

Supplementary Information for

Fragmentation landscape of cell-free DNA revealed by deconvolutional analysis of end motifs

Ze Zhou^{a,b,c,1}, Mary-Jane L. Ma^{a,b,c,1}, Rebecca W. Y. Chan^{a,b,c}, W. K. Jacky Lam^{a,b,c,d}, Wenlei Peng^{a,b,c}, Wanxia Gai^{a,b,c}, Xi Hu^{a,b,c}, Spencer C. Ding^{a,b,c}, Lu Ji^{a,b,c}, Qing Zhou^{a,b,c}, Peter P. H. Cheung^{b,c}, Stephanie C. Y. Yu^{a,b,c}, Jeremy Y. C. Teoh^e, Cheuk-Chun Szeto^f, John Wong^e, Vincent W. S. Wong^f, Grace L. H. Wong^g, Stephen L. Chan^{d,h}, Edwin P. Hui^{d,h}, Brigette B. Y. Ma^{d,h}, Anthony T. C. Chan^{d,h}, Rossa W. K. Chiu^{a,b,c}, K. C. Allen Chan^{a,b,c,d}, Y. M. Dennis Lo^{a,b,c,d,*}, and Peiyong Jiang^{a,b,c,d,*}

Y.M. Dennis Lo

Email: loym@cuhk.edu.hk.

Peiyong Jiang

Email: jiangpeiyong@cuhk.edu.hk.

This PDF file includes:

1. Figure S1 to S5
2. Table S1 to S4

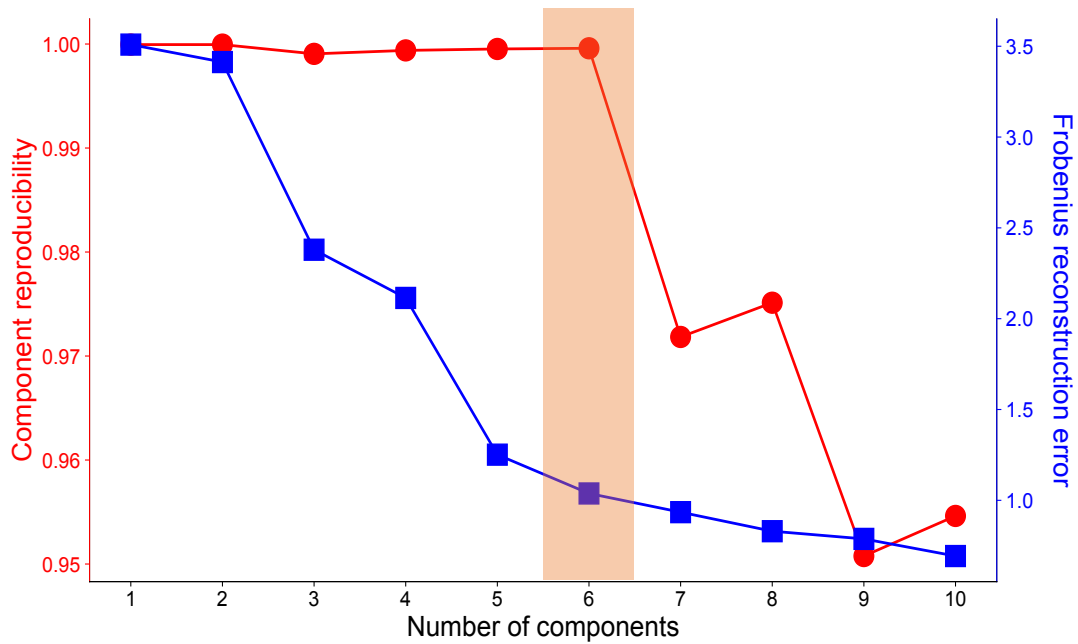


Fig. S1. The assessment of the reproducibility and the error according to the different number of F-profiles used in non-negative matrix factorization based on the 5-fold cross validation. The reproducibility was measured by the averaged cosine similarity between every fold in terms of F-profiles. The error was defined as the absolute difference between the observed end-motif profiles and the deduced end-motif profiles based on F-profiles.

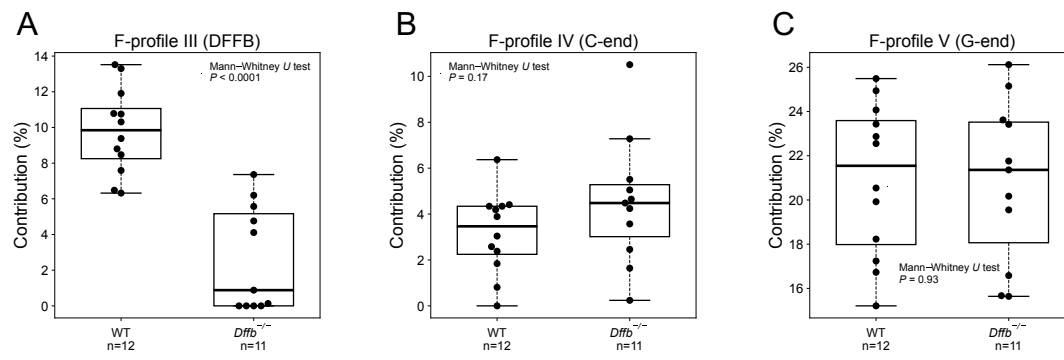


Fig. S2. Boxplots of F-profiles (A) III, (B) IV, and (C) V contributions in plasma cfDNA between WT and $Dffb^{-/-}$ mice.

