

Characterizing the Length-Dependence of DNA Nanotube End-to-End Joining Rates

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DNA nanotube and seed design sequences

REd tile sequences:

RE-4bp-1: CGTATTGGACATTTCCGTAGACCGACTGGACATCTTCG RE-4bp-2EE01:
TGGTCCTTCACACCAATACGGCAT RE-4bp-3Cy3:
/Cy3/TCTACGGAAATGTGGCAGAATCAATCATAAGACACCAGTCGG RE-4bp-4:
CAGACGAAGATGTGGTAGTGGAATGC RE-4bp-5:
TCCACTACCTGTCTTATGATTGATTCTGCCTGTGAAGG

SEd tile sequences:

SE-4bp-1: CTCAGTGGACAGCCGTTCTGGAGCGTTGGACGAAACTC SE-4bp-2DIAG:
TCTGGTAGAGCACCAGTGGAGGT SE-4bp-3Cy3:
/Cy3/CCAGAACGGCTGTGGCTAAACAGTAACCGAAGCACCAACGCT SE-4bp-4DIAG:
ACCAGAGTTTCGTGGTCATCGTACCT SE-4bp-5:
ACGATGACCTGCTTCGGTTACTGTTTAGCCTGCTCTAC

Here /Cy3/ denotes a covalently attached Cy3 fluorophore.

Seed staple sequences:

