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Analyzing and Classifying Single Molecule Microscopy Data

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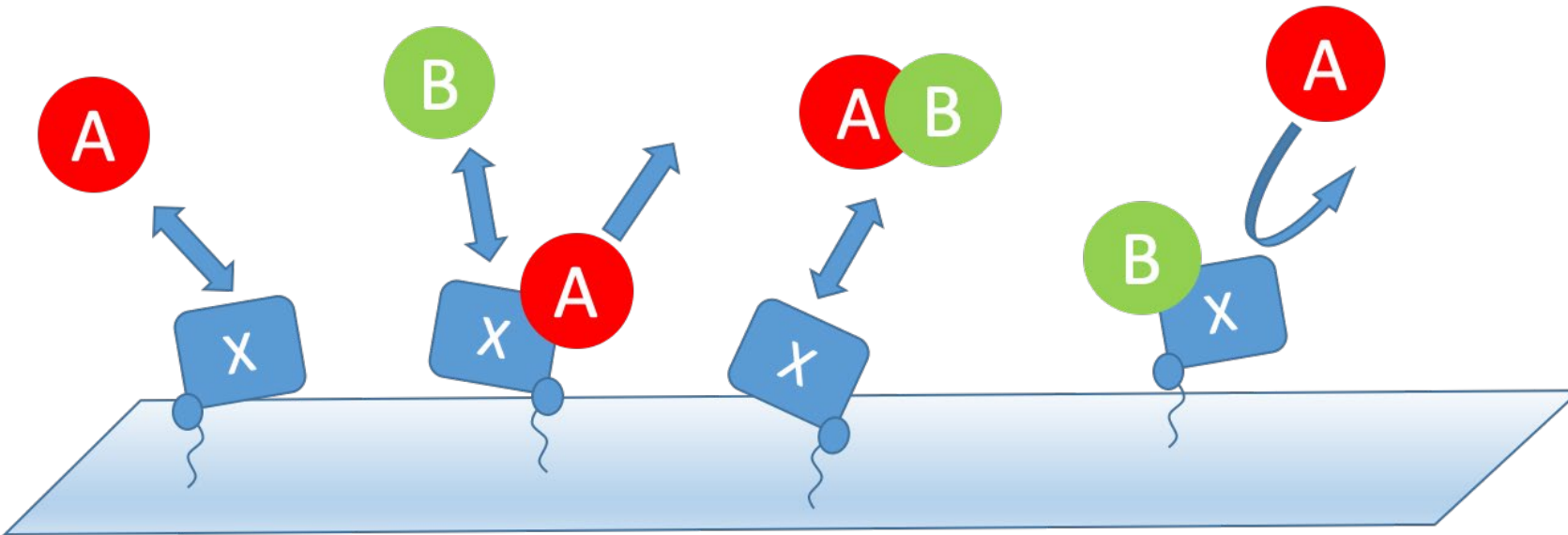
Analyzing and Classifying Single Molecule Microscopy Data

