	347	0	MGG	223	121	1990	-	-	-
44.85	dld	-	2340	T	1	1	2340	2340	EJB	144	367	1984	ECDLD	X01067	ECODLD
44.90	mglB	-	1384	T	1	1	1384	1384	MGG	208	247	1987	ECMGLB1	X05646	ECOMGLB1
44.96	cir	-	641	T	1	1	641	2499	JBac	169	5343	1987	ECCIRIR	M19295	ECOCIRIR
44.97	cir	-	2240	C	642	382	2239	0	JBac	171	1041	1989	ECCIR	J04229	ECOCIR
45.05	nfo	loc BB	1020	T	1	1	1020	1020	JBac	170	5141	1988	ECNFO	M22591	ECONFO
45.80	ptsF,orf3	ptsF = fruA	2600	T	1	1	2600	2600	JGMi	134	2757	1988	M23196	M23196	M23196
46.00	tRNA Pro2	new locus for tRNA Pro2	300	T	1	1	300	300	JMB	212	579	1990	X52793	X52793	-
46.40	cdd	cAMP regul. promoter	485	T	1	1	485	485	MoMB	3	1385	1989	ECCCDP	X16419	X16419
47.60	ada	-	267	T	1	1	267	1997	Cell	45	315	1986	ECADAPA	M13155	ECOADAPA
47.61	ada	-	1324	C	268	189	1324	0	JBCh	260	7281	1985	ECADA	M10211	ECOADA
47.63	alkB	-	959	C	1404	366	959	0	JBCh	261	15772	1986	ECADAB	J02607	ECOADAB
47.70	ompCR,micF	-	240	T	1	1	1713	1713	FEBS	151	159	1983	ECOMPC	K00541	ECOOMPC
48.00	rcsBC	including unpubl.data	5246	T	1	1	5246	5246	JBac	172	659	1990	ECRCSBC	M28242	ECORCSBC
48.24	gyrA	= hisW	3327	T	1	1	3327	3327	JMB	197	729	1987	ECGYRA1	X06373	ECOGYRA1
48.26	gyrA,orf		4729	T	1	1	4729	4729	MoMB	1	259	1987	ECGYRAAM	Y00544	Y00544
48.50	nrdAB	-	8554	T	1	1	8561	8561	PNAS	81	4294	1984	ECNRDA	K02672	ECONRDA
48.70	glpT	new HD	1560	T	0	1560	120	6180	MoMB	1	251	1987	ECGLPT	Y00536	ECOGLPT
48.71	glpABC	-	4739	C	1441	1	4739	0	JBac	170	2448	1988	ECGLPA	M20938	ECOGLPA
49.00	menD	-	2345	T	1	1	2345	2345	JBac	171	4349	1989	ECMEND	M21787	ECOMEND
49.91	hisMP	-	1332	T	1	1	1332	1332	NAR	15	8568	1987	ECHISMP	Y00455	ECOHISMP
49.94	argT,dedF	& purF,dedEDCBA,hisT	6172	T	1	6172	4728	10775	JBCh	262	12209	1987	ECHISPUR	J02800	ECOHISPUR
49.95	purF	J01666 in Gb	2478	C	1445	2321	911	0	JBCh	257	3525	1982	ECPURF	V00322	ECOPURF
49.96	argT,dedF	2. part of divided sequ	6172	C	2855	4729	161	0	JMB	148	107	1981	ECRRNBZ	J02800	ECOHISPUR
50.03	usg,hisT	-	2323	C	7423	2323	470	0	NAR	13	5297	1985	ECHIST1	X02743	ECOHIST1
50.05	pdxB,usg1	div, pdxB = usg2	1500	C	9276	1500	1	0	JBac	171	6084	1989	ECPDXB	M29962	ECOPDXB
50.25	fabB	-	1748	T	1	1	1748	1748	CRC	53	357	1988	ECFABB	M24427	ECOFABB
50.37	ackA	loc 49.8 BB ?	1758	T	1	1	1758	1758	JBac	171	577	1989	ECACKA	M22956	ECOACKA
50.40	aroC	new BB	1690	T	1	1	1690	1690	BJ	251	313	1988	ECAROCX	M33021	ECOAROCX
50.45	mepA	-	1765	T	1	1	1690	1765	MoMB	4	209	1990	ECMEPAMR	X16909	X16909
50.61	fadL	-	1899	T	1	1	1899	1899	MoMB	2	363	1988	ECFADL	Y00552	ECOFADL
50.96	dsdC	contains M13 sequence	1633	T	1	1633	1	3342	JBac	170	330	1988	ECDSDAA	M19035	ECODSDAA
50.97	dsdAC	-	1000	C	1634	281	1989	0	JBac	154	1508	1983	ECDSDA	J01603	ECODSDA
50.99	dsdA	corr	1445	C	0	0	0	0	JBCh	263	16926	1988	ECDSDA	J01603	ECODSDA
51.05	tRNA Arg5	new locus for tRNA Arg5	300	T	1	1	300	300	JMB	212	579	1990	X52794	X52794	-

51.95	tRNA Lys	& tRNA Val 17 bp differ.	542	T	1	1	542	542	JMB	212	579	1990	X52796	X52795	-
52.00	lysV,valU	& gltX,orf294,62,105,16	3649	P	1	1	1880	5163	JMB	214	825	1990	X55757	X55757	-
52.04	gltX	reading frame only	1514	C	1881	3	1413	0	JBCh	261	10610	1986	ECGLTX	M13687	ECOGLTX
52.05	orf62,105	& alaW, orf167	3649	F	3291	3291	5163	0	JMB	148	107	1981	ECRRNBZ	V00348	-
52.10	lig	-	3195	T	1	1	3195	3195	Unpub.			1989	ECLIG	M24278	ECOLIG
52.15	cysK	& ptsHI,crr	2596	T	1	1	2597	4861	JBac	170	3150	1988	ECCYSPTS	M21451	ECOCYSPTS
52.16	orf,cysK	& ptsHI,crr	3144	C	2598	881	3144	0	JBac	170	3827	1988	ECPHOSYS	M21994	ECOPHOSYS
52.35	cysP	& cysTWAM	1291	T	1	1	5736	5736	JBac	172	3358	1990	ECCYS	M32101	ECOCYS
52.36	cysTWAM	last 18 bp Mu	4446	C	0	0	0	0	JBac	172	3351	1990	ECCYS	M32101	ECOCYS
53.15	dapA	-	1171	T	0	1	1131	3191	JBac	166	297	1986	ECDAPA	M12844	ECODAPA
53.16	purC	-	2060	C	1132	1	2060	0	JBac	172	6035	1990	ECPURCA	M33928	-
53.80	purMN	-	2043	T	1	1	2899	2899	JBCh	261	10632	1986	ECPURMN	M13747	ECOPURMN
53.81	purN	-	1149	C	0	0	0	0	JBCh	262	10565	1987	ECPURMN	M13747	ECOPURMN
53.90	guaAB	- overlay gua-xse HD	1847	T	1	3531	323	4825	NAR	13	1303	1985	ECGUABA	M10101	ECOGUABA
53.93	xseA	-	1616	C	3209	1	1616	0	JBCh	261	14929	1986	ECXSEA	J02599	ECOXSEA
54.10	hisS	-	1673	T	1	1	1673	1673	JBCh	260	10063	1985	ECHISS	M11843	ECOHISS
54.60	suhB	-	1017	T	1	1	1017	1017	JBac	172	2124	1990	ECSUHBA	M34828	ECOSUHBA
54.77	glnB (PII)	map length BB	474	T	1	1	474	474	JBCh	262	8690	1987	ECGLNB	M16778	ECOGLNB
54.90	glyAX	-	378	T	1	1	378	1902	Gene	22	9	1983	ECGLYAX	J01621	ECOGLYA
54.91	glyA	J01620 in Gb	1725	C	379	202	1725	0	NAR	11	2065	1983	ECGLYA	V00283	ECOGLYA
55.20	purL	new BB	5865	T	1	1	5865	5865	BiCh	28	2459	1989	ECPURLA	J02848	ECOPURLA
55.40	lepA	& rnc,era	2089	T	1	1	3131	5728	JBCh	260	7206	1985	ECLEP	K00426	ECOLEP
55.43	rnc	-	1076	C	3132	33	1076	0	NAR	13	4677	1985	ECRNC1	X02673	ECORNC1
55.46	era	-	1020	C	4176	185	1020	0	PNAS	83	8849	1986	ECERA	M14658	ECOERA
55.48	recO,era	-	1588	C	5012	844	1590	0	JBac	171	3641	1989	M27251	M27251	M27251
56.00	ung	-	1532	T	1	1	1532	1532	JBCh	263	7776	1988	ECUNG01	J03725	ECOUNG
56.30	nadB	new BB	1724	T	1	1	1724	1724	EJB	175	221	1988	ECNADB	X12714	ECONADB
56.44	witA	loc. betw. pss & rrnG	1560	T	1	1560	1	10297	JBac	172	4745	1990	ECWITAG	X53027	-
56.45	rrfG, witA	distal end of rrfG	480	C	1561	287	1	0	NAR	18	3056	1990	ECRRFG	X52363	-
