Appendixes

Appendix A
Epidemiology of Mutations for Cystic Fibrosis

The differential distribution of mutations causing cystic fibrosis (CF) has clear implications for carrier screening. Besides DF508, which accounts for about 70 percent of CF chromosomes in Caucasians of Northern and Central European descent, more than 170 mutations have been identified, and the number increases steadily. The vast majority of these are rare mutations present in only a few individuals or families.

Not only are CF mutations heterogeneous, they are distributed with varying frequencies among populations according to geographic, ethnic, and racial distinctions; regional differences within countries also exist. In Europe, DF508 occurs along a decreasing gradient from north to south (figure A-l); other mutations also occur differentially among racial and ethnic groups. Denmark has the most homogeneous CF mutation population in Northern Europe, with DF508 accounting for about 88 percent of mutations.

International studies continue to document the frequency distribution of DF508 and other mutations (table A-l). Results are coordinated through international collaborative efforts, including the Cystic Fibrosis Genetic Analysis Consortium, the European Working Group on Cystic Fibrosis, and the European Concerted Action on Cystic Fibrosis.

In the United States and Canada, diverse heritages are reflected genetically (table A-2): The distribution of DF508, as an aggregate, is an average of European values. For example, in North American populations from mixed European descent, DF508 accounts for 68 to 76 percent of CF mutations, while the combined European data also average 68 percent (table A-3). Preliminary studies of some distinct ethnic groups in North America have similar profiles to areas of origin in Europe.

By studying markers surrounding the CF locus, researchers believe that the DF508 deletion most likely resulted from a single mutational event that was subsequently passed along by invading peoples. Some explanations of the distribution patterns of DF508 attempt to correlate waves of invasions with distribution of the mutation, although this remains speculation.

Figure A-l—Occurrence of DF508 in Europe

SOURCE: European Working Group on Cystic Fibrosis Genetics, "Gradient of Distribution in Europe of the Major CF Mutation and of Its Associated Haplotype," *Human Genetics 85:436-445, 1990.*

Table A-I—Distribution of DF508 in Europe

Country	Frequency of DF508 (percent of cystic fibrosis chromosomes)	Study size (number of cystic fibrosis chromosomes)	Source
Albania	75	92	G. Novelli, F. Sangiuolo, V. Mokini, et al., "The Cystic Fibrosis ΔF508 Mutation in the Albanian Population," *American Journal of Human Genetics* 50:875-876, 1992.
Belglum	59.5	116	H. Cuppens, E. Legius, P. Cabello, et al., "Association Between XV2c/CS7/KM19/D9 Haplotypes and the ΔF508 Mutation," *Human Genetics* 85:402-403, 1990.
	65 67 77	124 60 150	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
	76	146	M. Bonduelle, W. Lissens, A. Malfroot, et al., "The Deletion F508 is the Major Gene Mutation in a Representative Belgian Cystic Fibrosis Population," *Human Genetics* 85:395-396, 1990.
	78	214	P. Cocheaux, R. Van Geffel, D. Baran, et al., "Prevalence of the ΔF508 Deletion of the Cystic Fibrosis Gene in Belgian Patients," *Human Genetics* 85:400, 1990.
IAntwerp	80	71	J.G. Wauters, J. Hendrickx, P. Coucke, et al., "Frequency of the Phenylalanine Deletion (ΔF508) in the CF Gene of Belgian Cystic Fibrosis Patients," *Clinical Genetics* 39:89-92, 1991.
Bulgaria	56	96	L. Kalaydjieva, J. Antov, J. Bronzova, et al., "Molecular Data on Cystic Fibrosis Data in Bulgaria," *Human Genetics* 85:412-413, 1990.
	58	110	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Czech and Slovak Federal Republic	68	354	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Bohemia/Moravia	67	NA	M. Macek, V. Vavrová, I. Böhm, et al., "Frequency of the ΔF508 Mutation and Flanking Marker Haplotypes at the CF Locus From 167 Czech Families," *Human Genetics* 85:417-418, 1990.
Slovakia	63	46	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Denmark	87	304	M. Schwartz, H.K. Johansen, C. Koch, et al., "Frequency of the ΔF508 Mutation on Cystic Fibrosis Chromosomes in Denmark," *Human Genetics* 85:427-428, 1990.
	88	423	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Finland	45	40	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
	45	40	J. Kere, E. Savilahti, R. Norio, et al., "Cystic Fibrosis Mutation ΔF508 in Finland: Other Mutations Predominate," *Human Genetics* 85:413-415, 1990.
France	66 73 79	268 271 332	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
	67	248	J.C. Chomel, A. Haliassos, L. Tesson, et al., "Frequency of the Major CF Mutation in French CF Patients," *Human Genetics* 85:397-398, 1990.
	72.5	258	B. Simon-Bouy, E. Mornet, J.L. Serre, et al., "The Cystic Fibrosis ΔF508 Mutation in the French Population," *Human Genetics* 85:431-432, 1990.