T_5R12F_CYC_HP: GGAATTACCACCACCCGTGAGGCGTTTTTCGCCTCACTTTCATTTTTCCGTAACAC
T_5R12E_CYC_HP: CTCAGAGCGAGGCATAGGCTCCGCTTTTTCGGGAGCCTTGTAAGAGCACAGGTAG
T_3R12F_CYC_HP: CATAACCCACCGCCACCTGGCTCGTTTTTCGAGCCAGTTCCTCAGAAACAACGCC
T_3R12E_CYC_HP: CCTCAGATCGTTTACCCTGTCGTTTTTCGCAAGCGTTCAGACGACTTAATAAA
T_1R12F_CYC_HP: CCAAAATATACTCAGGTGCGGTCGTTTTTCGACCGCATTAGGTTTAGATAGTTAG
T_1R12E_CYC_HP: TATCACCGGCGAGAGGCTGCGTCGTTTTTCGACGCAGTTCCTTTTGAATCCTGAA
T1R12F_CYC_HP: TCTTACCATATAAGTACCGAGGCGTTTTTCGCCTCGGTTTAGCCCGGAATAGGTG
T1R12E_CYC_HP: AGGGTTGAACGCTAACGCCAGGACTTTTGTCTGGCTTGAGCGTCTGAACACCC
T3R12F_CYC_HP: CCTAATTTACCAGGCGTCGGAGCGTTTTTCGCTCCGATTGATAAGTGGGGGTCAG
T3R12E_CYC_HP: TGCTCAGTGCCAGTTAGGTGGTCGTTTTTCGACCACCTTCAAATAAACAGGGAA
T5R12F_CYC_HP: ATTATTTAGAAGGATTGCCATCGTTTTTCGATGGCTTAGGATTAGAAACAGTT
T5R12E_CYC_HP: CCTCAAGATCCCAATCCGTGGAGCTTTTGTCTCCACGTTCAAATAAGATAGCAGC
T_5R2F_HP: TGAGTTTCAAAGGAACGTCCACCGTTTTTCGGTGGACTTAACTAAAGATCTCCAA
T_5R4F_HP: AAAAAAGGCTTTTTCGGTGGTCCGTTTTTCGGACCACTTGATCGTCGGGTAGCA
T_5R6F_HP: ACGGCTACAAGTACAACTCGGCACTTTTGTGCCGAGTTTCGGAGATTCGCGACCT
T_5R8F_HP: GCTCCATGACGTAACACGGATCGTTTTTCGATCCGTTAAGCTGCTACACCAGA
T_5R10F_HP: ACGAGTAGATCAGTTGCACCGCTGTTTTTCAGCGGTGTTAGATTTAGCGCCAAAA
T_5R2E_HP: GAGAATAGGTCAACAGCGGAACCGTTTTTCGGTTCGTTTACAAACTCCGCCACC
T_5R4E_HP: AAAGGCCGCTCCAAAACCGTGGCGTTTTTCGCCACGTTGGAGCCTTAGCGGAGT
T_5R6E_HP: GCGAAACAAGAGGCTTGTGCTGCGTTTTTCGCAGCACTTTGAGGACTAGGGAGTT
T_5R8E_HP: CCAAATCATTACTTAGACGCTGGCTTTTTCGCCAGCGTTTCCGGAACGTACCAAGC
T_5R10E_HP: AAAGATTCTAAATTGGCGACGACTTTTGTCCGTCGTTGCTTGAGATTCATTAC
T_3R2F_HP: TGTAGCATAACTTTCAGGCATCCGTTTTTCGGATGCCTTACAGTTTCTAATTGTA
T_3R4F_HP: TCGGTTTAGGTGCTGGCTGACGCTTTTTCGCTCAGCTTAGGCTTGCAAAGACTT
T_3R6F_HP: TTTTCATGATGACCCCCACCAGCCGTTTTTCGGCTGGTTTAGCGATTAAGGCGCAG
T_3R8F_HP: ACGGTCAATGACAAGACGGAGCGTTTTTCGCCTCCGTTACCGGATATGGTTTAA
T_3R10F_HP: TTTCAACTACGGAACACTCGCTGCTTTTTTCGACGAGTTACATTATTAACACTAT
T_3R2E_HP: TGCTAAACTCCACAGAGCCAGTGCTTTTGCCTGGCTTCAGCCCTCTACCGCCA
T_3R4E_HP: ATATATTCTCAGCTTGCCGTCCGTTTTTCGGACGTTCTTTCGAGTGGGATTT
T_3R6E_HP: CTCATCTTGGAAGTTTCGGATGGCTTTTTCGCATCCGTTCCATTAAACATAACCG
T_3R8E_HP: AGTAATCTTCATAAGGTCTGGTCGTTTTTCGACCAGATTGAACCGAACTAAAAACA
T_3R10E_HP: ACGAACTATTAATCATGGCACCTGTTTTTCAGGTGCCTTTGTGAATTTTCATCAAG
T_1R2F_HP: CGTAACGAAAATGAATCCTGCCTGTTTTTCAGGCAGGTTTTTCTGTAGTGAATTT
T_1R4F_HP: CTTAAACAACAACCATCGGTGCCGTTTTTCGGCACCGTTTCGCCACGCGGGTAAA
T_1R6F_HP: ATACGTAAGAGGCAAACTCGGTGCTTTTTTCGACCGAGTTAGAATACACTGACCAA
T_1R8F_HP: CTTTGAAAATAGGCTGCCGAGGACTTTTGTCTCGGTTGCTGACCTACCTTATG
T_1R10F_HP: CGATTTTAGGAAGAAACGGCAGGCTTTTTCGCTGCCGTTAATCTACGGATAAAAA
T_1R2E_HP: ACGTTAGTTCTAAAGTCGCTTGGCTTTTTGCCAAGCGTTTTTGTCTGTGATACAGG
T_1R4E_HP: CAATGACAGCTTGATATGGCGAGCTTTTGTCTGCCATTCCGATAGTCTCCCTCA
T_1R6E_HP: AAACGAAATGCCACTACCACCTCGTTTTTCGAGGTGGTTTGAAGGCAGCCAGCAA
T_1R8E_HP: CCAGGCGCAGGACAGCTCTGGACTTTTGTCCAGAGTTATGAACGGGTAGAAAA
T_1R10E_HP: GGACGTTGAGAACTGGCGAGGCACTTTTGTGCCTCGTTCTCATTATGCGCTAAT
T1R2F_HP: AGTGTACTATACATGGCTCCTGCGTTTTTCGCAGGAGTTCTTTTGATCTTTCCAG
T1R4F_HP: GAGCCGCCCCACCACCGTCAGGCGTTTTTCGCCTGACTTGGAACCGCTGCGCCGA
T1R6F_HP: AATCACCACCATTTGGCGTCTGCTTTTGCAGGACGTTGAATTAGACCAACCTA
T1R8F_HP: TACATACACAGTATGTTCGGACCTGTTTTTCAGGTCCGTTTAGCAAACCTGTACAGA
T1R10F_HP: ATCAGAGAGTCAGAGGCGAGGTCGTTTTTCGACCTCGTTGTAATTGAACCACTCA
T1R2E_HP: TAAGCGTCGGTAATAACAGGAGCGTTTTTCGCTCCTGTTGTTTTAACCCGTCGAG
T1R4E_HP: AACCAGAGACCTCAGGCAGTCGTTTTTTCGCACTGCTTAACCGCCACGTTCCAG
T1R6E_HP: GACTTGAGGTAGCACCGTCTGGCGTTTTTCGCCAGACTTATTACCATATCACCGG
T1R8E_HP: TTATTACGTAAAGGTGTGGCTGCGTTTTTCGCAGCCATTGCAACATACCGTCACC
T1R10E_HP: TGAACAAAGATAACCCAGTGCCTGTTTTTCAGGCACCTTACAAGAATAAGACTCC
T3R2F_HP: TGCCTTGACAGTCTCTGTGCGTGTCTTTTCACCCGACTTGAATTTACCCCTCAGA
T3R4F_HP: GCCACCACTCTTTTACGGTCGGCTTTTTCGCCACCGTTAATCAAATAGCAAGG
T3R6F_HP: CCGGAACTAAAGGTGGACCTGGCTTTTTCGAGGTCTTAATTATCATAAAAGAA
T3R8F_HP: ACGCAAAGAAGAACTGTGGCTCGTTTTTCGAGCCGATTGCATGATTTGAGTTAA
T3R10F_HP: GCCCAATAGACGGGAGCACAGGCGTTTTTCGCCTGTGTTAATTAACCTTTCCAGAG
T3R2E_HP: GGAAAGCGGTAACAGTGTGGCAGCTTTTGTCTGCCACTTGCCCGTATCGGGGTTT
T3R4E_HP: GTTTGCCACCTCAGAGACCAGGCGTTTTTCGCCTGGTTTCCGCCACCGCCAGAAT
T3R6E_HP: TTATTCATGTCACCAAGCTCGCTGTTTTTCAGCGAGCTTTGAAACCATTATTAGC