56.53	spacer	analog rrnF ECRNA8	600	F	1848	128	35	0	N	215	735	1967	ECRN10	X00414	-
56.54	rrlG 23S	RNA analog J01695 in Gb	2904	C	1941	6403	3500	0	JMB	148	107	1981	ECRRNBZ	V00348	ECORGNB
56.55	rrnG space	rsl, tRNA Glu2	440	F	4844	440	1	0	FEBS	107	177	1979	ECG20	K01126	-
56.56	rrfG 16S	RNA analog J01695 in Gb	1541	C	5324	2959	2194	0	JMB	148	107	1981	ECRRNBZ	V00348	ECORGNB
56.58	clpB,rrnG	last 1438 bp ?	5684	C	6089	4248	1	0	Unpub.			1989	M29364	M29364	ECOPROT
56.62	pheA	& tyrA,aroF M10431 in Gb	4509	T	1	1	4509	4509	JMB	180	1023	1984	ECTYRA	X02137	ECOPHEAB
56.76	trmD	& rplS,rpsP	4586	T	1	1	4586	4586	EMBO	2	899	1983	ECTRMD	X01818	ECOTRMD
57.60	gabT	-	1612	P	1	1	1612	1612	JBac	172	7035	1990	-	-	-
57.79	gshI	E.coli B mut	2098	B	0	0	0	0	NAR	14	4393	1986	ECGSHI	X03954	ECOGSHI
57.90	hydHG	-	1744	T	1	1	1740	1744	JBac	171	4448	1989	ECHYDHGA	M28369	ECOHYDHGA
57.95	mprA	-	742	T	1	1	742	742	Unpub.			1991	ECMPRA	X54151	ECOMPRA
58.00	proU(VWX)	-	4362	T	1	1	4361	4362	JBac	171	1923	1989	ECPROU	M24856	ECOPROU
58.01	proU	corr delete G39	1	C	0	0	0	0	JBac	172	1165	1990	corr	corr	corr
58.10	tRNA Arg2	& tRNA Ser3	1200	T	1	1	1200	1200	JMB	212	579	1990	X52797	X52797	-
58.15	orf	61 aa small protein	611	T	1	1	611	611	Unpub			1990	ECSPROT	X52620	-
58.20	alaS mRNA	new BB	280	P	1	1	243	3010	JBCh	256	205	1981	-	-	-
58.21	alaS	-	500	C	244	1	500	0	PNAS	77	6531	1980	ECALASYN	J01581	ECOALAS
58.22	alaS	J01581 in Gb	2767	C	744	498	2767	0	Scie	213	1497	1981	ECALAS	V00254	ECOALAS
58.25	recA	J01672 in Gb	1320	T	1	1	1390	1391	PNAS	77	313	1980	ECRECA	V00328	ECORECA
58.26	recA	J01672 in Gb	1374	C	0	0	0	0	PNAS	77	2611	1980	ECRECA	V00328	ECORECA
58.28	recN	-	2224	T	1	1	2224	2224	NAR	15	5041	1987	ECRECN	Y00357	ECORECN
58.30	gutABD	= srlABD	3523	T	1	1	3523	5454	JBCh	262	5455	1987	ECGUT	J02708	ECOGUT
58.32	srlDMRQ	new BB	1800	C	3524	554	1800	0	JMB	203	569	1988	ECGUTMR	X13463	-
58.33	gutQ	-	935	C	4771	252	935	0	Unpub.			1990	ECGUTQ	X51361	X51361
58.46	ssrA	-	648	T	1	1	648	648	MoMB	3	1481	1989	ECSSRA	X16382	X16382
58.90	katF	-	1483	T	1	1	1483	1483	NAR	17	9979	1989	ECKATF	X16400	X16400
58.95	hevABCDEFG	& hevH	7650	T	1	1	7829	7829	MoMB	4	231	1990	ECHEVOP	X17506	X17506
58.96	hevOP	-	211	C	0	0	0	0	MoMB	4	13	1990	ECHEVOP	X17506	X17506
59.02	fhlA	fhlB at 95.4 + 60bp 3'	2443	P	1	1	209	2443	JBac	172	4798	1990	-	-	-
59.03	fhlA	= orfE	2193	C	210	1	2193	0	MoMB	4	1319	1990	X52227	X52227	-

59.25	cysD	cysD promoter	492	T	1	1	492	492	Gene	87	127	1990	ECCYSD	M35098	ECOCYSD
59.30	cysJI	E.coli B prom	324	B	1	1	2089	5939	JBac	171	130	1989	ECCYSJ01	M23008	ECOCYSJIH
59.31	cysJI	E.coli B	1825	B	0	0	0	0	JBCh	264	15796	1989	ECCYSJ01	M23008	ECOCYSJIH
59.32	cysJIH	E.coli B	3876	B	2090	27	3876	0	JBCh	264	15726	1989	ECCYSJIH	J05009	ECOCYSJIH
59.40	iap	conflict last bp = C	1664	T	1	1	1664	2832	JBac	169	5429	1987	ECIAP	M18270	ECOIAP
59.41	iap	14 times 29 bp repeat	1465	C	1665	1	1168	0	JBac	171	3553	1989	M27059	M27059	M27059
59.75	pyrG next	to 6 times 29 bp repeat	1531	T	1	1	1531	1531	JBac	171	3553	1989	M27060	M27060	M27060
59.80	pyrG	-	2442	T	1	1	2442	2442	JBCh	261	5568	1986	ECPYRG	M12843	ECOPYRG
59.82	relA	map	2858	T	1	1	2858	2858	JBCh	263	15699	1988	ECRELA	J04039	ECORELA
60.30	fucO	-	1690	T	0	0	0	8901	JBac	171	3754	1989	M27177	M27177	M27177
60.32	fucAPIKR	-	6901	C	1	1	8901	0	NAR	17	4883	1989	ECFUCOSE	X15025	ECOFUCOSE
60.51	thyA	ptr,recDC,argA	1147	T	1	1	1163	16371	PNAS	80	4914	1983	ECTHYA	J01710	ECOTHYA
60.52	thyA,recC	-	6000	C	1164	766	5992	0	NAR	14	4437	1986	ECRECC	X03966	ECORECC
60.53	ptr	-	1171	C	6391	189	1171	0	Gene	54	185	1987	ECPTR31	M17095	ECOPTR31
60.54	ptr	-	3120	C	7374	1094	3120	0	NAR	14	7695	1986	ECPTR	X06227	ECOPTR
60.55	recB	-	3960	C	9401	361	3960	0	NAR	14	8573	1986	ECRECB	X04581	ECORECB
60.56	recD	-	2160	C	13001	361	2160	0	NAR	14	8583	1986	ECRECD	X04582	ECORECD
60.58	argA &	-	1575	C	14801	1571	1	0	NAR	15	10586	1987	ECARGA	Y00492	ECOARGA
61.11	mutH	-	790	T	1	1	790	790	NAR	15	3073	1987	ECMUTH	Y00113	ECOMUTH
61.25	metZ	tRNA met	344	T	1	1	344	344	Gene	67	49	1988	ECTGM1Z	M21680	ECOTGM1Z
61.35	galR	J01614 in Gb	1150	T	1	1	1150	6097	PNAS	79	2427	1982	ECGALR	V00280	ECOGALLYS
61.36	lysR,orfX	-	1854	F	1151	1151	3231	0	JMB	168	333	1983	ECGALLYS	J01614	ECOGALLYS
61.37	galR,lysAR	-	2346	C	0	0	0	0	JMB	168	321	1983	ECGALLYS	J01614	ECOGALLYS
61.38	araE &	galR,lysRAS	2866	C	3232	2866	1	0	JBCh	263	8003	1988	ECARAEA	J03732	ECOARAEA
62.00	glyU	tRNA Gly1	300	T	1	1	300	300	JMB	212	579	1990	X52798	X52798	-
62.29	herC,prfB	& recF	1832	P	1	1832	1	6279	PNAS	85	5620	1988	ECHERC	J03795	ECOHERC
62.32	prfB (RF2)	partial map	1440	C	1833	1181	1	0	PNAS	82	3616	1985	ECRF2X	M11520	ECORF2X
62.34	recJ	-	3772	F	3014	3266	1	0	JBac	173	353	1991	-	-	-
62.80	serA	-	1233	T	1	1	1233	1233	JBCh	261	12179	1986	ECSERA	N00029	ECOSERA
62.84	ssr	-	954	T	1	1	954	954	JBac	161	1162	1985	ECSSR	M12965	ECOSSR
63.28	fda, pgk &	gapB new BB	8029	T	1	1	8029	8029	MoMB	3	723	1989	ECFDAPGK	X14436	ECOFDAPGK
63.65	speB	additional sequences	1090	T	1	2458	1	6529	Unpub			1990	ECSPEAA	M32363	ECOSPEAA
63.66	speB	near speA,metK	1371	C	0	0	0	0	JBac	172	538	1990	ECSPEAA	M32363	ECOSPEAA
63.67	speBA,metK	-	3236	C	2459	2887	1	0	JBac	172	4631	1990	ECSPEA	M31770	ECOSPEA
63.68	metK	-	1462	C	5346	278	1462	0	JBCh	259	14505	1984	ECMETK	K02129	ECOMETK
