Supporting Information

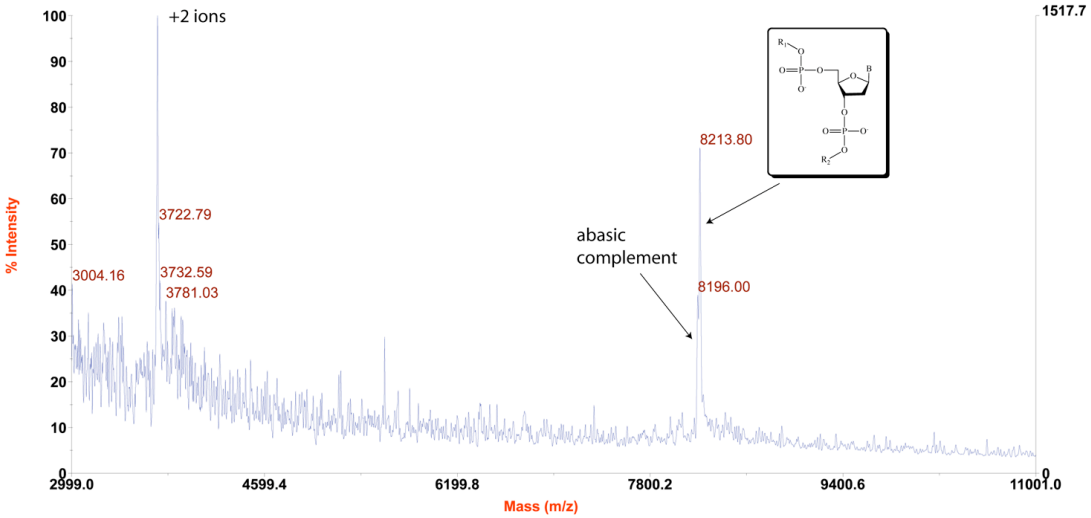
S1. MALDI-TOF spectrograph of unreacted AB1-C assembly

S2. MALDI-TOF spectrograph of unreacted AB1-MM assembly

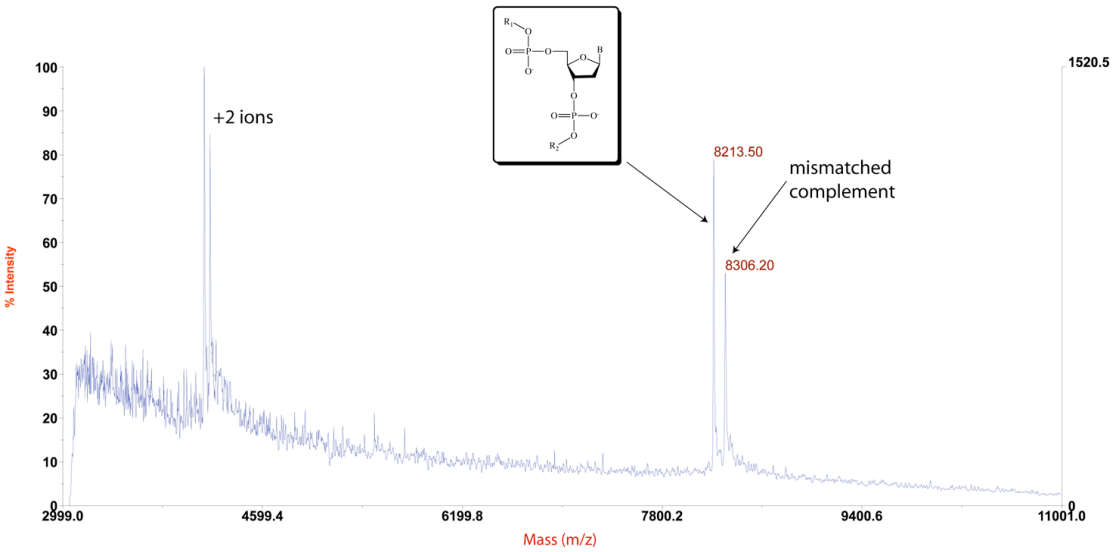
S3. MALDI-TOF spectrograph of photocleavage reaction with $Rh(bpy)_2(chrysi)^{3+}$ and AB1-MM assembly