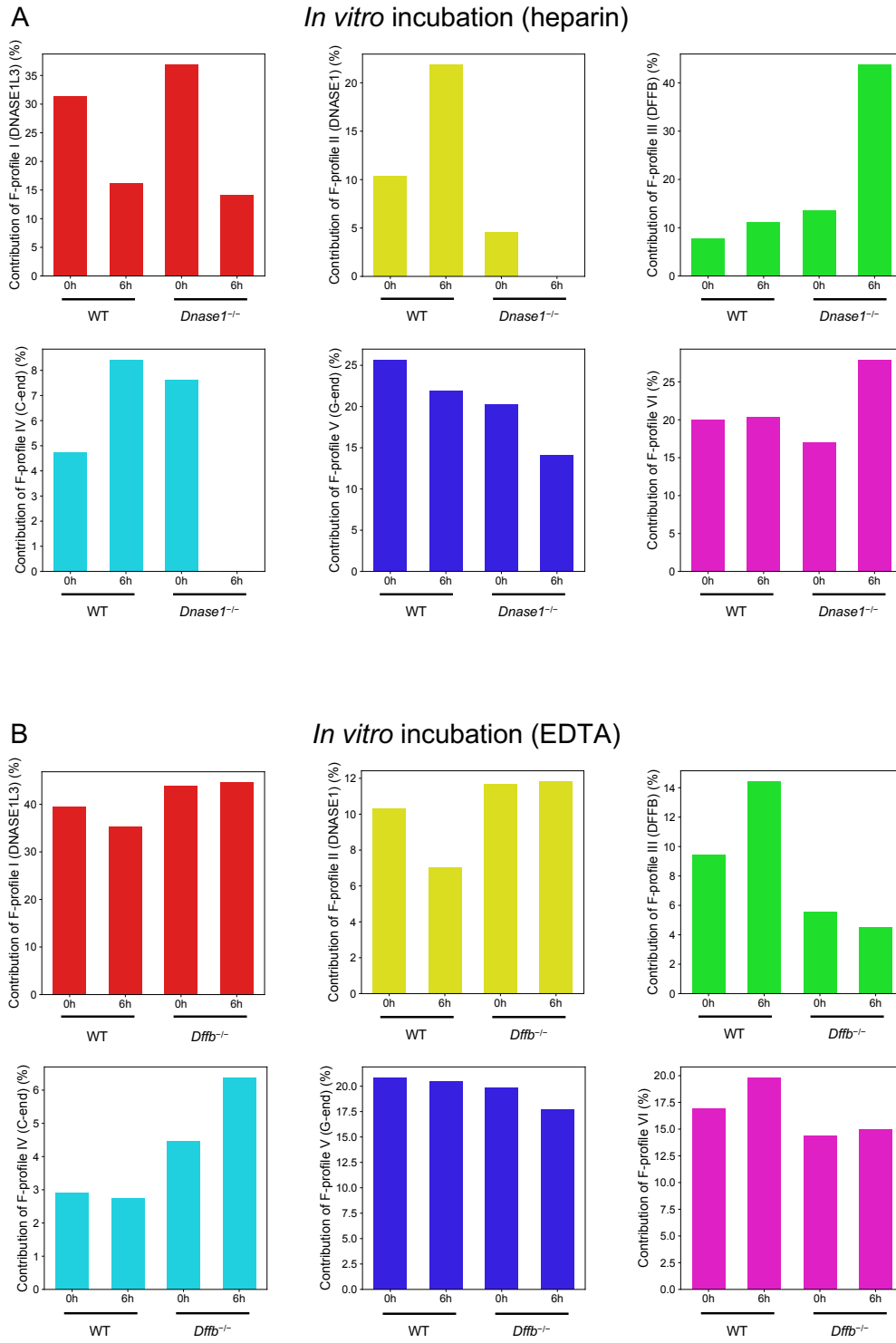


Fig. S3. The F-profiles levels in mouse plasma cfDNA samples that were subjected to whole blood *in vitro* incubation. (A) F-profile levels in WT and *Dnase1*^{-/-} mice before and after 6h incubation in heparin-contained tube. (B) F-profile levels in plasma cfDNA of WT and *Dffb*^{-/-} mice before incubation and after 6h incubation in EDTA-contained tube.