63.71	gshII	E.coli B	1474	B	1	1	1474	0	NAR	12	9299	1984	ECGSHII	X01666	ECOGSHII
63.80	ansB	-	1643	T	1	1	1643	1643	Gene	91	101	1990	ECANSBA	M34234	ECOANSBA
63.81	ansB	ansA maps at 39.10	1522	T	1	1	1522	1522	JBac	172	1491	1990	ECLASNII	M34277	ECOLASNII
63.90	mutY	adenine glycosylase	1231	T	1	1	1231	1231	NAR	18	3841	1990	ECMUTY	X52391	-
64.00	pheV	-	487	T	1	1	487	487	NAR	13	3699	1985	ECPHEV	X02480	ECOPHEV
64.11	nupG	regulatory region	111	T	1	1	23	1509	EJB	190	547	1990	X55813	X55813	-
64.12	nupG	-	1486	C	24	1	1486	0	EJB	168	385	1987	ECNUPG	X06174	ECONUPG
64.15	speC,crp	crp on 2.strand ?	2330	T	1	1	2330	2330	Unpub.			1990	ECSPEC	M33766	-
65.00	metC	-	1880	T	1	1880	1	3246	PNAS	83	867	1986	ECMETC	M12858	ECOMETC
65.01	exbBD	overlay met-exb HD	2195	C	1881	830	2195	0	JBac	171	5117	1989	ECEXBBD	M28819	ECOEXBBD
66.40	tolC	X00016 in Gb	173	T	0	0	0	2096	FEBS	156	307	1983	ECTOLC	V01505	ECOTOLC
66.43	tolC	corr	2096	C	1	1	2096	0	NAR	18	5547	1990	ECTOLCMP	X54049	-
66.55	parE	M37832	1869	T	1	1	1869	1869	Cell	63	393	1990	ECPARC	M58408	ECOPARC
66.60	parC	M37833	2284	T	1	1	2284	2284	Cell	63	393	1990	ECPARE	M58409	ECOPARE
66.80	cca	-	2257	T	1	1	2257	2257	JBCh	261	6444	1986	ECCCA	M12788	ECOCCA
66.91	rpsU	-	255	T	1	1	3930	8989	MGG	195	391	1984	ECRPSU01	M16194	ECORPSU
66.92	rpsU &	orfXYZ	4644	C	0	0	0	0	Gene	51	149	1987	ECRPSU01	M16194	ECORPSU
66.93	rpsU &	dnaG,rpoD	2600	C	3931	1	5059	0	NAR	9	2889	1981	-	J01687	ECORPSRPO
66.94	rpsU	J01687 in Gb	1283	C	0	0	0	0	MGG	189	48	1983	ECRPSU	V00346	ECORPSRPO
66.95	dnaG	J01687 in Gb	2000	C	0	0	0	0	PNAS	79	4550	1982	ECDNAG	V00274	ECORPSRPO
67.05	tRNA Ile2	new locus for tRNA Ile2	200	T	1	1	200	200	JMB	212	579	1990	X52800	X52800	-
67.79	ebgRABC	flanking seq	4983	T	1	1	4983	4983	G	123	635	1989	ECEBG	X52031	-
67.92	uxaC	exuT new BB	318	T	1	1	318	318	FEMS	33	205	1986	ECUXEX	M35280	ECOUXEX
68.10	tdcRABC &	orfX	1221	T	0	0	0	6294	MGG	201	308	1985	ECTDC	M21312	ECOTDC

68.11	tdcB	-	990	C	0	0	0	0	PNAS	84	393	1987	ECTDC	M21312	ECOTDC
68.12	tdcC,orfX	-	2122	C	0	0	0	0	JBac	170	5352	1988	M23638	M23638	M23638
68.14	tdc	flanking sequences	2044	C	1	1	6295	0	NAR	17	3994	1989	ECTDCRAB	X14430	ECOTDCRAB
68.41	prlF	-	927	T	1	1	927	927	JBac	172	185	1990	ECPRLF	M32358	ECOPRLF
68.80	mtr	near pnp,rps ccw MK	1868	F	1	1868	1	1868	JBac	173	108	1991	-	-	-
68.84	pnp,rpsO &	infB,nusA,metY	3030	T	1	3030	278	10151	JBCh	262	63	1987	ECRPS15	J02638	ECORPSOP
68.89	p15B,p35	-	1861	C	2753	1861	474	0	Unpub.			1988	ECP15B35	X13270	ECOP15B35
68.90	nusA,infB	gene and mRNA corr BB	903	C	4140	5423	211	0	PNAS	81	409	1984	ECNUSA2	K01175	ECONUSA
68.91	nusA tRNA	metF(Y),infB tRNA:X250	2427	C	0	0	0	0	NAR	12	3333	1984	ECNUSA2	X00513	ECONUSA
68.92	nusA,infB	-	3203	C	0	0	0	0	PNAS	81	7787	1984	ECNUSA2	X00513	ECONUSA
68.98	metY flank	3' flanking sequence	800	C	9352	800	1	0	JBac	172	2336	1990	ECMETY	M28401	ECOTGMETY
69.03	argG	-	1344	T	1	1	1344	1344	Gene	95	99	1990	ECARGGA	M35236	-
69.08	leuU	tRNA Leu2	300	T	1	1	300	300	JMB	212	579	1990	X52801	X52801	-
69.11	gltB= psiQ	-	48	T	1	1	48	48	JBac	172	3191	1990	ECALPHOR	M33740	ECOALPHOR
69.12	gltB= psiQ	-	39	T	1	1	39	39	JBac	172	3191	1990	ECALPHOU	M33743	ECOALPHOU
69.13	gltD= psiQ	-	52	T	1	1	52	52	JBac	172	3191	1990	ECALPHOO	M33737	ECOALPHOO
69.35	nanA	= npl new BB D00067 in Gb	1243	T	1	1	1243	1243	AgrB	50	2155	1986	ECNANAA	M20207	ECONANA
69.40	gltE	= aspB; gltB ?	6292	T	1	1	6292	6292	Gene	60	1	1987	ECGLTB	M18747	ECOGLTB
69.44	ssp	-	1616	T	1	1	1616	1616	NAR	15	1153	1987	ECSSPG	X05088	ECOSSPG
69.50	arcB	-	2390	T	1	1	2390	2390	MoMB	4	715	1990	-	-	-
69.91	rnpB	-	799	P	1	1	799	1446	PNAS	81	3959	1984	-	K01993	ECORNPBX
69.94	rnpB	preM1 RNA	600	C	800	800	804	0	NAR	11	8237	1983	ECRN09	X00211	ECORNPB
69.96	rnpB	new BB	773	F	805	132	773	0	PNAS	80	5359	1983	-	-	-
70.24	rpsI,rplM	length BB	1159	T	1	26	1184	1159	MGG	198	279	1985	ECRPSI	X02130	ECORPSI
70.40	mdh,argR	-	1046	T	0	0	0	3028	NAR	15	4993	1987	ECMDH1	Y00129	ECOMDH1
70.42	mdh argR	new BB	2470	C	1	2470	369	0	AcMB	149	36	1987	M24777	M24777	M24777
70.43	argR	= xerA new BB	926	C	2102	1	926	0	EMBO	7	4389	1988	ECXERA	X13968	X13968
70.76	sohA	supp.htrA	828	T	1	1	828	828	JBac	172	1587	1990	ECSOHA	M30178	ECOSOHA
71.10	panF	-	1904	T	1	1	1904	1904	JBac	172	3842	1990	ECPANF	M30953	ECOPANA
71.18	mreB &	mreCD; mreB = envB	2105	T	1	1	1621	3587	JBac	170	4619	1988	ECMREB	M22055	ECOMREB
71.20	mreCD	bad name in Em,Gb	1966	C	1622	1	1966	0	JBac	171	6511	1989	ECMERBCD	M31792	ECOMERBCD
71.40	fabE	-	1229	T	1	1	1229	1229	DNA	8	779	1989	ECFABEA	M32214	ECOFABEA
71.50	fis	-	536	T	1	1	536	583	PNAS	85	4237	1988	ECFISA	J03816	ECOFISA
71.51	fis	new BB	473	C	537	427	473	0	PNAS	85	3484	1988	ECFIS	J03245	ECOFIS
72.07	rrnD	operon J01692 in Gb	472	T	0	1	425	5738	Cell	17	225	1979	ECRGNX1	J01700	ECORGNDS1
72.11	rrsD 16S	RNA analog J01695 in Gb	1541	C	426	1519	2959	0	JMB	148	107	1981	ECRRNBZ	V00348	ECORGNB
72.12	rrsD tRNA	ile ala tRNA:A250	545	C	1866	1	437	0	JBCh	254	3264	1979	ECRGNX2	K00763	ECORGNX2
72.14	rrlD 23S	RNA analog J01695 in Gb	2903	C	2303	3501	6403	0	JMB	148	107	1981	ECRRNBZ	V00348	ECORGNB
72.15	rrlD,rrfD,	thrV,rrfD J01693 in Gb	667	C	5205	134	667	0	NAR	8	3793	1980	ECRNA6	V00334	ECORGNDIS
72.26	aroE	new BB	819	T	1	1	819	819	BJ	249	319	1988	ECAROE1	Y00710	Y00710