Table A-l—Distribution of DF508 in Europe-Continued

Country	Frequency of DF508 (percent of cystic fibrosis chromosomes)	Study size (number of cystic fibrosis chromosomes)	Source
	75	422	M. Vidaud, C. Ferec, O. Attree, et al., "Frequency of the Cystic Fibrosis ΔF508 Mutation in a Large Sample of the French Population," *Human Genetics* 85:434-435, 1990.
Britanny (Celtic)	81	224	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Lyon	74	230	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Paris	70	102	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Southern	64	98	M. Claustres, M. Desgeorges, H. Kjellberg, et al., "Cystic Fibrosis Typing With DNA Probes and Screening for ΔF508 Deletion in Families From Southern France," *Human Genetics* 85:398-399, 1990.
Germany			
Berlin	70	290	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
East (former)	60	388	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
	60	518	Ch. Coutelle, K. Grade, R. Bruckner, et al., "CF DNA-Diagnosis and Gene Mutation Analysis: Data From East Germany," *Pathologie Biologie* 6:585-586, 1991.
	62	314	K. Grade, K. Will, R. Szibor, et al., "First Analysis of the F508 Deletion in Cystic Fibrosis Patients From the GDR," *Human Genetics* 85:406-408, 1990.
West (former)	77 77	244 234	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
	77	400	A. Reis, S. Bremer, M. Schlösser, et al., "Distribution Patterns of the ΔF508 Mutation in the CFTR Gene on CF-Linked Marker Haplotypes in the German Population," *Human Genetics* 85:421-422, 1990.
	80	186	C. Aulehla-Scholz, R. Kaiser, J. Weber, et al., "The Frequency of the ΔF508 Deletion in CF Chromosomes of Different Ethnic Origin," *Human Genetics* 85:392-393, 1990.
Greece	54	194	A. Balassopoulou, D. Loukopoulos, P. Kollia, et al., "Cystic Fibrosis in Greece: Typing With DNA Probes and Identification of the Common Molecular Defect," *Human Genetics* 85:393-394, 1990.
	54	194	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Hungary	64	66	M. Nemeti, E. Louie, Z. Papp, et al., "Molecular Analysis of Cystic Fibrosis in the Hungarian Population," *Human Genetics* 87:511-512, 1991.
Ireland, Republic of	76	120	The Cystic Fibrosis Genetic Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
	76	88	M.A. De Arce, D. Mulherin, P. McWilliam, et al., "Frequency of Deletion 508 Among Irish Cystic Fibrosis Patients," *Human Genetics 403-404, 1990.*

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Table A-l—Distribution of DF508 in Europe-Continued