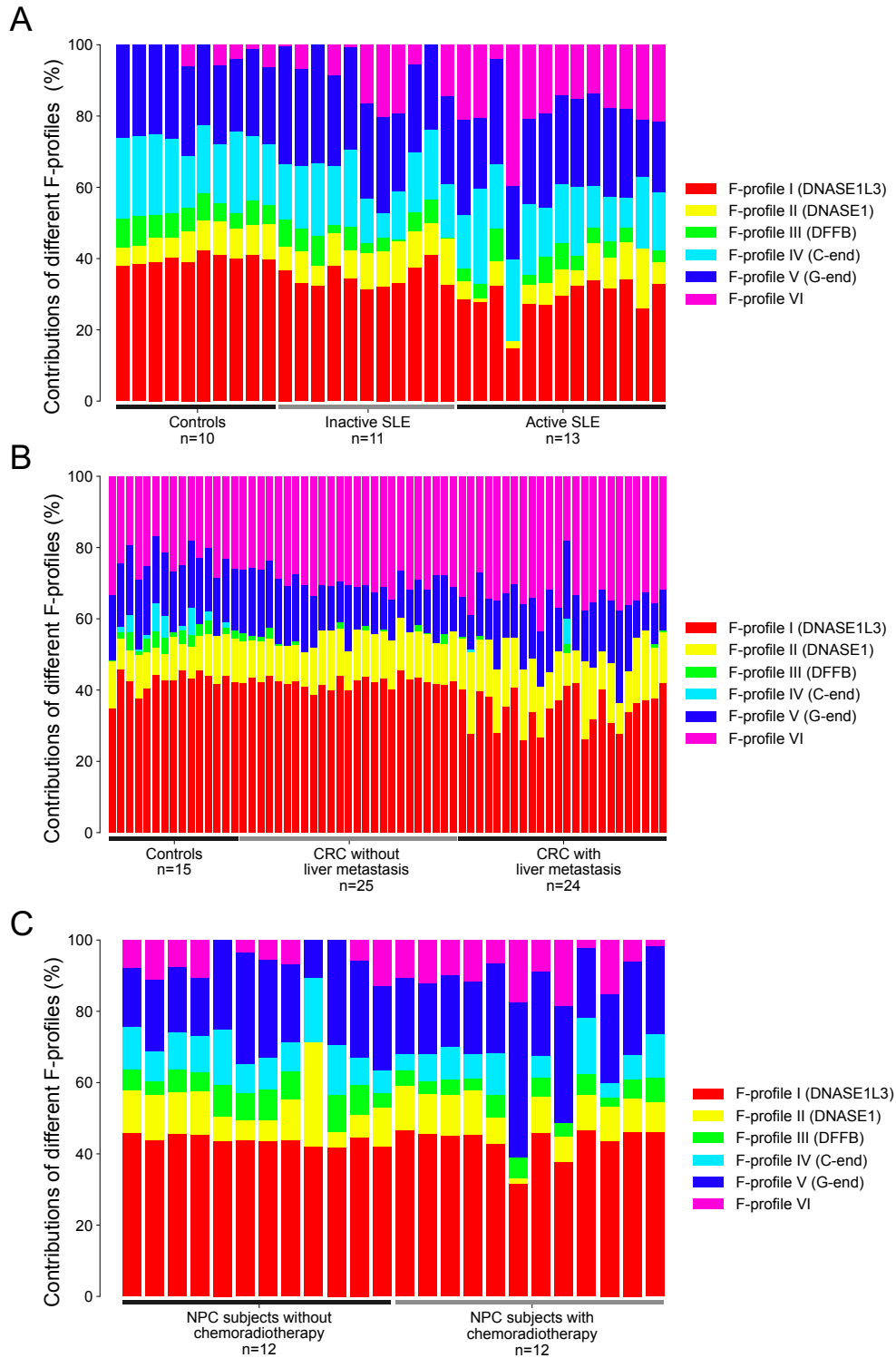


Fig. S4. The F-profiles levels in human diseased subjects. (A) F-profile levels in patients with and without sporadic (systemic lupus erythematosus) SLE. (B) F-profile levels in patients with and without colorectal cancer (C) F-profile levels in patients with nasopharyngeal carcinoma (NPC) in with and without chemoradiotherapy.