72.29	aroE,rplQ	intergenic M11148 in Gb	242	T	1	1	242	242	NAR	12	5813	1984	ECAROE	X00767	ECOAROE
72.40	alpha, spc	& S10 operons	3154	T	1	3154	329	14392	NAR	13	3891	1985	ECRPA	X02543	ECORPA
72.43	rplPII	(secY,rpmJ,rpsM)	759	C	2826	759	654	0	JBCh	255	4653	1980	ECRPLP2	M12432	ECORPLP2
72.44	rplN L14 &	rpsQ S17,spc	5922	C	2932	5922	224	0	NAR	11	2599	1983	ECSPC	X01563	ECORPLN
72.46	rpsJ S10	901 bp not det.here BB	4520	C	8631	5421	902	0	NAR	13	4521	1985	ECRPOS10	X02613	ECORPOS10
72.48	rpsJ S10 &	rplC L3 J01680 in Gb	1241	C	13151	1241	1	0	Cell	26	205	1981	ECRPSL	V00344	ECORPSJ
72.95	bfr, gp24'	& gp64 map	1350	T	1	1	1350	1350	JBac	171	3940	1989	ECBFR	M27176	ECOBFR
73.00	strA &	rpsL S12 J01688 in Gb	365	T	0	0	0	3546	Cell	15	215	1978	ECSPCX	V00354	ECOSTR1
73.05	strA,rpsL	fusA,tufA J01689 in Gb	405	C	1	1	405	0	JBCh	255	4660	1980	ECSTR2	V00356	ECOSTR2
73.06	fusA	length BB	2076	C	406	310	2145	0	NAR	12	2181	1984	ECFUSG	X00415	ECOSTRA
73.07	strA,rpsL	= S12 (fusA,tufA)	1374	C	2242	70	1374	0	Gene	12	25	1980	ECSTR3	J01690	ECOSTR3
73.20	strA,rpsL	= S12 (tufA)	200	T	1	1	200	200	Gene	12	25	1980	ECSTR4	J01691	ECOSTR4
73.51	crp	-	1127	T	1	1	1127	1298	NAR	10	1363	1982	ECCRP	J01598	ECOCRP
73.53	crp	-	269	C	1128	99	269	0	JBac	169	654	1987	ECCRP3B	M15200	ECOCRP3B
74.00	argD	-	1224	T	1	1224	1	3923	Gene	90	69	1990	ECARGD	M32796	ECOARGD
74.01	pabA,fic &	orf,utu,dtu	2059	C	1225	2008	1	0	JBac	172	397	1990	ECPABAA	M32354	-
74.03	pabA,fic &	orf190,orf77	2496	C	3233	694	1	0	JBac	171	4525	1989	ECFIC1	M28363	ECOFIC1
74.20	nirBDEC &	cysG last 18 bp artf MK	5618	T	1	1	5796	8413	EJB	191	315	1990	ECNIRBC	X14202	ECONIRBC
74.23	cysG,orf	-	5281	F	5797	2664	5281	0	JBac	173	325	1991	-	-	-

74.28	trpS	figure 5 BB	160	T	1	1	126	1132	JBac	148	941	1981	ECTRPS	V00370	-
74.29	trpS	J01716 in Gb length BB	1005	C	127	1	1005	0	JBCh	257	6132	1982	ECTRPSZ	V00371	ECOTRPS
74.35	dam,orf	76 bp artificial subtr.	1058	T	1	1134	77	3852	NAR	11	837	1983	ECDAM	J01600	ECODAM
74.36	dam,orf &	aroB	1560	C	1059	1265	1	0	MGG	217	85	1989	ECURF743	X15162	ECOURF743
74.37	aroB	last 7 bp artificial ?	1636	C	2324	1528	1	0	FEBS	200	11	1986	ECAROB	X03867	ECOAROB
74.60	mrcA	-	2764	T	1	1	2764	2764	EJB	147	437	1985	ECPONA	X02164	ECOPONA
74.76	pckA	-	1861	P	1	1	1861	1861	JBac	172	7151	1990	-	-	-
74.80	ompR,envZ	= ompB corr BB	1288	T	1	1	1286	2705	JBCh	257	13685	1982	ECOMPB	J01656	ECOOMPB
74.81	envZ	corr BB	1603	C	1287	187	1600	0	JBCh	257	13692	1982	ECENVZ	J01606	ECOOMPB
75.01	bioH	-	2614	T	1	1	2614	2614	Unpub.			1989	ECBIOH	X15587	X15587
75.15	malQP	-	2866	T	1	2866	1	8728	MoMB	2	473	1988	-	M32793	ECOMALQP
75.16	malPT,zhg	corr BB X02003 in Gb	2437	C	2867	1926	1	0	ZNfC	42	394	1987	ECMALP2	X06791	ECOMALP
75.17	malP	length BB	1901	C	4793	639	1	0	N	313	500	1985	ECMALP1	X02003	ECOMALP
75.20	malT	-	3508	C	5432	211	3508	0	Gene	42	201	1986	ECMALT	M13585	ECOMALT
75.56	glpRGED	X07520 in Gb	2913	T	1	1	2913	16391	NAR	16	7732	1988	ECGLPRZ	M54940	ECOGLPREG
75.58	glgDP	flavoenzyme	2838	C	1	421	2838	0	AgrB	53	1135	1989	ECGLPD01	D00425	ECOGLPDA
75.60	glgPACXB &	asd, 21 bp difference	2580	C	2839	2580	1	0	JBCh	263	13706	1988	ECGLGPA	J03966	ECOGLGPA
75.63	glgA	-	1601	C	5419	1505	1	0	JBCh	261	16256	1986	ECGLGA	J02616	ECOGLGA
75.64	glgC	J01616 in Gb	1328	C	6924	1182	1	0	JBCh	258	5084	1983	ECGLGC	V00281	ECOGLG
75.67	glgX	J01616 in Gb	2047	F	8106	2026	1	0	Gene	70	363	1988	ECGLGY	J01616	ECOGLG
75.68	glgB	-	2559	C	10132	2352	260	0	JBCh	261	8738	1986	ECGLGBA	M13751	ECOGLGBA
75.69	asd	-	1674	C	12226	1674	1	0	EMBO	1	379	1982	ECASDX	V00262	ECOASD
75.80	ggt	map counterclockwise	2148	T	1	2148	1	2148	JBac	171	5169	1989	M28722	M28722	M28722
76.00	ugpQ	-	819	T	1	819	1	18080	NAR	17	2854	1989	ECUGPQ	X14437	ECOUGPQ
76.01	ugpBAEC	-	4717	C	820	4558	325	0	MoMB	2	767	1988	ECUGP	X13141	ECOUGP
76.03	livHJK	ATGA overlaps	1087	T	0	0	0	0	JBac	166	565	1986	ECLIVH	M13166	ECOLIVHMG
76.09	liv Operon	-	7586	C	5053	8703	155	0	JBCh	265	11436	1990	ECLIVHMG	J05516	ECOLIVHMG
76.10	htpR	correction and summary	1222	C	0	0	0	0	Unpub.			1990	ECLIVHMG	J05516	ECOLIVHMG
76.15	ftsXEY	-	4480	C	13600	4480	1	0	MGG	205	134	1986	ECFTSYEX	X04398	ECOFTSYEX
77.20	gor	-	1500	T	1	1	1500	1500	BiCh	25	2736	1986	ECGOR	M13141	ECOGOR
77.40	rhsB	start	400	T	1	1	400	400	JBac	171	636	1989	ECRHSB	M21762	ECORHSB
77.41	rhsB	core	140	T	1	1	140	140	JBac	171	636	1989	ECRHSA3	M21766	ECORHSA3
77.42	rhsB		577	T	1	1	577	577	JBac	172	446	1990	ECRHSBA	M29717	ECORHSBA
78.00	tRNA Pro1	new locus for tRNA Pro1	184	T	1	1	184	184	JMB	212	579	1990	X52802	X52802	-
79.00	cspA	cold shock prot.A	1205	T	1	1	1205	1205	PNAS	87	283	1990	ECCSPA	M30139	ECOCSPAA
79.10	tag,bisC	-	869	T	1	1	869	3894	JBCh	261	15761	1986	ECTAG3M	J02606	ECOTAG
79.12	bisC	overlay KR	3337	C	870	3024	1	0	JBac	172	2194	1990	ECBISCAS	M34827	ECOBISCAS
79.40	dppA = fpp	dipeptide transport pr.	1950	T	1	1	1950	1950	JBac	173	234	1991	ECFPP	M35045	ECOFPP
79.51	glyS	-	240	T	0	0	0	3333	JBCh	257	12503	1982	ECGLYSIS	J01623	ECOGLYSIS
79.52	glyS	-	3153	C	1	1	3333	0	JBCh	258	10637	1983	ECGLYS	J01622	ECOGLYS
79.71	xylAB	K01996 in Gb	4175	T	1	1	4175	4175	AEMb	47	15	1984	ECXYLIK	X04691	ECOXYLABA
80.30	avtA	map BB	1752	T	1	1	1752	1752	NAR	15	9461	1987	ECAVT	Y00490	ECOAVT
80.40	selB	-	2000	T	1	1	2000	2000	N	342	453	1989	ECSELB	X16644	X16644
80.60	rhsA	-	9234	T	1	1	9234	9234	JBac	172	446	1990	ECRHSA	M29716	ECORHSA