T3R8E_HP: ATACCCAAACACCACGCCTACCGCTTTTGCGGTAGGTTGAATAAGTGACGGAAA
T3R10E_HP: GCGCATTAATAAGAGCCTGGACGCTTTTGCCTCCAGTTAAGAAACAATAACGGA
T5R2F_HP: AATGCCCCATAAATCCGCTCGGACTTTTGTCCGAGCTTTCATTAAGAACCAC
T5R4F_HP: CACCAGAGTTCGGTCAGCCGAGCGTTTTGCTCGGCTTTAGCCCCCTCGATAGC
T5R6F_HP: AGCACCGTAGGGAAGGTCGGAGGCTTTTGCCTCCGATTAAATATTTATTTG
T5R8F_HP: TCACAATCCCGAGGAAGTGGTGGCTTTTGCCACCAGTTACGCAATAATGAAATA
T5R10F_HP: GCAATAGCAGAGAATACCGCAGGCTTTTGCCTGCGGTTACATAAAAACAGCCAT
T5R2E_HP: ACAAACAACCTGCCTATCACGACGCTTTTGCCTCGTGTTTTCGGAACCTGAGACT
T5R4E_HP: TCGGCATTCCGCCGCCGCTCGCTGCTTTTGCAGCGACTTAGCATTGATGATATTC
T5R6E_HP: ATTGAGGGAATCAGTACGGAGCACTTTTGTGCTCCGTTGCGACAGACGTTTTCA
T5R8E_HP: GAAGGAAAAATAGAAAGCCTAGCGTTTTGCTAGGCTTATTCATATTTCAACCG
T5R10E_HP: CTTTACAGTATCTTACCGCTCGTGTTTTACGAGCGTTCGAAGCCCAGTTACCA