Country	Frequency of DF508 (percent of cystic fibrosis chromosomes)	Study size (number of cystic fibrosis chromosomes)	Source
Israel	32	113	1. Lerer, S. Cohen, M. Chemke, et al., "The Frequency of the DF508 Mutation on Cystic Fibrosis Chrornmomes in Israeli Families: Correlation to CF Jewish Haplotypes in Jewish Communities and Arabs," Human *Genetics* 85:416-417, 1990.
Arab	22	23	
Ashkenazic Jewish	32	40	
Non-Ashkenazic Jewish	38	29	
Arab	25	40	T. Shosani, A. Augarten, E. Gazit, et al., "Association of a Nonsense Mutation (W1282X), the Most Common Mutation in the Ashkenazi Jewish Cystic Fibrosis Patients in Israel, With Presentation of Severe Disease," *American Journal of Human Genetics 50:222-228, 1992.*
Ashkenazic Jewish	23	95	
Sephardic Jewish	35	51	
Unclassified	25	8	
Jewish (mixed)	*34*	127	*1.* Lerer, M. Sagi, G.R. Cutting, et al., "Cystic Fibrosis Mutations DF508 and G542X in Jewish Patients," *Journal of Medical Genetics 29:131-133, 1992.*
Ashkenazic Jewish	30	84	
Non-Ashkenazic Jewish	42	43	
Italy	43	54	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
	47	122	
	55	284	
	43	348	X. Estivill, M. Chillón, T. Casals, et al., "ΔF508 Gene Deletion in Cystic Fibrosis in Southern Europe," *Lancet* II:1404-1405, 1989.
	50	35	G. Restagno, S. Garnerone, C. Gennaro, et al., "ΔF508 Deletion in Cystic Fibrosis in Italian Families," *Human Genetics* 85:422-423, 1990.
	53	350	L. Cremonesi, L. Ruocco, M. Seia, et al., "Frequency of the ΔF508 Mutation in a Sample of 175 Italian Cystic Fibrosis Patients," *Human Genetics* 85:400-402, 1990.
	53	624	M. Devoto, P. Ronchetto, P. Fanen, et al., "Screening for Non-DeltaF508 Mutations in Five Exons of the Cystic Fibrosis Transmembrane Conductance Regulator (CFTR) Gene in Italy," *American Journal of Human Genetics* 48:1127-1132, 1991.
Campania	*54*	102	G. Sebastio, O. Castiglione, B. Incerti, et al., "The ΔF508 Mutation in Cystic Fibrosis Patients of Southern Italy," *Human Genetics* 85:430-431, 1990.
Central/ Southern	45	350	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Northern	40	218	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Rome/Verona	42	424	G. Novelli, P. Gasparini, A. Savoia, et al., "Polymorphic DNA Haplotypes and ΔF508 Deletion in 212 Italian CF Families," *Human Genetics* 85:420-421, 1990.
Sardinia	57	42	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Netherlands	75	166	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
	79	235	
	76	152	H. Scheffer, D.J. Bruinvels, G.J. te Meerman, et al., "Frequency of the ΔF508 Mutation and XV2c, KM19 Haplotypes in Cystic Fibrosis Families From The Netherlands: Haplotypes Without ΔF508 Still in Disequilibrium," *Human Genetics* 85:425-427, 1990.
	77	190	D.J.J. Halley, H.J. Veeze, and L.A. Sandkuyl, "The Mutation ΔF508 on Dutch Cystic Fibrosis Chrornmomes: Frequency and Relation to Patients' Age at Diagnosis," *Human Genetics 85:407-408, 1990.*

Table A-I—Distribution of DF508 in Europe-Continued

Country	Frequency of DF508 (percent of cystic fibrosis chromosomes)	Study size (number of cystic fibrosis chromosomes)	Source
Poland	55	22	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Portugal	52	82	A. Duarte, C. Barreto, L. Marques-Pinto, et al., "Cystic Fibrosis in the Portuguese Population: Haplotype Distribution and Molecular Pathology," *Human Genetics* 85:404-405, 1990.
	54	84	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Spain	49	388	X. Estivill, M. Chillón, T. Casals, et al., "ΔF508 Gene Deletion in Cystic Fibrosis in Southern Europe," *Lancet* II:1404-1405, 1989.
	50	388	M. Chillón, V. Nunes, T. Casals, et al., "Distribution of the ΔF508 Mutation in 194 Spanish Cystic Fibrosis Families," *Human Genetics* 85:396-397, 1990.
	51 65	466 142	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Basque country Basque Mixed Basque	 87 58	 30 60	T. Casals, C. Vázquez, C. Lázaro, et al., "Cystic Fibrosis in the Basque Country: High Frequency of Mutation ΔF508 in Patients of Basque Origin," *American Journal of Human Genetics* 50:404-410, 1992.
Central/ Southern	61	120	B. Peral, C. Hernández-Chico, J.L. San Millán, et al., "The ΔF508 Mutation and RFLP-linked Loci in Spanish Cystic Fibrosis Families," *Human Genetics* 87:516-517, 1991.
Continental Balearic islands Baiearic Islands	66 58 58	45 13 13	B. Jaume-Roig, B. Simon-Bouy, A. Taillandier, et al., "Genotyping of the Spanish Cystic Fibrosis Population at the ΔF508 Mutation Site and RFLP Linked Loci," *Human Genetics* 85:410-411, 1990.
Switzerland	69	334	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Turkey	27	30	J. Hundrieser, S. Bremer, F. Peinemann, et al., "Frequency of the ΔF508 Mutation in the CFTR Gene in Turkish Cystic Fibrosis Patients," *Human Genetics* 85:409-410, 1990.
Turkish population in Germany	27	30	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Union of Soviet Socialist Republics (former)	36	25	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
	49	58	P. Ronchetto, M. Devoto, A. Puliti, et al., "Preliminary Results on the Frequency of the ΔF508 Mutation in Cystic Fibrosis Patients From the USSR," *Human Genetics* 85:423-425, 1990.
Moscow/Odessa	45	58	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
United Kingdom	77	39	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.