80.70	mtlOP	corrected by 80.71	300	T	1	1	299	3810	MoMB	2	405	1988	ECMTLOP	X06793	ECOMTLOP
80.72	mtlA	K00051 in Gb	2164	C	300	60	2162	0	JBCh	258	10761	1983	ECMTLA	V01503	ECOMTLA
80.73	mtlDA	corrected by 80.74	1407	C	2403	172	1407	0	MoMB	2	405	1988	ECMTLD	X06794	ECOMTLD
80.95	cysE	-	1135	T	1	1	2	1398	JGMi	133	515	1987	ECCYSE	M15745	ECOCYSE
80.96	cysXE	overlap on 2.strand	1396	C	3	1	1396	0	BBRC	167	948	1990	ECCYSXE	M34333	ECOCYSXE
81.05	secB	revers overlap of gene	593	T	1	1	593	593	Gene	75	167	1989	ECSECB	M24489	ECOSECB
81.15	kbl,tdh	length BB	1694	T	1	1	3563	3563	NAR	16	3586	1988	ECKBLTDH	X06690	ECOKBLTDH
81.16	tdh	length BB	1872	C	0	0	0	0	JBCh	264	5226	1989	ECKBLTDH	X06690	ECOKBLTDH
81.25	rfaD	-	2037	T	1	1	2037	2037	JBac	172	4652	1990	ECRFADA	M33577	ECORFADA
81.80	rpmBG fpg	-	764	T	1	1	620	1713	MGG	184	218	1981	ECRPMBG	J01677	ECORPMBG
81.81	fpg	-	1093	C	621	1	1093	0	EMBO	6	3177	1987	ECFPG	X06036	ECOFPG
81.95	dut,orf &	pyrE, atte X01714 in Gb	1613	T	1	1	2568	5352	EMBO	2	967	1983	ECDUTPYR	V01578	ECOPYREA
81.97	pyrE	-	1113	C	2569	657	351	0	EJB	135	223	1983	ECPYRE	X00781	ECOPYRE
81.98	pyrE	-	1177	C	0	0	0	0	EMBO	3	1783	1984	ECPYRE	X00781	ECOPYRE
81.99	orfXY	in paper X14235 new BB	2375	F	2875	1	2375	0	MoMB	3	393	1989	-	-	-

82.05	rpoZ,spoT	-	764	T	1	1	278	3451	Gene	48	33	1986	ECOMEGA	M15266	ECOOMEGA
82.07	rpoZ,spoT	& orf M24503 in Gb	3171	C	279	1	3171	0	JBCh	264	15074	1989	ECSPOT	J04976	ECOSPOT
82.40	selC	seleno tRNA	233	T	1	1	233	233	N	331	723	1988	ECSELC1	X17419	X17419
82.60	uhpTCBA &	ilvBN	5403	T	1	5400	1	7647	JBac	169	3556	1987	ECUHP	M17102	ECOUHP
82.63	ilvBN	-	2462	C	5401	2240	1	0	NAR	13	3995	1985	ECILVBN	X02541	ECOILVBPR
82.66	ilvB	-	370	C	7641	7	1	0	NAR	12	8145	1984	ECILVBN	X01131	ECOILVBPR
83.42	gyrB,recF	& dnaNA,rpmH,rnpA	1498	T	0	0	0	8716	NAR	12	6389	1984	ECGYRBF	X04341	ECORECFA
83.44	gyrB	corr	3752	C	1	3752	1	0	NAR	15	771	1987	ECGYRBF	X04341	ECORECFA
83.46	recF	-	1325	C	3753	1314	1	0	PNAS	81	4622	1984	ECRECF	K02179	ECORECF
83.51	dnaAN,rpmH	-	3278	C	5067	2681	101	0	Gene	28	159	1984	ECDNAAN	J01602	ECODNAAOP
83.54	rnpA	-	1069	C	7648	1	1069	0	Gene	38	85	1985	ECRNPA	M11056	ECORNPA
83.71	tnaA corr	antitermination site	623	T	1	1	17	2011	JBac	164	731	1985	ECTNAAA	M11990	ECOTNAAA
83.75	tnaAC	-	1994	C	18	1	1994	0	JBac	147	787	1981	ECTNAA	K00032	ECOTNAA
84.02	bglBCS &	phoTS,unc,ori,asnA	5270	T	1	5271	587	27230	JBac	169	2579	1987	ECBGLO	M16487	ECOBGLO
84.06	phoTU,pstB	-	3860	C	4684	3860	3651	0	JMB	184	241	1985	ECPHOWTU	X02723	ECOPHOWTU
84.07	phoU &	pstBAC	3730	C	4894	3730	1	0	JBac	161	189	1985	ECPHOS	K01992	ECOPHOS
84.09	phoS	-	1497	C	86624	1302	295	0	JBac	157	772	1984	ECPHOS	K01992	ECOPHOS
84.19	gid,unc &	glmS,phoS corr	14106	C	9633	14526	1	0	BJ	224	799	1984	ECUNC	X01631	ECOUNCC
84.34	uncBI,gidB	-	1150	C	0	0	0	0	MGG	193	64	1984	ECATPP	X01383	ECOATPP
84.45	gidA,oriC	& fvd,asnCA	4012	C	24159	995	4012	0	Gene	24	265	1983	ECORIASN	K00826	ECOORIASN
84.50	rbsBACK	-	5820	T	1	1	5820	5820	Unpub.			1987	ECRBS	M13169	ECORBS
84.60	rrnC	ribosomal operon C	682	T	1	1	664	6048	PNAS	82	5073	1985	ECRGNC	M10739	ECORGNC
84.61	rrsC 16S	RNA analog J01695 in Gb	1541	C	665	1519	3054	0	JMB	148	107	1981	ECRRNBZ	V00348	ECORGNB
84.62	gltU	tRNA glu2, relA1	354	C	2200	1	354	0	JBac	170	1235	1988	M20398	M20398	M20398
84.63	rrlC 23S	RNA analog J01695 in Gb	2903	C	2554	3501	6495	0	JMB	148	107	1981	ECRRNBZ	V00348	ECORGNB
84.66	rrfC,aspT,	trpT J01696 in Gb	500	C	5548	1	500	0	JBCh	254	12725	1979	ECRRNC	V00349	ECORGNX3
84.75	kdsB	-	1308	T	1	1	1308	1308	JBCh	261	15831	1986	ECKDSB	J02614	ECOKDSB
84.81	ilvG	M11651 in Gb	300	T	1	1	43	9898	PNAS	77	1823	1980	ECILVG	V00289	ECOILVGEB
84.84	ilvGEDA	E.coli B	304	B	0	0	0	0	JBac	164	207	1985	ECILVGEB	M11651	ECOILVGEB
84.88	ilvGME	mut M10313 in Gb	2343	C	44	1	317	0	PNAS	78	922	1981	ECILVX	V00290	ECOILVGE
84.93	ilvGMEDA	mut corr BB	7201	C	361	1	6742	0	NAR	15	2137	1987	mut	M32253	ECOILVGME
84.94	ilvYC	length BB	3009	C	7102	213	3009	0	JBCh	261	2441	1986	ECILVYC	M11689	ECOILVYC
85.05	rep,hel	-	2671	T	1	1	2671	2671	NAR	15	465	1987	ECREPHEL	X04794	ECOREPHEL
85.20	trxA	-	657	T	1	1	33	2349	JBac	163	311	1985	ECRHOA	M10424	ECORHOA
85.21	trxA,rho	-	842	T	0	0	0	0	Gene	32	399	1984	ECRHOB	K02845	ECORHOB
85.22	trxA,rho	-	1493	C	34	1	436	0	JBac	166	945	1986	ECTRXA	M12779	ECOTRXA
85.24	rho	-	1800	C	470	1	1880	0	NAR	11	3531	1983	ECRHO	J01673	ECORHO
85.60	tRNA arg &	his leu1 pro	646	T	1	1	646	646	JBac	158	934	1984	ECTGRHLP	K01994	ECOTGRHLP
85.70	hemCDXY &		4260	T	0	4260	1	7573	NAR	16	9871	1988	ECHEMCD	X12614	ECOHEMCD
85.76	cyaA	-	3697	C	4261	387	3699	0	NAR	12	9427	1984	ECCYA01	X01653	ECOCYA
85.83	dapF	-	1308	P	0	1	1010	5870	NAR	16	10367	1988	ECDAPF	X12968	ECODAPF
85.84	orf,xerC	-	2500	F	1011	1	2500	0	JBac	172	6973	1990	-	-	-
85.88	uvrD	corr	2849	C	2501	483	2846	0	JBio	99	1579	1986	ECUVRD02	X04037	ECOUVRD02
86.15	pldA,recQ	-	1319	T	1	1	809	3504	JBio	96	1655	1984	ECPLDA1	X02143	ECOPLDAA
86.17	recQ	-	2695	C	810	1	2695	0	MGG	205	298	1986	ECRECQ	M30198	ECORECQ
86.25	pldB	-	1576	T	1	1	1576	1576	JBio	98	1017	1985	ECPLDB	X03155	ECOPLDB
86.30	metER	E.coli B operator	360	B	0	0	0	0	PNAS	86	85	1989	ECMETER	J04155	ECOMETER
86.31	metEH	operator	285	T	0	285	1	1248	PNAS	86	4407	1989	-	-	-