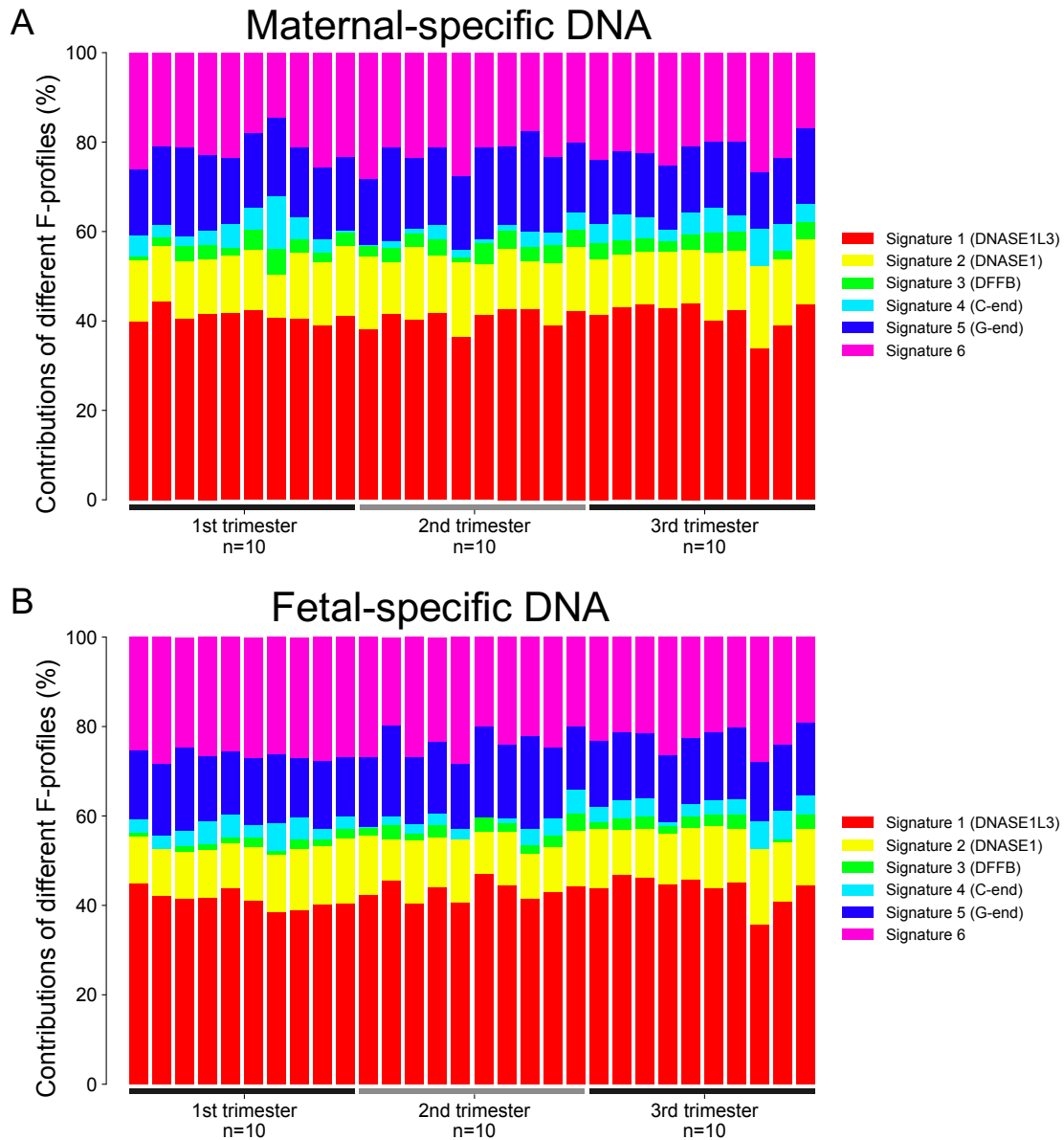


Fig. S5. The F-profiles levels in the (A) maternal- and (B) fetal-specific DNA in plasma cfDNA of pregnant women across first, second and third trimesters.

Table S1. 256 4-mer end motif frequencies of six F-profiles.

4-mer end motif	F-profile I	F-profile II	F-profile III	F-profile IV	F-profile V	F-profile VI
AAAA	0.0036	0.0020	0.0000	0.0004	0.0023	0.0037
AAAC	0.0025	0.0010	0.0026	0.0017	0.0039	0.0038
AAAG	0.0042	0.0014	0.0000	0.0024	0.0044	0.0032
AAAT	0.0031	0.0002	0.0046	0.0000	0.0013	0.0045
AACA	0.0023	0.0023	0.0108	0.0000	0.0029	0.0045
AACC	0.0018	0.0023	0.0131	0.0013	0.0028	0.0048
AACG	0.0009	0.0021	0.0142	0.0028	0.0027	0.0048
AACT	0.0005	0.0002	0.0212	0.0000	0.0000	0.0070
AAGA	0.0025	0.0024	0.0000	0.0023	0.0028	0.0028
AAGC	0.0013	0.0019	0.0000	0.0052	0.0021	0.0032
AAGG	0.0023	0.0022	0.0000	0.0046	0.0032	0.0026
AAGT	0.0012	0.0014	0.0003	0.0013	0.0016	0.0030
ATAA	0.0020	0.0010	0.0047	0.0000	0.0013	0.0030
AATC	0.0003	0.0008	0.0071	0.0008	0.0020	0.0042
AATG	0.0016	0.0012	0.0036	0.0005	0.0030	0.0028
AATT	0.0005	0.0000	0.0126	0.0000	0.0000	0.0057
ACAA	0.0048	0.0021	0.0018	0.0000	0.0045	0.0037
ACAC	0.0020	0.0000	0.0035	0.0011	0.0067	0.0022
ACAG	0.0040	0.0015	0.0010	0.0010	0.0069	0.0030
ACAT	0.0032	0.0003	0.0095	0.0000	0.0037	0.0049
ACCA	0.0029	0.0015	0.0118	0.0000	0.0117	0.0044
ACCC	0.0043	0.0023	0.0205	0.0020	0.0050	0.0062
ACCG	0.0015	0.0023	0.0147	0.0065	0.0095	0.0044
ACCT	0.0032	0.0000	0.0354	0.0000	0.0017	0.0099
ACGA	0.0011	0.0008	0.0000	0.0034	0.0024	0.0028
ACGC	0.0001	0.0000	0.0015	0.0064	0.0012	0.0030
ACGG	0.0006	0.0004	0.0000	0.0052	0.0019	0.0027
ACGT	0.0006	0.0002	0.0019	0.0025	0.0025	0.0029
ACTA	0.0022	0.0000	0.0091	0.0000	0.0061	0.0039
ACTC	0.0023	0.0010	0.0142	0.0004	0.0027	0.0059
ACTG	0.0031	0.0007	0.0084	0.0002	0.0061	0.0041
ACTT	0.0017	0.0000	0.0262	0.0000	0.0000	0.0085
AGAA	0.0033	0.0027	0.0037	0.0013	0.0041	0.0039
AGAC	0.0023	0.0014	0.0033	0.0027	0.0044	0.0034
AGAG	0.0039	0.0015	0.0006	0.0037	0.0065	0.0028
AGAT	0.0025	0.0016	0.0083	0.0002	0.0032	0.0044
AGCA	0.0008	0.0023	0.0094	0.0024	0.0083	0.0029
AGCC	0.0011	0.0028	0.0137	0.0045	0.0049	0.0044