S4. MALDI-TOF spectrograph of unreacted B1-C assembly

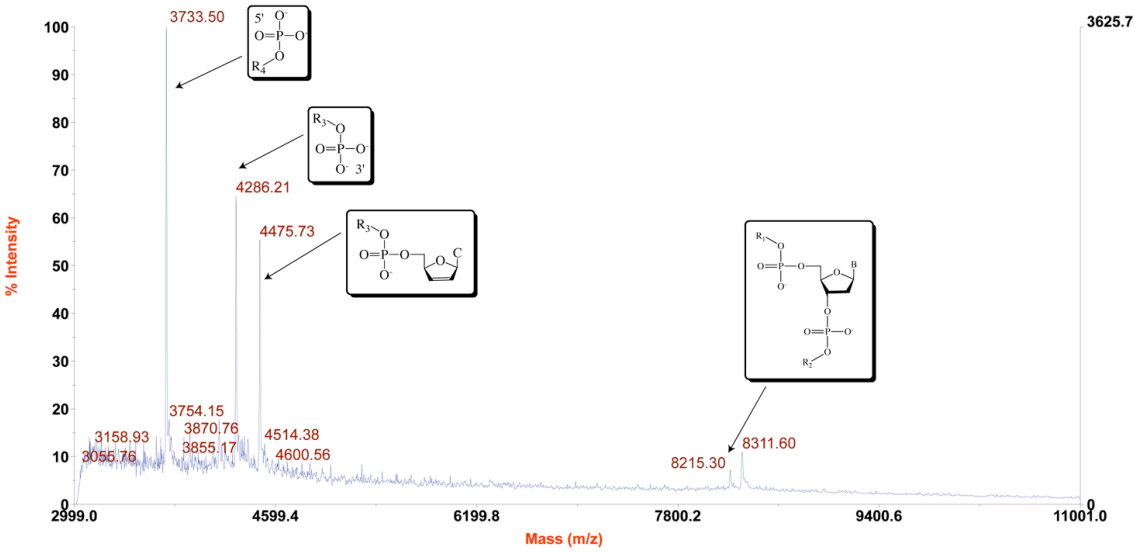
S5. MALDI-TOF spectrograph of photocleavage reaction with $Rh(bpy)_2(chrysi)^{3+}$ and B1-C assembly



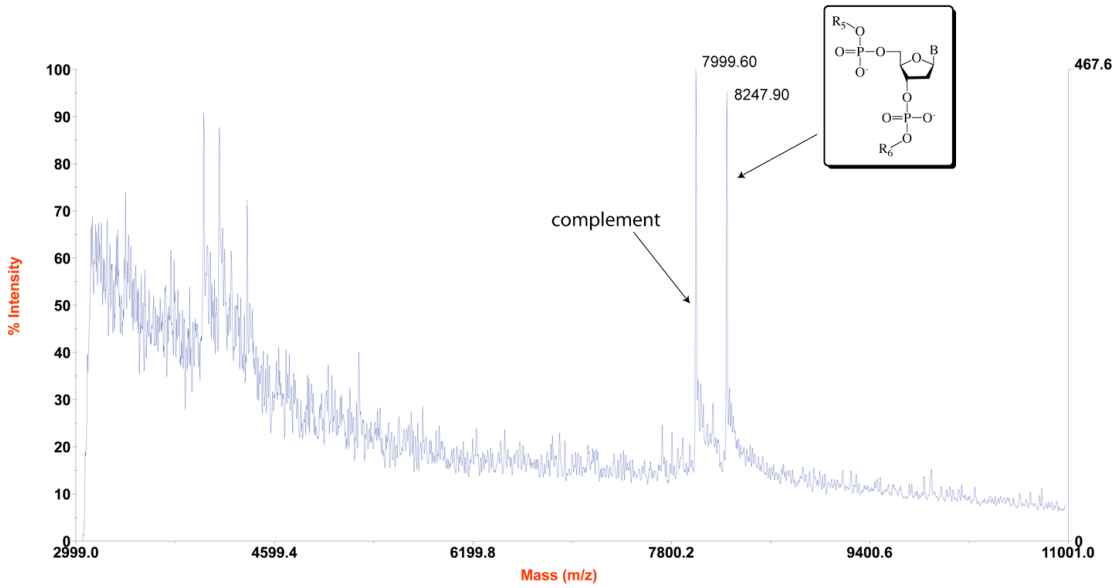
S1. MALDI-TOF mass spectrograph of unreacted duplex AB1-C, 5'- GAC CAG CTT ATC A*C*C CCT AGA TAA GCG -3' in which the underlined, italicized cytosine is the unpaired complement of an abasic site. R_1 = GAC CAG CTT ATC A; R_2 = CCC TAG ATA AGC G; B = cytosine.