86.33	metR	-	1013	C	286	50	1013	0	PNAS	87	7076	1990	ECMETR	M37630	-
86.40	udp	including unpub. seq.	2479	T	1	1	2479	2479	NAR	17	6741	1989	ECUDP	X15689	X15689
87.22	fadA	map	1594	T	1	1594	1367	13217	JBCh	265	10424	1990	ECFADA	J05498	ECOFADA
87.23	fadAB		3679	C	228	4950	1368	0	NAR	18	4937	1990	ECFADAB	X52837	-
87.24	pepQ,orf	-	4151	C	3809	1	4041	0	NAR	18	6439	1990	ECPEPQ	X54687	-
87.25	rrnA ribos	operon A J01694 in Gb	426	C	7850	1	376	0	Cell	17	201	1979	ECRNA2	V00330	ECORGNA
87.26	rrsA 16S	RNA analog J01695 in Gb	1541	C	8227	1519	2959	0	JMB	148	107	1981	ECRRNBZ	V00348	ECORGNB
87.31	alaUV &	ileUV tRNAs analogs	545	C	9667	1	438	0	JBCh	254	3264	1979	ECRGNX2	K00763	ECORGNX2
87.32	rrlA 23S	RNA analog J01695 in Gb	2903	C	10105	3501	6403	0	JMB	148	107	1981	ECRRNBZ	V00348	ECORGNB
87.33	intergenic	region rrfA	247	C	13007	129	247	0	Cell	19	393	1980	ECRGNDS3	K00766	ECORGNDS3
87.35	5S RNA	-	120	C	13125	28	120	0	NAR	6	2453	1979	ECRN10	X00414	ECORRAA

87.40	polA	J01663 in Gb	3190	T	0	0	0	4127	JBCh	257	1958	1982	ECPOLA	V00317	ECOPOLA
87.41	polA,spf		1076	F	1	1	4127	0	JBac	152	1211	1982	-	J01663	ECOPOLA
87.70	glnALG	J01618 in Gb	814	T	1	1	659	4972	MGG	190	171	1983	ECGLNA	V00282	ECOGLNACR
87.71	glnALG	= ntrBC	4311	C	660	1	4311	0	NAR	15	2757	1987	ECGLN	X05173	ECOGLN
88.00	rhaSR	new BB	2201	T	1	1	2201	2201	JMB	196	789	1987	ECRHAC	X06058	ECORHAC
88.05	fdhE	-	1200	T	1	1	1200	1200	Unpub.			1989	ECFDHE	X16016	X16016
88.11	sod(nrdB)	-	1053	T	1	1	1053	1053	NAR	14	4577	1986	ECSOD	X03951	ECOSOD
88.14	cpxA	new BB	1841	T	1	1	1841	1841	JMB	203	467	1988	ECCPXA01	M36795	ECOCPXA01
88.26	pfkA,sbp	& cdh,tpiA	3304	T	1	1	3306	4267	EJB	149	363	1985	ECPFKA	X02519	ECOCDHA
88.28	tpi	-	1338	C	3307	1	961	0	MGG	195	314	1984	ECTPI	X00617	ECOTPIA
88.40	glpKF	-	1170	T	1	1	1170	3070	NAR	17	4378	1989	ECGLPF	X15054	ECOGLPF
88.41	glpK	incl. unpubl. material	1545	C	1171	129	2028	0	JBCh	263	135	1988	ECGLYK	M18393	ECOGLYK
88.42	bending	site 6	195	C	0	0	0	0	NAR	15	6827	1987	ECBENT6	X05961	ECOBENT6
88.78	priA,cytR	Ac Nr D00616	2907	T	0	1	2299	3683	PNAS	87	4615	1990	ECPRIAY	M33881	ECOPRIAY
88.80	cytR	-	1384	C	2300	1	1384	0	NAR	14	2215	1986	ECCYTR	X03683	ECOCYTR
88.97	metJBLF	corr BB	729	T	1	1	729	8542	JBCh	259	14282	1984	ECMETJA	M12869	ECOMETJA
89.00	metLB	-	1411	C	730	240	1411	0	JBCh	258	14868	1983	ECMETLB1	K01546	ECOMETLB1
89.01	metL	J01651 in Gb	2433	C	1902	16	2430	0	JBCh	258	3028	1983	ECMETL	V00305	ECOMETL
89.05	metL	direct continuity	240	C	4316	1	240	0	JBCh	258	14868	1983	ECMETLB2	K01547	ECOMETLB2
89.09	metF,katG	direct continuity	1238	C	4555	1	1182	0	NAR	11	6723	1983	ECMETF	V01502	ECOMETF
89.10	katG,rpmE	-	2805	C	5737	1	2805	0	JBac	170	4415	1988	ECKATGA	M21516	ECOKATGA
89.22	ppc	ppc 59, ppc 67	3106	T	1	1	3106	3106	JBio	95	909	1984	ECPPCG	X05903	ECOPPCG
89.30	argE	-	440	T	1	1	330	2201	NAR	10	8031	1982	ECARGOP1	J01587	ECOARGOP1
89.34	argCBH	-	2117	C	331	261	2117	0	Gene	68	275	1988	ECARGBCH	M21446	ECOARGBCH
89.40	mor = oxyR	= momR	1500	T	1	1	1500	1500	JGMi	136	455	1990	ECMOR	M34102	ECOMOR
89.75	btuB,rrnB	& birA,rts,tufB,sec,nus	2220	T	1	1	1511	30222	JBac	161	904	1985	ECBTUB	M10112	ECOBTUB
89.77	rrnB	5'-flanking region corr	1821	C	1512	7	578	0	BBA	739	173	1983	ECRRNB	V00347	ECORGNBP
89.82	rrsB rrlB	&rrfB corr	7258	C	2083	275	7508	0	JMB	148	107	1981	ECRGNB	J01695	ECORGNB
89.89	birA	length BB	2491	C	9316	893	2491	0	Gene	35	321	1985	ECBIRA	M10123	ECOBIRA
89.91	rts	-	1407	C	10914	1133	158	0	Gene	74	555	1989	ECRTSA	M36321	ECORTSA
89.94	tufB	& tRNA thr tyr gly J01717	1973	C	11989	1	1973	0	Gene	12	33	1980	X57091	X57091	ECOTGTUFB
89.99	secE,nusG	-	1380	C	13862	79	1380	0	JBac	172	1621	1990	ECSECE	M30610	ECOSECE
90.01	rpoBC,rplK	J01678 in Gb	3072	C	15163	224	12337	0	PNAS	76	1697	1979	ECRPOBC	V00339	ECORPLRPO
90.02	rpoBC	J01678 in Gb	1089	C	0	0	0	0	Bioo	5	1735	1979	ECRPOBC	V00339	ECORPLRPO
90.05	rpoB	mut J01678 in Gb	4714	C	0	0	0	0	EJB	116	621	1981	ECRPOI	V00340	ECORPLRPO
90.08	rpoC	-	5321	C	0	0	0	0	NAR	10	4035	1982	-	J01678	ECORPLRPO
90.15	pac	penicillin acylase	2593	C	27277	7	2593	0	NAR	14	5713	1986	ECPAC	X04114	ECOPACX
90.16	pac	penicillin acylase	360	C	29864	324	360	0	JMAG	3	36	1985	ECPA2	M12373	ECOPA2
90.17	pga	83 bp diff p.acylase G	3158	C	29900	2836	3158	0	Gene	56	87	1987	ECPGA	M17609	ECOPGA
90.30	hupA,hupB	promoter regulation	288	T	0	0	0	584	JMB	213	27	1990	regul	regul	regul
90.31	hupA	= HU-2 comparison	0	C	1	27	42	0	JBac	170	5751	1988	STHUPA	M22975	-
90.32	HU-2	= hupA	568	C	17	1	568	0	MGG	209	408	1987	ECHU2	X05994	ECOHU2
90.38	purHD,rrnE	& metA,aceBAK	3535	T	1	3535	1	16036	JBCh	264	21239	1989	ECPURH01	J05126	ECOPURHD
90.41	rrnE ribos	operon E J01697 in Gb	410	C	3536	59	372	0	Cell	17	201	1979	ECRNA7	V00335	ECORGNE
90.43	rrsE 16S	RNA analog	1541	C	3908	1519	3054	0	JMB	148	107	1981	ECRGNB	J01695	ECORGNB
90.44	gltV	= tRNA glu2	354	C	5442	1	354	0	JBac	170	1235	1988	M20398	M20398	M20398
90.45	rrlE	23S RNA analog	2903	C	5802	3500	6403	0	JMB	148	107	1981	ECRGNB	J01695	ECORGNB
90.46	rrfE/A	intergenic region	247	C	8699	129	220	0	Cell	19	393	1980	ECRGNDS3	K00766	ECORGNDS3
90.47	rrsE	-	1444	C	8791	1	1197	0	NAR	13	5515	1985	ECRRNE1	X02800	ECORRNE
90.49	metA	-	973	C	9988	1	662	0	NAR	17	2856	1989	ECMETAG	X14501	ECOMETAG
90.51	aceB	publ. also NAR 16 9342	2280	C	10650	1	2280	0	NAR	16	10924	1988	ECACEB	X12431	ECOACEB