Troy Buzynski University of Northern Iowa

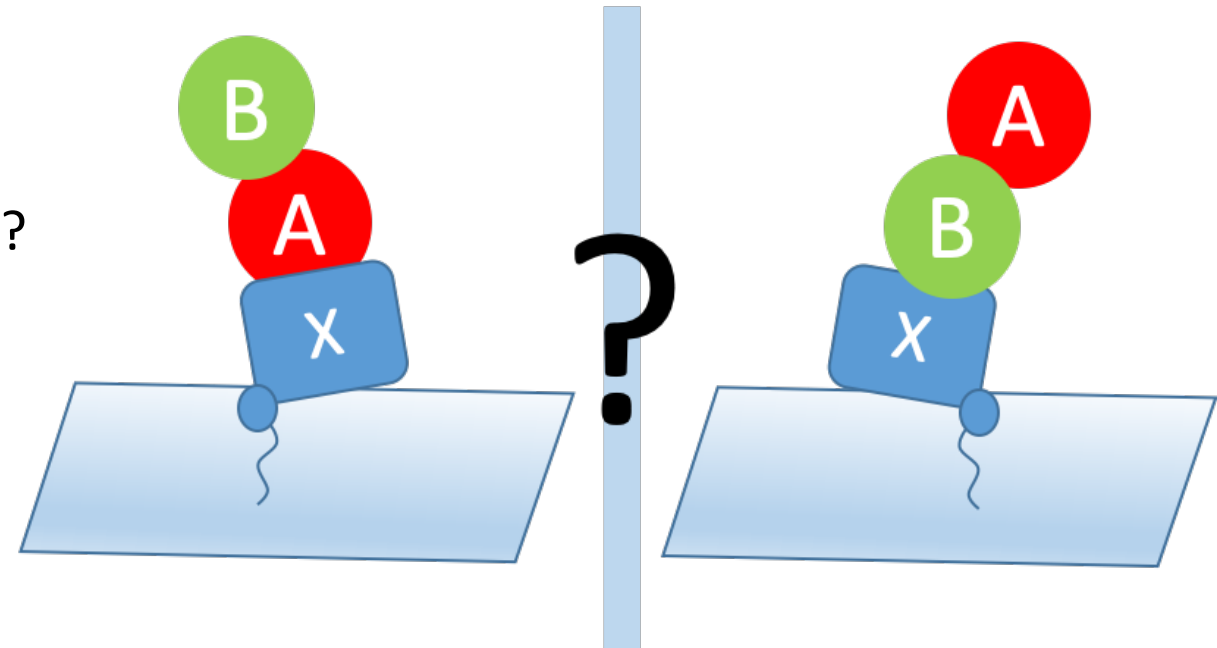
Purpose

- **Discover the equations that describe the individual interactions between proteins and DNA. Determine the probabilities of each type of interaction.**
- DNA damage is a common occurrence. Organisms have a natural process to repair this damage, but when this process does not function properly it can cause disease, namely cancer. We are attempting to discover more about this process in hope that it leads to better techniques for dealing with diseases such as cancer.

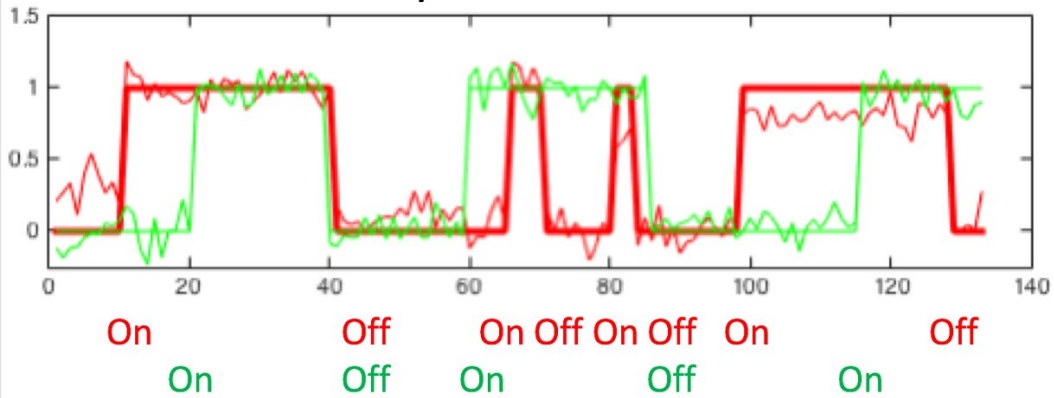
How do these proteins interact?



Does the binding of "B" cause "A" to unbind?
Do "A" and "B" bind together and then bind to the DNA?
If "B" is bound, does the inhibit the binding of "A"?



What kind of interactions are most common?