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Table A-I—Distribution of DF508 in Europe-Continued

Country	Frequency of DF508 (percent of cystic fibrosis chromosomes)	Study size (number of cystic fibrosis chromosomes)	Source
England	70	210	The Cystic Fibrosis Genetic Analysis Consortium, "worldwide Survey of the DF508 Mutation-Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics 47:354-359, 1990.*
	70	150	
	75	180	
	75	186	
	79	252	
	80	600	
	70	108	G. Santis, L. Osborne, R. Knight, et al., "Cystic Fibrosis Haplotype Association and the ΔF508 Mutation in Adult British CF Patients," *Human Genetics* 85:424-425, 1990.
	71.5	144	A. Harris, F. Beards, and C. Mathew, "Mutation Analysis at the Cystic Fibrosis Locus in the British Population," *Human Genetics* 85:408-409, 1990.
	78.5	214	M.J. Schwarz, M. Super, C. Wallis, et al., "ΔF508 Testing of the DNA Bank of the Royal Manchester Children's Hospital," *Human Genetics* 85:428-430, 1990.
	80	195	E.K. Watson, E.S. Mayall, L. Simova, et al., "The Incidence of ΔF508 CF Mutation, and Associated Haplotypes, in a Sample of English CF Families," *Human Genetics* 85:435-436, 1990.
Northern Ireland	54	204	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Scotland	71	361	A.E. Shrimpton, I. McIntosh, and D.J.H. Brock, "The Incidence of Different Cystic Fibrosis Mutations in the Scottish Population: Effects on Prenatal Diagnosis and Genetic Counselling," *Journal of Medical Genetics* 28:317-321, 1991.
	74	238	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
	74	215	I. McIntosh, A. Curtis, and M.-L. Lorenzo, "The Haplotype Distribution of the ΔF508 Mutation in Cystic Fibrosis Families in Scotland," *Human Genetics* 85:419-420, 1990.
Yugoslavia (former)	92	12	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Macedonia	39.5	38	L. Simova, C. Williams, G.D. Efremov, et al., "ΔF508 Frequency and Associated Haplotypes Near the Cystic Fibrosis Locus in the Yugoslav Population," *Human Genetics* 85:432-433, 1990.
Slovenia	26	34	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.
Southern (mixed population)	38	39	The Cystic Fibrosis Genetic Analysis Consortium, "Worldwide Survey of the ΔF508 Mutation—Report From the Cystic Fibrosis Genetic Analysis Consortium," *American Journal of Human Genetics* 47:354-359, 1990.

NA=Not available

SOURCE: Office of Technology Assessment, 1992.

Table A-2—Distribution of DF508 in North America

Population	Frequency of DF508 (percent)
Caucasian, mixed European ancestry.	68 to 76
Hispanic.	71
Louisiana French Acadian.	69
French Canadian.	54 to 69
Ashkenazic Jewish. , ...	26 to 50
African American.	37
Hutterite.	35

SOURCE: Office of Technology Assessment, 1992.

Table A-3-Frequencies of Common Cystic Fibrosis Mutations

Mutation	European frequency[a] (aggregate data; percent)	North American frequency (percent Caucasian population)
ΔF508.	68.0	68.0 to 76.0
G551D.	4.4	3.2[b]
G542X.	6.0	2.7[b] to 4.6[c]
R553X.	3.4	0.8[c] to 1.4[b]
N1303K.	4.2	1.4[b]
W1282X.	NA	0.01[d] to 0.9[e]
R560T.	6.0	0.01[f] to 0.6[b,e]
Δ1507.	1.0	0.01[f] to 0.6[b,e]
S549N.	0.7	0.01[f]

[a] *Newsletter of the European Concerted Action on Cystic Fibrosis*, R. Williamson (ed.), vol. 3, 1990.
[b] A.L. Beaudet, Howard Hughes Medical Institute, Baylor College of Medicine, Houston, TX, personal communication, 1991.
[c] GeneScreen, "Two Years Later . . . Seven Mutations in the CF Panel," *In the Genome*, Addendum, summer 1991.
[d] S. Curristin, B.J. Rosenstein, and G.R. Cutting, "North American Caucasian and African-American Cystic Fibrosis (CF) Patients Have Different Distributions of CF Gene Mutations," *American Journal of Human Genetics* 49 (Supp.): 490, 1991.
[e] P. Kristidis, D. Bozon, M. Corey, et al., "Genetic Determination of Exocrine Pancreatic Function in Cystic Fibrosis, " *American Journal of Human Genetics* 50: 1178-1184, 1992.
[f] IG Laboratories, Inc., "CF/12 Mutation Test for Cystic Fibrosis," brochure, fall 1991.

NA=Not available.

SOURCE: Office of Technology Assessment, 1992.