AGCG	0.0000	0.0027	0.0114	0.0104	0.0078	0.0026
AGCT	0.0000	0.0002	0.0243	0.0013	0.0031	0.0070
AGGA	0.0021	0.0028	0.0000	0.0040	0.0043	0.0023
AGGC	0.0010	0.0034	0.0000	0.0066	0.0045	0.0027
AGGG	0.0021	0.0031	0.0000	0.0055	0.0055	0.0019
AGGT	0.0009	0.0032	0.0004	0.0024	0.0039	0.0025
AGTA	0.0024	0.0016	0.0064	0.0000	0.0052	0.0032
AGTC	0.0013	0.0024	0.0092	0.0019	0.0054	0.0046
AGTG	0.0020	0.0023	0.0038	0.0017	0.0082	0.0023
AGTT	0.0012	0.0014	0.0186	0.0000	0.0014	0.0068
ATAA	0.0019	0.0001	0.0000	0.0005	0.0015	0.0029
ATAC	0.0006	0.0000	0.0008	0.0011	0.0023	0.0025
ATAG	0.0010	0.0000	0.0000	0.0020	0.0026	0.0023
ATAT	0.0014	0.0000	0.0028	0.0003	0.0011	0.0027
ATCA	0.0000	0.0007	0.0017	0.0012	0.0029	0.0023
ATCC	0.0000	0.0006	0.0038	0.0023	0.0019	0.0032
ATCG	0.0000	0.0005	0.0023	0.0036	0.0021	0.0020
ATCT	0.0000	0.0000	0.0101	0.0003	0.0001	0.0042
ATGA	0.0008	0.0002	0.0000	0.0018	0.0023	0.0022
ATGC	0.0000	0.0000	0.0000	0.0036	0.0018	0.0027
ATGG	0.0003	0.0001	0.0000	0.0034	0.0019	0.0021
ATGT	0.0005	0.0000	0.0003	0.0013	0.0017	0.0024
ATTA	0.0006	0.0000	0.0009	0.0003	0.0021	0.0022
ATTC	0.0002	0.0000	0.0022	0.0012	0.0009	0.0034
ATTG	0.0002	0.0000	0.0005	0.0010	0.0022	0.0021
ATTT	0.0008	0.0000	0.0058	0.0000	0.0000	0.0041
CAAA	0.0103	0.0044	0.0000	0.0031	0.0023	0.0057
CAAC	0.0073	0.0021	0.0018	0.0043	0.0041	0.0052
CAAG	0.0118	0.0023	0.0000	0.0077	0.0058	0.0051
CAAT	0.0097	0.0026	0.0019	0.0004	0.0035	0.0068
CACA	0.0054	0.0059	0.0090	0.0018	0.0073	0.0041
CACC	0.0042	0.0065	0.0132	0.0050	0.0051	0.0041
CACG	0.0044	0.0054	0.0132	0.0115	0.0048	0.0039
CACT	0.0045	0.0053	0.0191	0.0010	0.0040	0.0064
CAGA	0.0076	0.0030	0.0000	0.0060	0.0032	0.0043
CAGC	0.0043	0.0024	0.0000	0.0113	0.0016	0.0045
CAGG	0.0073	0.0027	0.0000	0.0090	0.0041	0.0039
CAGT	0.0054	0.0028	0.0000	0.0030	0.0030	0.0043
CATA	0.0084	0.0038	0.0037	0.0000	0.0024	0.0058
CATC	0.0042	0.0048	0.0086	0.0023	0.0034	0.0067
CATG	0.0078	0.0048	0.0031	0.0017	0.0055	0.0051
CATT	0.0065	0.0038	0.0132	0.0000	0.0000	0.0093

CCAA	0.0234	0.0000	0.0000	0.0034	0.0036	0.0049
CCAC	0.0163	0.0000	0.0008	0.0070	0.0047	0.0048
CCAG	0.0232	0.0000	0.0000	0.0075	0.0063	0.0041
CCAT	0.0194	0.0000	0.0025	0.0010	0.0046	0.0061
CCCA	0.0246	0.0024	0.0048	0.0056	0.0106	0.0051
CCCC	0.0165	0.0041	0.0102	0.0083	0.0045	0.0048
CCCG	0.0191	0.0024	0.0098	0.0260	0.0037	0.0049
CCCT	0.0212	0.0012	0.0194	0.0041	0.0023	0.0092
CCGA	0.0070	0.0003	0.0002	0.0123	0.0002	0.0045
CCGC	0.0028	0.0000	0.0001	0.0233	0.0000	0.0045
CCGG	0.0045	0.0000	0.0007	0.0173	0.0000	0.0039
CCGT	0.0046	0.0007	0.0017	0.0088	0.0011	0.0044
CCTA	0.0224	0.0004	0.0043	0.0000	0.0043	0.0068
CCTC	0.0150	0.0024	0.0098	0.0057	0.0008	0.0080
CCTG	0.0215	0.0019	0.0043	0.0055	0.0035	0.0059
CCTT	0.0179	0.0000	0.0157	0.0000	0.0000	0.0110
CGAA	0.0100	0.0131	0.0006	0.0074	0.0053	0.0031
CGAC	0.0082	0.0091	0.0006	0.0108	0.0034	0.0032
CGAG	0.0123	0.0111	0.0011	0.0156	0.0080	0.0028
CGAT	0.0099	0.0124	0.0000	0.0050	0.0070	0.0034
CGCA	0.0056	0.0164	0.0071	0.0134	0.0053	0.0017
CGCC	0.0056	0.0133	0.0078	0.0172	0.0024	0.0018
CGCG	0.0031	0.0083	0.0096	0.0276	0.0000	0.0016
CGCT	0.0059	0.0137	0.0101	0.0118	0.0023	0.0030
CGGA	0.0056	0.0101	0.0000	0.0149	0.0052	0.0029
CGGC	0.0038	0.0100	0.0000	0.0224	0.0029	0.0029
CGGG	0.0053	0.0104	0.0011	0.0174	0.0061	0.0021
CGGT	0.0037	0.0108	0.0000	0.0083	0.0052	0.0025
CGTA	0.0116	0.0150	0.0000	0.0049	0.0040	0.0039
CGTC	0.0083	0.0180	0.0035	0.0145	0.0075	0.0039
CGTG	0.0110	0.0173	0.0039	0.0119	0.0070	0.0023
CGTT	0.0104	0.0155	0.0046	0.0054	0.0028	0.0052
CTAA	0.0075	0.0000	0.0000	0.0032	0.0018	0.0060
CTAC	0.0039	0.0000	0.0006	0.0041	0.0024	0.0051
CTAG	0.0056	0.0002	0.0000	0.0071	0.0035	0.0050
CTAT	0.0058	0.0000	0.0005	0.0013	0.0017	0.0058
CTCA	0.0018	0.0037	0.0023	0.0047	0.0040	0.0048
CTCC	0.0010	0.0027	0.0034	0.0061	0.0012	0.0048
CTCG	0.0013	0.0026	0.0041	0.0121	0.0014	0.0040
CTCT	0.0017	0.0016	0.0056	0.0031	0.0009	0.0055
CTGA	0.0062	0.0006	0.0000	0.0053	0.0016	0.0043
CTGC	0.0027	0.0000	0.0000	0.0099	0.0004	0.0046