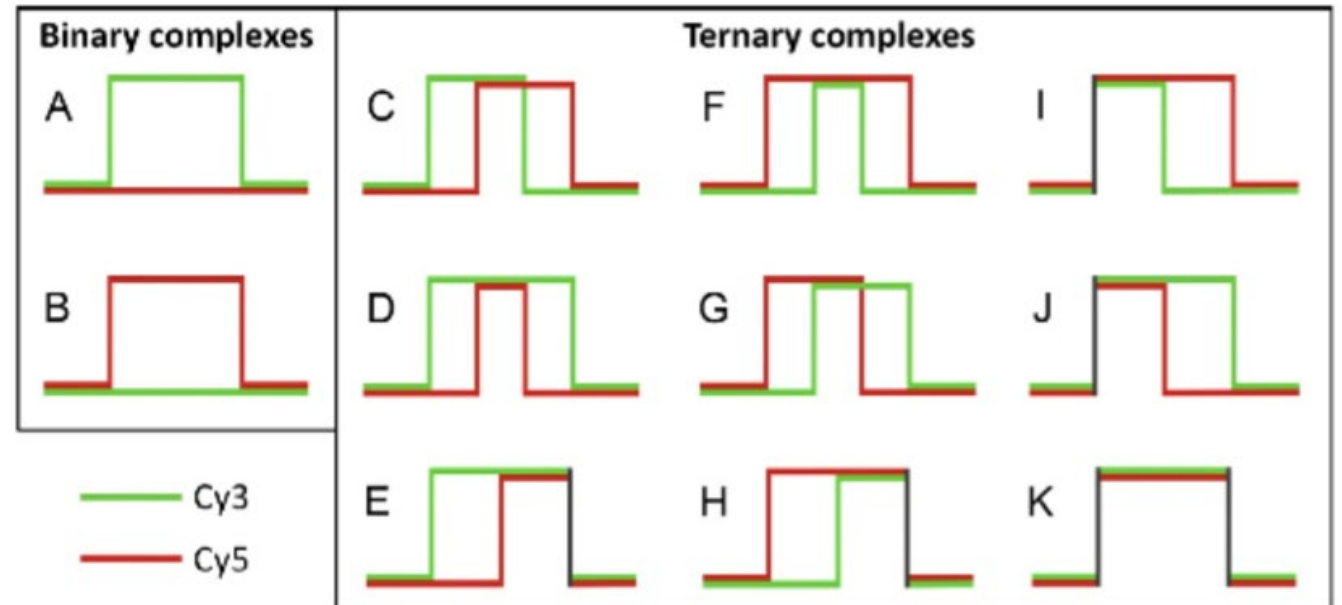


Signal and Noise

We process the DATA using KERA (Kinetic Event Resolving Algorithm) to give us an Idealized signal.