A-seed adapter sequences

A-4bp-1REd_1: CAGCCAAGACGCAGGTAGCGAGACAGAGCTGAAAGTATTAAGAGG
A-4bp-1_2REd_3: TCGCTACCTGCGTTCGTCCGATGGTGAGGTCCACGCTCTGTC
A-4bp-1_2REd_5: CTATTATTCTGAAACAGTGACCTCACCATCCGACGACACGAGCA
A-4bp-2REd_2: TGGTTGCTCGTGCTTGGCTGGCAT
A-4bp-3SEd_1: CACGGAGTCGAAGCGTAGGACGGTAGCCAGTCAGACGATTGGCCT
A-4bp-3_4SEd_3: GTCCTACGCTTCGGACCTTGGTGATGCTGGACTGTGGCTACC
A-4bp-4SEd_5: CAGGAGGTTGAGGCAGCAGTCCAGCATCACCAAGGTCGCTCGGCA
A-4bp-3_4SEd_2: TCTGTGCCGAGCACTCCGTGAGGT
A-4bp-5REd_1: CAGAGCCACGGCATGGTCTTGCGTTGGAGGCGTCAGACTGTAGCG
A-4bp-5_6REd_3: CAAGACCATGCCGACCTCATCCTCGCTTTCGGTGCTCCAACG
A-4bp-6REd_5: ATCAAGTTTGCCTTTACACCGAAAGCGAGGATGAGGTGCGGACGA
A-4bp-5_6REd_2: TGGTTGCTCGTGCTTGGCTGGCAT
A-4bp-7SEd_1: CACGGAGTCTACGGCAGTGACCGATCTCCAGACAAAAGGGCGACA
A-4bp-7_8SEd_3: GTCCTGCCGTAGCTCACGAGGCACAACCACAGCGGAGATCG
A-4bp-8SEd_5: GGTTTACCAGCGCCAAGCTGTGGTTGTGCCTCGTGAGGCTCGGCA
A-4bp-7_8SEd_2: TCTGTGCCGAGCACTCCGTGAGGT
A-4bp-9REd_1: CAACCGTCGTTCCACAGGACTCGCACTTCGCAGATAGCCGAACAA
A-4bp-9_10REd_3: AGTCCTGTGGAACACCACGAGACGCCATCGAGCGGAAGTGCG
A-4bp-10SRd_5: TTTTAAAGAAAAGTAACGCTCGATGGCGTCTCGTGGTAAAGCCTGA
A-4bp-9_10SRd_2: TGGTTGCTCGTGCTTGGCTGGCAT
A-4bp-11SEd_1: CACGGAGTCAAGGCTACGAGTCAGACAGGAACGTCAAAAATGAAA
A-4bp-11_12SEd_3: ACTCGTAGCCTTGGACCGCACTCACCCTGCTCGCCTGTCTG
A-4bp-12SEd_5: AAACGATTTTTTGTTCGAGCAGTGGTGAGTGCGGTCGCTCGGCA
A-4bp-11_12SEd_2: TCTGTGCCGAGCACTCCGTGAGGT