CTGG	0.0035	0.0003	0.0000	0.0085	0.0019	0.0039
CTGT	0.0038	0.0004	0.0001	0.0037	0.0021	0.0044
CTTA	0.0068	0.0000	0.0000	0.0020	0.0029	0.0062
CTTC	0.0032	0.0001	0.0008	0.0050	0.0005	0.0069
CTTG	0.0045	0.0002	0.0000	0.0053	0.0029	0.0051
CTTT	0.0057	0.0000	0.0020	0.0019	0.0000	0.0084
GAAA	0.0031	0.0037	0.0000	0.0019	0.0041	0.0063
GAAC	0.0000	0.0008	0.0017	0.0040	0.0092	0.0048
GAAG	0.0022	0.0013	0.0000	0.0047	0.0082	0.0044
GAAT	0.0014	0.0005	0.0034	0.0005	0.0055	0.0070
GACA	0.0000	0.0014	0.0108	0.0002	0.0101	0.0047
GACC	0.0017	0.0040	0.0131	0.0023	0.0048	0.0056
GACG	0.0001	0.0019	0.0139	0.0063	0.0060	0.0054
GACT	0.0000	0.0006	0.0226	0.0000	0.0036	0.0080
GAGA	0.0000	0.0029	0.0000	0.0038	0.0056	0.0032
GAGC	0.0000	0.0019	0.0000	0.0074	0.0035	0.0039
GAGG	0.0004	0.0024	0.0000	0.0067	0.0046	0.0034
GAGT	0.0000	0.0012	0.0001	0.0016	0.0035	0.0038
GATA	0.0004	0.0003	0.0052	0.0000	0.0056	0.0048
GATC	0.0000	0.0009	0.0085	0.0021	0.0046	0.0062
GATG	0.0000	0.0014	0.0034	0.0013	0.0072	0.0041
GATT	0.0000	0.0002	0.0170	0.0000	0.0001	0.0101
GCAA	0.0067	0.0040	0.0008	0.0002	0.0068	0.0036
GCAC	0.0040	0.0025	0.0020	0.0027	0.0088	0.0032
GCAG	0.0063	0.0033	0.0011	0.0024	0.0083	0.0029
GCAT	0.0047	0.0018	0.0053	0.0000	0.0070	0.0047
GCCA	0.0059	0.0045	0.0064	0.0023	0.0175	0.0029
GCCC	0.0068	0.0073	0.0162	0.0054	0.0081	0.0039
GCCG	0.0045	0.0063	0.0122	0.0138	0.0097	0.0023
GCCT	0.0064	0.0020	0.0263	0.0014	0.0090	0.0080
GCGA	0.0009	0.0023	0.0005	0.0067	0.0038	0.0030
GCGC	0.0000	0.0012	0.0015	0.0112	0.0019	0.0031
GCGG	0.0002	0.0018	0.0014	0.0091	0.0022	0.0026
GCGT	0.0001	0.0012	0.0007	0.0050	0.0027	0.0029
GCTA	0.0053	0.0011	0.0060	0.0000	0.0090	0.0045
GCTC	0.0047	0.0041	0.0112	0.0030	0.0035	0.0059
GCTG	0.0066	0.0030	0.0064	0.0019	0.0071	0.0039
GCTT	0.0060	0.0008	0.0227	0.0000	0.0006	0.0093
GGAA	0.0056	0.0030	0.0016	0.0030	0.0125	0.0038
GGAC	0.0023	0.0010	0.0005	0.0053	0.0146	0.0030
GGAG	0.0046	0.0004	0.0000	0.0064	0.0171	0.0025
GGAT	0.0039	0.0017	0.0044	0.0010	0.0114	0.0043