90.52	aceA	-	1344	C	12930	163	970	0	NAR	16	5689	1988	ECACEA	X07543	ECOACEA
90.54	aceAK	-	2358	C	13737	1	2358	0	JBac	170	2763	1988	ECIDHKPA	M20714	ECOIDHKPA
90.80	iclR	repressor	1166	T	1	1166	1	4989	JBac	172	2642	1990	ECICLR	M31761	ECOICLR
90.81	metH	100 bp deleted	4098	C	1167	276	4098	0	Gene	87	15	1990	ECMTHM	X16584	X16584
91.21	lysC	-	1587	T	1	1587	1	4154	JBCh	261	1052	1986	ECLYSCA3	M11812	ECOLYSC
91.30	pgi	-	2573	C	1588	7	2573	0	MGG	217	126	1989	ECPGI	X15196	ECOPGI
91.47	xylE	& malFEKB, lamB map	2842	T	0	0	0	10803	JBCh	262	13928	1987	ECXYLE	J02812	ECOXYLE
91.48	xylE	-	984	C	1	2842	1	0	NAR	16	4097	1988	ECMALG3	X06663	ECOMALG3

91.50	malG	-	1103	C	2843	1	1013	0	EMBO	4	2287	1985	ECMALG	X02871	ECOMALG
91.51	malE	mut	144	C	3856	169	6545	0	N	285	78	1980	ECMALB	J01648	ECOMALB
91.55	lamB,malM	J01648 in Gb	2183	C	0	0	0	0	Cell	27	507	1981	ECLAMBA	V00298	ECOMALB
91.58	malK	-	1292	C	0	0	0	0	NAR	10	7449	1982	ECMALB	J01648	ECOMALB
91.60	malE	-	1191	C	0	0	0	0	JBCh	259	10606	1984	ECMALB	J01648	ECOMALB
91.62	malF	K02117 in Gb?	1744	C	0	0	0	0	JBCh	259	10896	1984	ECMALB	J01648	ECOMALB
91.66	malM	corr	1313	C	10233	743	1313	0	JMB	191	303	1986	ECMALM	X04477	ECOMALM
91.78	plsB,dgkA	-	3865	T	1	1	3865	3865	JBCh	258	10856	1983	ECPLSB	K00127	ECOPLSB
91.81	lexA	-	951	T	1	1	951	951	Cell	23	689	1981	-	J01643	ECOLEXA
91.90	dnaB	-	1661	T	1	1	1661	1661	JBCh	259	97	1984	ECDNAB	K01174	ECODNAB
91.95	tyrB	-	1733	T	1	1	1733	1733	BBRC	133	134	1985	ECTYRBA	M12047	ECOTYRBA
92.01	ssb	-	764	T	1	764	1	3850	PNAS	78	4274	1981	ECSSB	J01704	ECOSSB
92.05	uvrA,ssb	-	3205	C	765	120	3205	0	JBCh	261	4895	1986	ECUVRAA	M13495	ECOUVRAA
92.60	fdhF	-	2273	T	1	1	2971	2971	PNAS	83	4650	1986	ECFDHF	M13563	ECOFDHF
92.61	fdhF	-	784	C	0	0	0	0	AcMB	148	44	1987	ECFDHF	M13563	ECOFDHF
93.00	lysU	comp to lysS	1518	T	1	1	1578	1518	NAR	18	305	1990	ECLYSUG	X16542	X16542
93.20	leuV	tRNA leu J01712 in Gb	699	T	1	1	699	699	NAR	9	2121	1981	ECTRNA	V00363	ECOTGLEUV
93.31	phnA-Q	E.coli B alkylphosph.	15611	B	0	0	0	0	JBCh	265	4461	1990	ECPHNAQ	J05260	ECOPHNAQ
93.32	psiD = phn	-	203	T	1	1	203	203	JBac	172	3191	1990	ECALPHOH	M33730	ECOALPHOH
93.33	psiD = phn	-	52	T	1	1	52	52	JBac	172	3191	1990	ECALPHOF	M33728	ECOALPHOF
93.39	melRAB	& aspA	1628	T	1	1	1628	4607	Gene	59	253	1987	ECMELOPA	M18425	ECOMELOPA
93.41	melA	-	1835	C	1629	294	1835	0	NAR	15	2213	1987	ECMELA	X04894	ECOMELA
93.43	melB	-	1575	C	3171	139	1575	0	JBCh	259	4320	1984	ECMELB	K01991	ECOMELB
93.48	fumB,genF	map	3162	T	1	1	3162	3162	JBac	171	3494	1989	ECFUMB	M27058	ECOFUMB
93.65	lysU	-	3034	T	1	1	3034	3034	JBac	172	3237	1990	ECLYSU	M30630	ECOLYSU
93.75	pheU	152 bp id. K00969 in Gb	312	T	1	1	312	312	NAR	11	4379	1983	ECTRNAP	X00912	ECOTGF
93.80	pheU	2.locus for pheU	200	T	1	1	200	200	JMB	212	579	1990	X53235	X53235	-
94.11	aspA	-	2921	T	1	1	2921	3364	BJ	237	547	1986	ECASPAG	X04066	ECOASPAG
94.12	aspA	E.coli W	2901	W	2922	2459	2901	0	NAR	13	2063	1985	ECASPA	X02307	ECOASPAW
94.15	mopBA	= groESL	2267	T	1	1	2267	2267	N	333	330	1988	ECGROESL	X07850	ECOGROESL
94.39	frdD	terminator	105	T	1	1	5482	5482	JBac	164	1100	1985	ECAMPCF2	M11979	ECOAMPCF2
94.42	frdD,ampC	-	1536	C	0	0	0	0	PNAS	78	4897	1981	ECAMPCFR	J01611	ECOAMPCFR
94.43	frdA	-	2640	C	0	0	0	0	EJB	122	479	1982	ECAMPCFR	J01611	ECOAMPCFR
94.44	frdBCD	& ampC J01611 in Gb	956	C	0	0	0	0	PNAS	79	1111	1982	ECFRDB	V00277	ECOAMPCFR
94.45	frdBC	-	842	C	0	0	0	0	EJB	126	211	1982	ECAMPCFR	J01611	ECOAMPCFR
94.70	psd	-	1350	T	1	1	1350	1350	JBCh	263	11516	1988	ECPSD	J03916	-
94.80	miaA	quoted in 519.00	225	P	1	1	225	225	-				-	-	-
95.00	purA	-	2726	T	1	1	2726	2726	JBCh	263	19147	1988	ECPURAA	J04199	ECOPURAA
95.05	glyV	tRNA Gly3	423	T	1	1	423	423	JMB	212	579	1990	X53236	X53236	-
95.50	rpsFR,rplI	-	1979	T	1	1	1979	1979	MGG	204	126	1986	ECRPSFRI	X04022	ECORPSFRI
95.69	cpdB	operator and orf	543	T	1	1	333	2531	MGG	222	161	1990	X54008	X54008	-
95.70	cpdB	-	2198	C	334	1	2198	0	JBac	165	1002	1986	ECCPDB	M13464	ECOCPDB
95.95	fdp	-	1611	C	1	1	1611	1611	NAR	16	8707	1988	ECFBPASE	X12545	ECOFBPASE
96.00	pmbA	-	1682	T	1	1	1682	1682	MoMB	4	1921	1990	ECPMBA	X54152	-
96.50	pyrBI	-	758	T	1	1	1581	2038	JBac	163	991	1985	ECPYRBIB	M10743	ECOPYRBIB
96.55	pyrB	J01670 in Gb	990	C	0	0	0	0	PNAS	80	2462	1983	ECPYRB	V00323	ECOPYRBI
96.57	pyrBI	-	1410	C	1582	964	1410	0	PNAS	81	115	1984	ECPYRBIA	K01472	ECOPYRBIA
96.60	argI	new BB	300	T	1	1	300	1222	EMBO	1	853	1982	ECARGIPR	M24186	ECOARGIPR
96.62	argI	-	1085	C	301	164	1085	0	NAR	11	8509	1983	ECARGI	X00210	ECOARGI
96.76	valS	-	57	T	1	1	3011	3305	JBCh	263	857	1988	ECSYNTGV	J03497	ECOSYNTGV
96.79	valS	-	3291	C	3012	2997	3293	0	NAR	15	9081	1987	ECVALS	X05891	ECOVALS
96.84	xerB	= pepA & urf13	1692	T	1	1	2038	2038	EMBO	8	1623	1989	ECXERB	X15130	ECOXERB
96.85	urf13	-	446	C	0	0	0	0	Unpub.			1989	ECXERB	X15130	ECOXERB
96.95	leuX	-	1101	T	1	1	1100	1101	JMB	177	627	1984	ECTRNLSU	X04174	ECOTRNLSU
97.10	is4	flanking regions new BB	173	T	1	1	173	173	MGG	181	169	1981	IS4ECO	J01733	INS4ECO
97.80	uxuA	-	434	T	1	1	434	434	MGG	202	112	1986	ECUXU1	X03411	ECOUXU1
98.00	fimBE	function	3050	T	1	1	3050	3888	EMBO	5	1389	1986	ECFIMBE	X03923	ECOFIMBE
98.03	fimA	-	1450	C	3051	612	1450	0	EJB	143	395	1984	ECFIMA01	X00981	ECOFIMA
98.10	fimD	10kb map of fimBEACDFGH	2718	T	1	1	2718	4728	MGG	220	334	1990	X51655	X51655	-