B-seed adapter sequences

B-4bp-1REd_1: AGGGATAGCAAGCCCACAACGTGAGGACACTTGGAGGCTGCACTCG
B-4bp-1_2REd_3: TGTCCTCACGTTGCTGGATGCCGATCCTACGACACCTCCAAG
B-4bp-2REd_5: TCGCTGACTTGTCTGATAGGATCGGCATCCAGATAGGAACCCATGTAC
B-4bp-1_2REd_4: CAGACGAGTGCAGAGTCAGCGAATGC
B-4bp-3SEd_1: GAATTGCGAATAATAAGTGACCTTGCTGTACCGTCGAGATGGAGTC
B-4bp-3_4SEd_3: ACAGCAAGGTCACCGCAGTTGGCACTAGGCGACATCGACGGT 15
B-4bp-4SEd_5: ACCACAACCTGTCGCCTAGTGCCAACTGCGTTTTTTCACGTTGAAA
B-4bp-3_4SEd_4: ACCAGACTCCATCGGTTGTGGTACCT
B-4bp-5REd_1: ACCCTCAGCAGCGAAACGAGTACGGCAACACGGTGAGAGCCTACGG
B-4bp-5_6REd_3: GTTGCCGTA CTGACTGGTACGAACGTCTCCAACCTACCGT
B-4bp-6REd_5: TGCTCTGCCTTGGAGACGTTTCGTGACCAGTGACAGCATCGGAACGA
B-4bp-5_6REd_4: CAGACCGTAGGCTGGCAGAGCAATGC
B-4bp-7SEd_1: TGTATCATCGCCTGATCAACGGTACGAGATGCGAAGCACAGAGTGC
B-4bp-7_8SEd_3: TCTCGTACCGTTGCCAGTAGACCTAGCCGACGTGGCTTCGCA
B-4bp-8SEd_5: AGTCACGCTCACGTCCGCTAGGTCTACTGGAAATTGTGTGCGAAATC
B-4bp-7_8SEd_4: ACCAGCACTCTGTAGCGTGACTACCT
B-4bp-9REd_1: CATTCAAGTGAATAAGGACGCTATGCCTATCGCTCTAGGACCTCTGG
B-4bp-9_10REd_3: ATAGGCATAGCGTTGCTCCAGTCTGCTGCTCAGGCTAGAGCG
B-4bp-10REd_5: TCCACGACTCCTGAGCAGCAGACTGGAGCACTTGCCCTGACGAGAA
B-4bp-9_10REd_4: CAGACCAGAGGTCAGTCGTGGAATGC
B-4bp-11SEd_1: GAATACCACATTCAACACCGATGAGGATCACGGCACTCGACACTGC
B-4bp-11_12SEd_3: GATCCTCATCGGTCAAGCGAAGGTGCGAGCCTGTAGTGCCGT
B-4bp-12SEd_5: AGCGGACTGACAGGCTCGCACCTTCGCTTGTAATGCAGATACATAA
B-4bp-11_12SEd_4: ACCAGCAGTGTGCGAGTCCGCTACCT

Dye-labelling strand sequences

Labeling_strand_ATTO647N_seed /5ATTO647NN/AAGCGTAGTCGGATCTC
Labeling_strand_ATTO488_cap /5ATTO488N/AAGCGTAGTCGGATCTC