GGCA	0.0002	0.0006	0.0067	0.0033	0.0232	0.0009
GGCC	0.0019	0.0050	0.0111	0.0075	0.0126	0.0033
GGCG	0.0001	0.0014	0.0103	0.0153	0.0183	0.0010
GGCT	0.0009	0.0003	0.0184	0.0027	0.0149	0.0049
GGGA	0.0017	0.0025	0.0000	0.0057	0.0134	0.0015
GGGC	0.0007	0.0035	0.0000	0.0090	0.0106	0.0023
GGGG	0.0020	0.0018	0.0000	0.0050	0.0129	0.0012
GGGT	0.0014	0.0034	0.0004	0.0024	0.0091	0.0021
GGTA	0.0023	0.0000	0.0038	0.0000	0.0197	0.0022
GGTC	0.0026	0.0045	0.0066	0.0038	0.0147	0.0050
GGTG	0.0023	0.0013	0.0029	0.0024	0.0204	0.0017
GGTT	0.0048	0.0026	0.0172	0.0000	0.0099	0.0075
GTAA	0.0005	0.0014	0.0000	0.0013	0.0046	0.0035
GTAC	0.0000	0.0000	0.0000	0.0023	0.0051	0.0032
GTAG	0.0000	0.0012	0.0000	0.0034	0.0051	0.0031
GTAT	0.0002	0.0000	0.0008	0.0000	0.0054	0.0039
GTCA	0.0000	0.0023	0.0007	0.0025	0.0066	0.0025
GTCC	0.0000	0.0035	0.0025	0.0042	0.0045	0.0036
GTCG	0.0000	0.0026	0.0027	0.0063	0.0038	0.0023
GTCT	0.0000	0.0003	0.0080	0.0014	0.0046	0.0047
GTGA	0.0000	0.0013	0.0000	0.0033	0.0052	0.0025
GTGC	0.0000	0.0012	0.0000	0.0068	0.0035	0.0032
GTGG	0.0000	0.0014	0.0000	0.0049	0.0034	0.0024
GTGT	0.0000	0.0003	0.0000	0.0019	0.0041	0.0023
GTTA	0.0004	0.0000	0.0000	0.0004	0.0061	0.0048
G TTC	0.0001	0.0004	0.0000	0.0031	0.0032	0.0065
GTTG	0.0002	0.0001	0.0000	0.0022	0.0049	0.0042
GTTT	0.0016	0.0000	0.0044	0.0000	0.0018	0.0085
TAAA	0.0068	0.0112	0.0000	0.0002	0.0005	0.0043
TAAC	0.0047	0.0110	0.0000	0.0019	0.0029	0.0036
TAAG	0.0065	0.0104	0.0000	0.0025	0.0026	0.0039
TAAT	0.0072	0.0092	0.0000	0.0000	0.0018	0.0038
TACA	0.0064	0.0138	0.0010	0.0000	0.0027	0.0032
TACC	0.0046	0.0166	0.0022	0.0015	0.0038	0.0024
TACG	0.0043	0.0127	0.0045	0.0036	0.0000	0.0032
TACT	0.0059	0.0116	0.0026	0.0000	0.0009	0.0034
TAGA	0.0036	0.0103	0.0000	0.0022	0.0019	0.0036
TAGC	0.0018	0.0113	0.0000	0.0050	0.0023	0.0035
TAGG	0.0032	0.0114	0.0000	0.0043	0.0031	0.0034
TAGT	0.0034	0.0076	0.0000	0.0002	0.0012	0.0033
TATA	0.0076	0.0094	0.0009	0.0000	0.0017	0.0028
TATC	0.0049	0.0117	0.0000	0.0000	0.0041	0.0036

TATG	0.0064	0.0109	0.0001	0.0000	0.0034	0.0032
TATT	0.0069	0.0094	0.0000	0.0000	0.0010	0.0043
TCAA	0.0038	0.0057	0.0000	0.0006	0.0000	0.0034
TCAC	0.0034	0.0060	0.0000	0.0024	0.0000	0.0033
TCAG	0.0035	0.0054	0.0000	0.0018	0.0000	0.0035
TCAT	0.0049	0.0057	0.0000	0.0003	0.0000	0.0032
TCCA	0.0036	0.0099	0.0007	0.0024	0.0011	0.0026
TCCC	0.0028	0.0108	0.0028	0.0042	0.0005	0.0019
TCCG	0.0017	0.0079	0.0029	0.0068	0.0000	0.0024
TCCT	0.0043	0.0076	0.0014	0.0014	0.0000	0.0028
TCGA	0.0006	0.0025	0.0000	0.0019	0.0000	0.0029
TCGC	0.0000	0.0019	0.0000	0.0044	0.0000	0.0028
TCGG	0.0000	0.0018	0.0002	0.0034	0.0000	0.0028
TCGT	0.0004	0.0017	0.0000	0.0017	0.0000	0.0027
TCTA	0.0058	0.0060	0.0000	0.0000	0.0000	0.0030
TCTC	0.0041	0.0070	0.0000	0.0017	0.0001	0.0032
TCTG	0.0046	0.0069	0.0001	0.0014	0.0000	0.0030
TCTT	0.0056	0.0050	0.0000	0.0000	0.0000	0.0035
TGAA	0.0066	0.0137	0.0000	0.0029	0.0021	0.0037
TGAC	0.0054	0.0120	0.0000	0.0049	0.0011	0.0033
TGAG	0.0077	0.0123	0.0000	0.0065	0.0034	0.0033
TGAT	0.0068	0.0134	0.0000	0.0010	0.0034	0.0031
TGCA	0.0056	0.0175	0.0033	0.0047	0.0014	0.0019
TGCC	0.0038	0.0178	0.0042	0.0069	0.0006	0.0015
TGCG	0.0034	0.0145	0.0061	0.0100	0.0000	0.0016
TGCT	0.0055	0.0139	0.0032	0.0033	0.0000	0.0024
TGGA	0.0029	0.0118	0.0000	0.0060	0.0029	0.0031
TGGC	0.0011	0.0134	0.0000	0.0089	0.0033	0.0028
TGGG	0.0029	0.0122	0.0000	0.0072	0.0043	0.0026
TGGT	0.0018	0.0113	0.0000	0.0028	0.0028	0.0027
TGTA	0.0078	0.0131	0.0000	0.0000	0.0014	0.0031
TGTC	0.0057	0.0167	0.0000	0.0036	0.0031	0.0034
TGTG	0.0068	0.0127	0.0013	0.0020	0.0032	0.0022
TGTT	0.0080	0.0145	0.0003	0.0000	0.0013	0.0036
TTAA	0.0010	0.0007	0.0000	0.0011	0.0000	0.0035
TTAC	0.0003	0.0005	0.0000	0.0016	0.0000	0.0035
TTAG	0.0004	0.0006	0.0000	0.0021	0.0000	0.0035
TTAT	0.0012	0.0006	0.0000	0.0010	0.0000	0.0031
TTCA	0.0000	0.0038	0.0000	0.0026	0.0000	0.0026
TTCC	0.0000	0.0025	0.0000	0.0036	0.0000	0.0024
TTCG	0.0000	0.0014	0.0001	0.0032	0.0000	0.0024
TTCT	0.0000	0.0017	0.0000	0.0019	0.0000	0.0024

TTGA	0.0012	0.0012	0.0000	0.0005	0.0000	0.0028
TTGC	0.0000	0.0011	0.0000	0.0023	0.0000	0.0030
TTGG	0.0000	0.0010	0.0000	0.0020	0.0000	0.0028
TTGT	0.0006	0.0008	0.0000	0.0008	0.0000	0.0025
TTTA	0.0016	0.0009	0.0000	0.0010	0.0000	0.0028
TTTC	0.0004	0.0008	0.0000	0.0023	0.0000	0.0032
TTTG	0.0005	0.0007	0.0000	0.0017	0.0000	0.0026
TTTT	0.0014	0.0002	0.0000	0.0011	0.0000	0.0029

Table S2. Relevant clinical information available for colorectal cancer (CRC) patients.