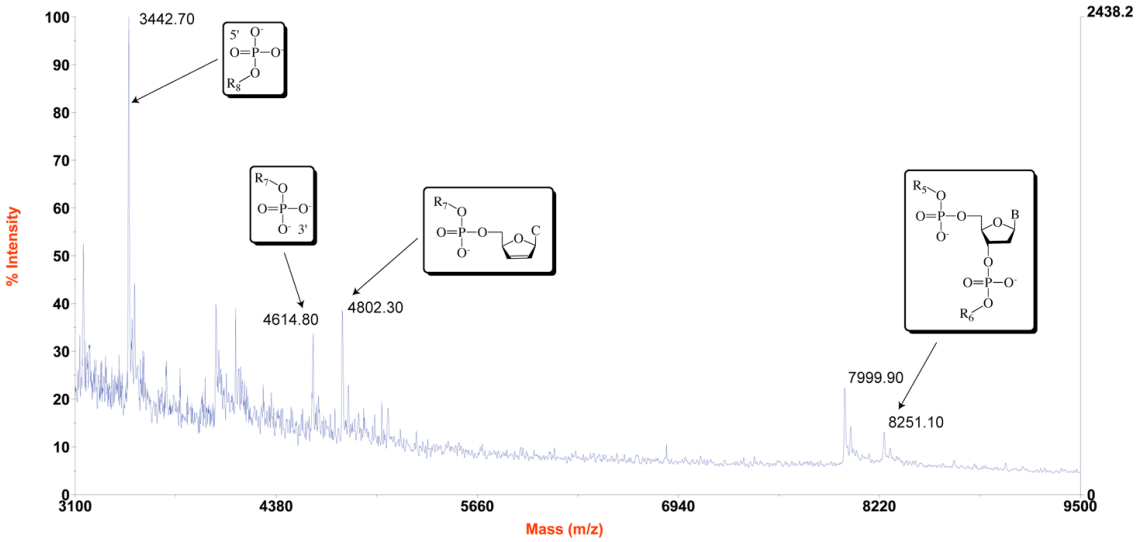
S2. MALDI-TOF mass spectrograph of unreacted duplex AB1-MM. R_1 = GAC CAG CTT ATC A; R_2 = CCC TAG ATA AGC G; B = cytosine.



S3. MALDI-TOF mass spectrograph of photocleavage products of duplex AB1-MM, 5'-GAC CAG CTT ATC A*C*C CCT AGA TAA GCG -3' in which the underlined, italicized cytosine is the complement of a mismatched C. The rightmost peaks correspond to the full, uncleaved parent strands. Assigned scission products can be viewed on the left-hand side of the plot and correspond to 5'-PO_4-CCT AGA TAA GCG-3', 5'-GAC CAG CCT ATC A*C*-PO_4-3', and 5'-GAC CAG CCT ATC A*C*-dehydroC-3'. R_1 = GAC CAG CTT ATC A; R_2 = CCC TAG ATA AGC G; R_3 = GAC CAG CCT ATC A*C*; R_4 = CCT AGA TAA GCG; B = cytosine.



S4. MALDI-TOF mass spectrograph of unreacted duplex B2-A. R_5 = GAC CAG CTT ATC AT; R_6 = CCT AGA TAA GCG; B = Adenine.



S5. MALDI-TOF mass spectrograph of photocleavage products of duplex B2-A, 5'-GAC CAG CTT ATC AT*A* CCT AGA TAA GCG -3' in which the underlined, italicized adenine is the unpaired, bulged base. The rightmost peaks correspond to the full, uncleaved parent strands. Assigned scission products can be viewed on the left-hand side of the plot and correspond to 5'-PO_4-CTA GAT AAG CG-3', 5'-GAC CAG CCT ATC AT*A*-PO_4-3', and 5'-GAC CAG CCT ATC AT*A*-dehydroC-3'. R_5 = GAC CAG CTT ATC AT; R_6 = CCT AGA TAA GCG; R_7 = GAC CAG CCT ATC AT*A*; R_8 = CTA GAT AAG CG; B = Adenine