Dye-labelling strand attachment sequences

Unused_m13mp18_01 AAATTCTTACCAGTATAAAGCCAACTTTTGAGATCCGACTACGC
Unused_m13mp18_02 GCCTGTTTAGTATCATATGCGTTATTTTTGAGATCCGACTACGC
Unused_m13mp18_03 ACACCGGAATCATAATTACTAGAAATTTTGAGATCCGACTACGC
Unused_m13mp18_04 GATAAATAAGGCGTTAAATAAGAATTTTGAGATCCGACTACGC
Unused_m13mp18_05 TTTAATGGTTTGAAATACCGACCGTTTTTGAGATCCGACTACGC
Unused_m13mp18_06 TTAGTTAATTCATCTTCTGACCTATTTTGAGATCCGACTACGC
Unused_m13mp18_07 ACGCGAGAAAACCTTTTTCAAATATATTTTGAGATCCGACTACGC
Unused_m13mp18_08 GATGCAAATCCAATCGCAAGACAAATTTTGAGATCCGACTACGC
Unused_m13mp18_09 TGGGTTATATAACTATATGTAAATGTTTTGAGATCCGACTACGC
Unused_m13mp18_10 ACTACCTTTTTAACCTCCGGCTTAGTTTTGAGATCCGACTACGC
Unused_m13mp18_11 AATTTATCAAAATCATAGGTCTGAGTTTTGAGATCCGACTACGC
Unused_m13mp18_12 TTAAGACGCTGAGAAGAGTCAATAGTTTTGAGATCCGACTACGC
Unused_m13mp18_13 TCCTTGAAAACATAGCGATAGCTTATTTTGAGATCCGACTACGC
Unused_m13mp18_14 TCGCTATTAATTAATTTCCCTTAGTTTTGAGATCCGACTACGC
Unused_m13mp18_15 AGTGAATAACCTTGCTTCTGTAAATTTTTGAGATCCGACTACGC
Unused_m13mp18_16 GAAACAGTACATAAATCAATATATGTTTTGAGATCCGACTACGC
Unused_m13mp18_17 ATTTCAATTTGAATTACCTTTTTTAATTTTGAGATCCGACTACGC
Unused_m13mp18_18 AGAAAACAAAATTAATTACATTTAATTTTGAGATCCGACTACGC
Unused_m13mp18_19 CAAAAGAAGATGATGAAACAAACATTTTGAGATCCGACTACGC