Sample ID	CRC patients with/without liver metastasis	Stage group	Primary cancer site	Metastatic sites
TBR1197	No-liver metastasis	I	Rectosigmoid junction	/
TBR1731	No-liver metastasis	I	Colon	/
TBR1782	No-liver metastasis	II	Colon	/
TBR1810	No-liver metastasis	NA	Rectum	/
TBR1917	No-liver metastasis	II	Colon	/
TBR2026	No-liver metastasis	III	Rectum	/
TBR2153	No-liver metastasis	III	Colon	/
TBR2154	No-liver metastasis	II	Colon	/
TBR289	No-liver metastasis	III	Colon	/
TBR783	No-liver metastasis	III	Colon	/
TBR798	No-liver metastasis	II	Colon	/
TBR810	No-liver metastasis	II	Colon	/
TBR814	No-liver metastasis	III	Rectum	/
TBR835	No-liver metastasis	I	Rectum	/
TBR850	No-liver metastasis	NA	Rectum	/
TBR851	No-liver metastasis	III	Colon	/
TBR859	No-liver metastasis	II	Rectum	/
TBR881	No-liver metastasis	III	Colon	/
TBR899	No-liver metastasis	I	Colon	/

TBR900	No-liver metastasis	II	Rectosigmoid junction	/
TBR904	No-liver metastasis	II	Colon	/
TBR906	No-liver metastasis	III	Colon	/
TBR913	No-liver metastasis	NA	Rectosigmoid junction	/
TBR938	No-liver metastasis	II	Colon	/
TBR941	No-liver metastasis	III	Rectum	/
TBR1408	Liver metastasis	IV	Colon	Liver
TBR1484	Liver metastasis	IV	Rectosigmoid junction	Liver
TBR1552	Liver metastasis	IV	rectosigmoid junction	Liver
TBR1718	Liver metastasis	IV	Colon	Liver/Lung
TBR1730	Liver metastasis	IV	Colon	Liver
TBR1735	Liver metastasis	IV	Colon	Liver/Lung/ Adnexal region/ Peritoneal
TBR1751	Liver metastasis	IV	Colon	Liver
TBR1753	Liver metastasis	IV	Rectum	Liver
TBR1797	Liver metastasis	IV	Colon	Liver/ Peritoneal
TBR1798	Liver metastasis	IV	Colon	Liver
TBR1910	Liver metastasis	IV	Colon	Liver/Lung
TBR1984	Liver metastasis	IV	Rectum	Liver/Bone/ Distant lymph node/Lung
TBR1998	Liver metastasis	IV	Colon	Liver/Distant lymph node
TBR2025	Liver metastasis	IV	Colon	Liver
TBR2092	Liver metastasis	IV	Rectum	Liver
TBR2104	Liver metastasis	IV	Colon	Liver
TBR2206	Liver metastasis	IV	Colon	Liver/Lung/ Distant lymph node
TBR2337	Liver metastasis	IV	Colon	Liver
TBR2346	Liver metastasis	IV	Rectum	Liver
TBR2364	Liver metastasis	IV	Colon	Liver

TBR290	Liver metastasis	IV	Colon	Liver/Bone/ Lung
TBR396	Liver metastasis	IV	Rectum	Liver
TBR768	Liver metastasis	IV	Colon	Liver
TBR773	Liver metastasis	IV	Rectum	Liver

Table S3. Barcelona Clinic Liver Cancer (BCLC) staging information for patients with hepatocellular carcinoma (HCC).

Sample ID	Cancer type	BCLC staging system
TBR1015	HCC	A
TBR1373	HCC	0
TBR1388	HCC	A
TBR1555	HCC	C
TBR1586	HCC	A
TBR1644	HCC	B
TBR1662	HCC	A
TBR1676	HCC	A
TBR1677	HCC	A
TBR1723	HCC	B
TBR1757	HCC	C
TBR1772	HCC	B
TBR1774	HCC	A
TBR1828	HCC	A
TBR1838	HCC	C
TBR1850	HCC	A
TBR1861	HCC	C
TBR1886	HCC	A
TBR1899	HCC	A
TBR1916	HCC	A
TBR1920	HCC	A
TBR1932	HCC	B
TBR2000	HCC	C
TBR2038	HCC	A
TBR2080	HCC	A
TBR2083	HCC	B
TBR846	HCC	B
TBR852	HCC	B
TBR853	HCC	C
TBR855	HCC	C
TBR858	HCC	B
TBR874	HCC	B
TBR931	HCC	A
TBR964	HCC	B

Table S4. Stage group information for patients with nasopharyngeal carcinoma (NPC).

Sample ID	Cancer type	Stage group
TBR2343	NPC	II
TBR2385	NPC	III
TBR2406	NPC	IV
TBR2430	NPC	IV
TBR2553	NPC	III
TBR2605	NPC	IV
TBR2937	NPC	III
TBR2987	NPC	III
TBR2995	NPC	III
TBR3133	NPC	III
TBR3277	NPC	II
TBR3295	NPC	I