98.11	fimFGH		2050	C	2719	41	2050	0	MGG	208	439	1987	ECFIMFGH	X05672	ECOFIMFGH
98.48	mcrBC	AcNr M34235 in paper	2576	T	0	0	0	10258	JBac	172	4888	1990	corr	corr	corr
98.50	mcrB	-	2695	C	1	2695	325	0	JBac	171	1974	1989	ECMCR	M24927	ECOMCR
98.51	hsdS	J01632 in Gb	2528	C	2371	2528	231	0	JMB	166	1	1983	ECHSDK	V00288	ECOHSDSK
98.52	hsdRMS	& mcrBC	5591	C	4667	5591	1	0	JMB	198	159	1987	ECHSDRM	X06545	ECOHSDRM
98.75	tsr	J01718 in Gb	1788	T	1	1	1788	1788	N	301	623	1983	ECTSRX	V00373	ECOTSR
98.83	dnaTC	-	2554	T	1	1	2554	2554	JBCh	263	15083	1988	ECDNATC	J04030	ECODNATC
99.30	rimI	new BB	1423	T	1	1	1423	1423	MGG	209	481	1987	ECRIMI	X06117	ECORIMI
99.44	deoRCAB	-	480	T	1	1	480	2084	EMBO	5	2015	1986	ECDEOP1	X04151	ECODEOP1
99.46	deoCA	X00314 in Gb	204	C	481	114	1718	0	EMBO	3	179	1984	ECDEOCA1	X03224	ECODEOCA
99.47	deoC	J01601 in Gb	780	C	0	0	0	0	EJB	125	561	1982	ECDEOCA1	X03224	ECODEOC
99.48	deoC	J01601 in Gb	807	C	0	0	0	0	EMBO	1	317	1982	ECDEOCA1	X03224	ECODEOC
99.49	deoAB	-	358	T	1	1	358	358	NAR	12	5211	1984	ECDEOAB	X00742	ECODEOAB
99.50	deoD	-	455	T	1	1	455	455	NAR	15	5125	1987	ECDEOD3	X05629	ECODEOD3
99.60	serB	& smp,orf	1161	T	1	1161	28	1933	NAR	13	7025	1985	ECSERB	X03046	ECOSERB
99.61	smp,orf	-	878	C	1135	79	878	0	Gene	82	219	1989	-	X03046	ECOSERB
99.71	trpR	& slt BB length	1041	T	1	1	1041	1041	NAR	8	1551	1980	ECTRPR	V00369	ECOTRPR
99.80	orf 88,ile	-	890	T	1	1	890	890	JBCh	261	9966	1986	ECILER	M14018	ECOILER
99.82	phoM	operon & cet,dye	4658	T	1	1	4658	5461	JBac	168	294	1986	ECPHOM	M13608	ECOPHOM
99.84	dye	-	1468	C	4659	1	804	0	JBCh	260	4236	1985	ECDYE	M10044	ECODYE
101.01	aspS	aspartyl-tRNA synthetas	3866	F	0	1	3866	3866	NAR	18	7109	1990	ECASPS	X53863	ECOASPS
102.01	bending	site 6	188	T	1	1	188	1970	NAR	15	6827	1987	ECBENT5	X05960	ECOBENT5
102.02	bending	site 10	222	T	1	1	222	0	NAR	15	6827	1987	ECBENT10	X05963	ECOBENT10
102.03	bending	site 12	210	T	1	1	210	0	NAR	15	6827	1987	ECBENT12	X05964	ECOBENT12
102.04	bending	site 15	255	T	1	1	255	0	NAR	15	6827	1987	ECBENT15	X05965	ECOBENT15
102.05	bending	site 19	426	T	1	1	426	0	NAR	15	6827	1987	ECBENT19	X05967	ECOBENT19
102.06	bending	site 20	473	T	1	1	473	0	NAR	15	6827	1987	ECBENT20	X05968	ECOBENT20
104.01	dacC	new BB	1505	T	1	1	1505	1505	NAR	16	1617	1988	ECDACC	X06480	ECODACC
107.01	gltP	glutamate carrier prot.	1630	T	1	1	1630	1630	JBac	172	3214	1990	ECGACAR	M32488	ECOGACAR
107.02	greA	libr.=p9522; cl=PJS13	1744	T	1	1	1744	1744	NAR	18	6443	1990	ECGREAG	X54718	-
114.01	nlpA	-	1689	T	1	1	1689	1689	JBCh	261	2284	1986	ECLP28	M12163	ECOLP28
116.01	appII,pepP	aminopeptidase P	1850	T	1	1	1850	1850	JBio	105	412	1989	ECAPP2	D00398	ECOAPP2
116.02	ppa	pyrophosphatase	1195	T	1	1	1195	1195	JBac	170	5901	1988	M23550	M23550	M23550
116.07	heat shock	promoter 10,92 BB ?	96	T	1	1	96	96	PNAS	82	2679	1985	ECC625	M10419	ECOC625
116.08	pantothen	permease gene SEE 71.10	1904	T	1	1	1904	1904	Unpub.			1990	ECPANF	M30953	ECOPANA
116.09	psiH	-	37	T	1	1	37	37	JBac	172	3191	1990	ECALPHON	M33736	ECOALPHON
116.10	psiH	-	64	T	1	1	64	64	JBac	172	3191	1990	ECALPHOV	M33744	ECOALPHOV
116.11	psiK	-	86	T	1	1	86	86	JBac	172	3191	1990	ECALPHOP	M33738	ECOALPHOP
116.12	psiJ	-	57	T	1	1	57	57	JBac	172	3191	1990	ECALPHOS	M33741	ECOALPHOS
116.13	psiJ	-	29	T	1	1	29	29	JBac	172	3191	1990	ECALPHOW	M33745	ECOALPHOW
116.14	psiR	-	37	T	1	1	37	37	JBac	172	3191	1990	ECALPHOL	M33734	ECOALPHOL
117.01	queuosin	biosythesis, tRNA modif	3013	T	1	1	3013	3013	Unpub			1990	ECQBIO	M37702	-
119.02	srmB	-	1967	T	1	1	1967	1967	N	336	496	1988	-	-	-
119.04	sdaA	-	2610	T	1	1	2610	2610	JBac	171	5095	1989	ECSDAA	M28695	ECOSDAA
120.01	thioredoxi	thioredoxin	453	T	1	1	453	453	BiRp	4	917	1984	M26133	M26133	ECOTRX
124.01	xylose	gene for xylose-uptake	363	T	1	1	363	363	NAR	14	7115	1986	ECXYLUP1	X04387	ECOXYLUP1
200.01	is1	6 commun copies	768	I	1	1	768	4608	MGG	169	213	1979	IS1ECLAC	J01729	INS1ECLAC
200.02	is2,is1	7 copies M18426 in Gb	1331	I	1	1	1331	9317	Gene	59	291	1987	ECGALI	V00279	ECOINS2K
200.03	is3	3 commun copies	1258	I	1	1	1258	3774	NAR	13	2127	1985	ECIS3	X02311	INS3
200.04	is4	1 commun copy	1426	I	1	1	1426	1426	MGG	181	169	1981	IS4ECO	J01733	INS4ECO
200.05	is5	length MK	1195	I	1	1	1195	0	N	297	159	1982	IS5LAM	J01735	INS5LAM
200.10	is10	IS10-R	160	I	1	1	160	160	JBac	164	556	1985	ECOOUT2	K03315	ECOTRNOU2
200.30	is30	3 commun copies	1221	I	1	1	1221	3663	EMBO	3	2145	1984	ECIS30	X00792	INS30ECO
201.50	is150	1 commun copy	1443	I	1	1	1443	1443	NAR	16	6789	1988	ECIS150	X07037	INS150CG
201.86	is186	length MK	1336	I	1	1	1341	1341	FEBS	192	47	1985	IS186	X03123	INS186ECB
304.03	tRNA asp	& trp	241	T	1	1	382	382	NAR	10	7153	1982	ECTGDW	K01858	ECOTGDWS
313.04	leu tRNA1	-	146	T	1	1	146	146	Cell	30	855	1982	ECTGLGKP	K01687	ECOTGLGKP
313.06	leu tRNA3	CTC single gene	300	T	1	1	300	300	Gene	81	193	1989	ECTGL3A	M29082	ECOTGL3A
316.04	pheW	-	492	T	1	1	492	492	NAR	14	5937	1986	ECPHEW	X04126	ECOPHEW
317.02	pro tRNA	-	1085	T	1	1	1085	1085	NAR	13	3213	1985	ECTRNPRO	X02434	ECOTGPRO
333.00	selC tRNA	UCA seleno-serine	95	T	1	1	95	95	NAR	17	7159	1989	ECSELC	X15993	X15993
401.00	6S RNA	-	184	T	1	1	184	184	NNB	229	147	1971	ECRRN6S	X01238	ECORRN6S
402.00	spot 42RNA	-	109	T	1	1	109	109	JMB	131	573	1979	EC42RNA	X01895	ECO42RNA