Unused_m13mp18_20 GCGAATTATTCATTTCAATTACCTGTTTTGAGATCCGACTACGC
Unused_m13mp18_21 AATACCAAGTTACAAAATCGCGCAGTTTTGAGATCCGACTACGC
Unused_m13mp18_22 CAATAACGGATTTCGCTGATTGCTTTTTTGAGATCCGACTACGC
Unused_m13mp18_23 TAACAGTACCTTTTACATCGGGAGATTTTGAGATCCGACTACGC
Unused_m13mp18_24 CAGGTTTAACGTCAGATGAATATACTTTTGAGATCCGACTACGC
Unused_m13mp18_25 CAGAAATAAAGAAATTGCGTAGATTTTTTGAGATCCGACTACGC
Unused_m13mp18_26 CCATATCAAAATTATTTGCACGTAATTTTGAGATCCGACTACGC
Unused_m13mp18_27 TCTGAATAATGGAAGGGTTAGAACCTTTTGAGATCCGACTACGC
Unused_m13mp18_28 TATAATCCTGATTGTTTGATTATATTTTGAGATCCGACTACGC
Unused_m13mp18_29 GATTATCAGATGATGGCAATTCATCTTTTGAGATCCGACTACGC
Unused_m13mp18_30 AAGGAGCGGAATTATCATCATATTTTGAGATCCGACTACGC
Unused_m13mp18_31 CATTTTGCGGAACAAAGAAACCACCTTTTGAGATCCGACTACGC
Unused_m13mp18_32 TAATTTTAAAAGTTTGAGTAACATTTTTTGAGATCCGACTACGC
Unused_m13mp18_33 GTATTAAATCCTTTGCCCGAACGTTTTTGAGATCCGACTACGC
Unused_m13mp18_34 TAGACTTTACAAACAATTCGACAACCTTTTGAGATCCGACTACGC
Unused_m13mp18_35 ATAATACATTTGAGGATTTAGAAAGTTTTTGAGATCCGACTACGC
Unused_m13mp18_36 CAACTAATAGATTAGAGCCGTCAATTTTTTGAGATCCGACTACGC
Unused_m13mp18_37 TATCTAAAATATCTTTAGGAGCACTTTTTTGAGATCCGACTACGC
Unused_m13mp18_38 ACTGATAGCCCTAAAACATCGCCATTTTTTGAGATCCGACTACGC
Unused_m13mp18_39 GAATGGCTATTAGTCTTTAATGCGCTTTTGAGATCCGACTACGC
Unused_m13mp18_40 AGAATACGTGGCACAGACAATATTTTTTGAGATCCGACTACGC
Unused_m13mp18_41 ATAGAACCTTCTGACCTGAAAGCGTTTTTGAGATCCGACTACGC
Unused_m13mp18_42 ATAAAAGGGACATTCTGGCCAACAGTTTTTGAGATCCGACTACGC
Unused_m13mp18_43 GCAGATTCACCAGTCACACGACCAGTTTTTGAGATCCGACTACGC
Unused_m13mp18_44 ATCGTCTGAAATGGATTATTTACATTTTTTGAGATCCGACTACGC
Unused_m13mp18_45 ATGGAAATACCTACATTTTGACGCTTTTTTGAGATCCGACTACGC
Unused_m13mp18_46 CCAGCCATTGCAACAGGAAAAACGCTTTTGAGATCCGACTACGC
Unused_m13mp18_47 CTGGTAATATCCAGAACAATATTACTTTTGAGATCCGACTACGC
Unused_m13mp18_48 GTAGAAGAACTCAAACATATCGGCCTTTTTTGAGATCCGACTACGC
Unused_m13mp18_49 TGATTAGTAATAACATCACTTGCCTTTTTGAGATCCGACTACGC
Unused_m13mp18_50 AAATTAACCGTTGTAGCAATACTTCTTTTGAGATCCGACTACGC
Unused_m13mp18_51 CCGAGTAAAAGAGTCTGTCCATCACTTTTGAGATCCGACTACGC
Unused_m13mp18_52 GAAGTGTTTTTATAATCAGTGAGGCTTTTGAGATCCGACTACGC
Unused_m13mp18_53 GACAGGAACGGTACGCCAGAATCCTTTTGAGATCCGACTACGC
Unused_m13mp18_54 AACAGGAGGCCGATTAAAGGGATTTTTTGAGATCCGACTACGC
Unused_m13mp18_55 TCCTCGTTAGAATCAGAGCGGGAGCTTTTGAGATCCGACTACGC
Unused_m13mp18_56 GCTTTGACGAGCACGTATAACGTGCTTTTGAGATCCGACTACGC
Unused_m13mp18_57 CGCCGCTACAGGGCGCGTACTATGGTTTTTGAGATCCGACTACGC
Unused_m13mp18_58 TAACCACCACACCCGCCGCGCTTAATTTTGAGATCCGACTACGC
Unused_m13mp18_59 TGGCAAGTGTAGCGGTACGCTGCGTTTTTGAGATCCGACTACGC
Unused_m13mp18_60 AAGCGAAAGGAGCGGGCGCTAGGGCTTTTGAGATCCGACTACGC
Unused_m13mp18_61 CGAACGTGGCGAGAAAGGAAGGAATTTTGAGATCCGACTACGC
Unused_m13mp18_62 GATTTAGAGCTTGACGGGGAAAGCCTTTTGAGATCCGACTACGC
Unused_m13mp18_63 TAAATCGGAACCTAAAGGGAGCCCTTTTGAGATCCGACTACGC
Unused_m13mp18_64 TTTTGGGGTCGAGGTGCCGTAAAGCTTTTGAGATCCGACTACGC
Unused_m13mp18_65 TACGTGAACCATCACCCAAATCAAGTTTTTGAGATCCGACTACGC
Unused_m13mp18_66 AAACCGTCTATCAGGGCGATGGCCCTTTTGAGATCCGACTACGC
Unused_m13mp18_67 ACGTGGACTCCAACGTCAAAGGGCGTTTTTGAGATCCGACTACGC
Unused_m13mp18_68 TTTGGAACAAGAGTCCACTATTAAATTTTGAGATCCGACTACGC
Unused_m13mp18_69 CCGAGATAGGGTTGAGTGTGTTCCCTTTTGAGATCCGACTACGC
Unused_m13mp18_70 AAATCCCTTATAAATCAAAAGAATATTTTGAGATCCGACTACGC
Unused_m13mp18_71 TGTTTGATGGTGGTTCCGAAATCGGTTTTTGAGATCCGACTACGC
Unused_m13mp18_72 CTGGTTTGCCCCAGCAGGCGAAAATTTTTTGAGATCCGACTACGC
Unused_m13mp18_73 TGAGAGAGTTGCAGCAAGCGGTCCATTTTGAGATCCGACTACGC
Unused_m13mp18_74 AGCTGATTGCCCTTACCGCCTGGCTTTTGAGATCCGACTACGC
Unused_m13mp18_75 TTTCTTTTACCAGTGAGACGGGCATTTTGAGATCCGACTACGC

Unused_m13mp18_76 GTTTGGCTATTGGGCGCCAGGGTGGTTTTGAGATCCGACTACGC
Unused_m13mp18_77 GAATCGGCCAACGCGCGGGGAGAGGTTTTGAGATCCGACTACGC
Unused_m13mp18_78 GAAACCTGTCGTGCCAGCTGCATTATTTTGAAGATCCGACTACGC
Unused_m13mp18_79 TGGGCTCACTGCCCCGCTTTCCAGTCTTTTGAAGATCCGACTACGC
Unused_m13mp18_80 GAGTGAGCTAACTCACATTAATTGCTTTTGAAGATCCGACTACGC
Unused_m13mp18_81 TAAAGTGTAAGCCTGGGGTGCCTATTTTGAAGATCCGACTACGC
Unused_m13mp18_82 TTCCACACAACATACGAGCCGGAAGTTTTGAAGATCCGACTACGC
Unused_m13mp18_83 CTGTGTGAAATTGTTATCCGCTCACTTTTGAAGATCCGACTACGC
Unused_m13mp18_84 ATTCGTAATCATGGTCATAGCTGTTTTTGAAGATCCGACTACGC
Unused_m13mp18_85 TAGAGGATCCCCGGGTACCGAGCTCTTTTGAAGATCCGACTACGC
Unused_m13mp18_86 CAAGCTTGCATGCCTGCAGGTCGACTTTTGAAGATCCGACTACGC
Unused_m13mp18_87 ACGACGTTGTAAAACGACGGCCAGTTTTTGAAGATCCGACTACGC
Unused_m13mp18_88 TTGGGTAACGCCAGGGTTTTCCAGTTTTTGAAGATCCGACTACGC
Unused_m13mp18_89 AGGGGGATGTGCTGCAAGGCGATTATTTTGAAGATCCGACTACGC
Unused_m13mp18_90 CTCTTCGCTATTACGCCAGCTGGCGTTTTTGAAGATCCGACTACGC
Unused_m13mp18_91 CTGTTGGGAAGGGCGATCGGTGCGGTTTTTGAAGATCCGACTACGC
Unused_m13mp18_92 GCGCCATTCGCCATTCAGGCTGCGCTTTTGAAGATCCGACTACGC
Unused_m13mp18_93 CGCTTCTGGTGCCGAAACCAGGCATTTTGAAGATCCGACTACGC
Unused_m13mp18_94 ATCGCACTCCAGCCAGCTTTCCGGCTTTTGAAGATCCGACTACGC
Unused_m13mp18_95 GACGACGACAGTATCGGCCTCAGGATTTTGAAGATCCGACTACGC
Unused_m13mp18_96 GTAACCGTGCATCTGCCAGTTTGAGTTTTGAGATCCGACTACGC
Unused_m13mp18_97 GGTACGTTGGTGTAAGTGGGCGCATTTTGAAGATCCGACTACGC
Unused_m13mp18_98 AAACGGCGGATTGACCGTAATGGGATTTTGAAGATCCGACTACGC
Unused_m13mp18_99 ACAACCCGTCGGATTCTCCGTGGGATTTTGAAGATCCGACTACGC
Unused_m13mp18_100 TTCATCAACATTAAATGTGAGCGAGTTTTGAGATCCGACTACGC