Search for Patterns

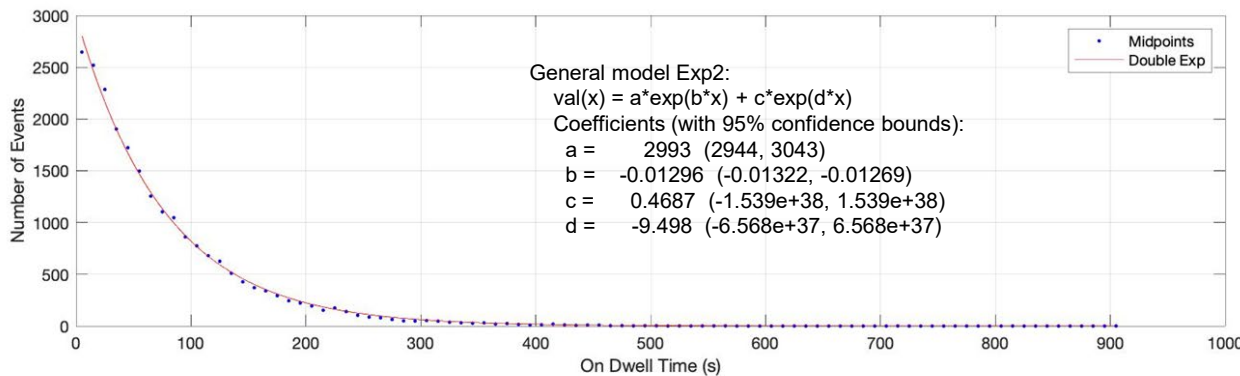
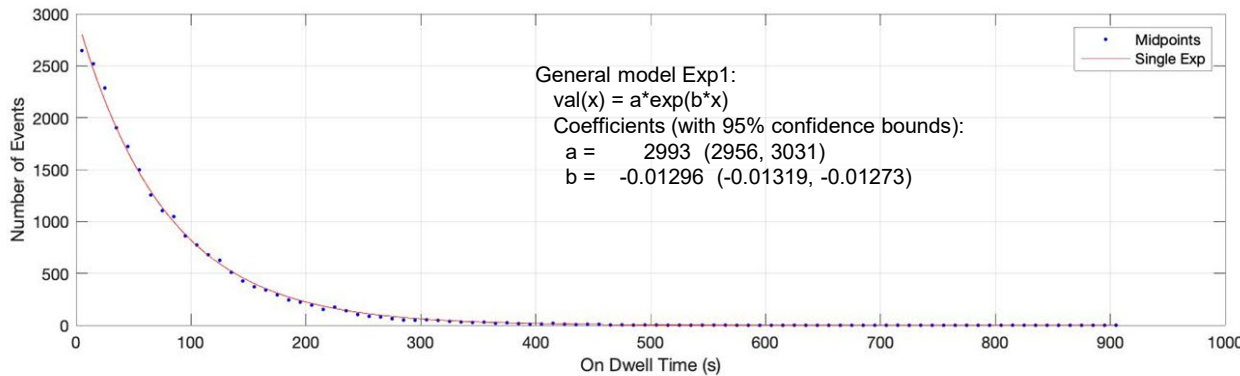
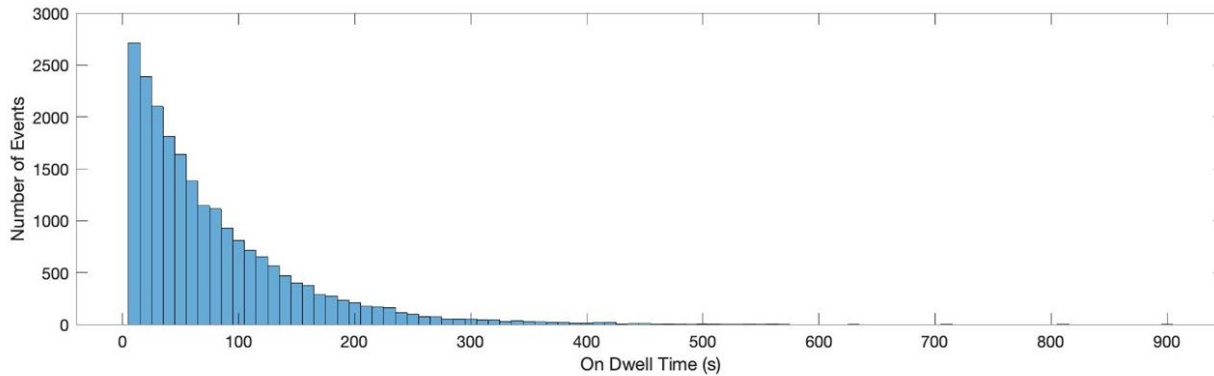
We record the occurrence of certain patterns or events.



The DATA

expr	count	meanLength	eventList	timeLengths	table	count_Gaps	meanLength_Gaps
'All events'	5469	431.3129	5469x1 cell	5469x1 double	5469x7 t...	5217	4.8427e+03
'_ 4 -4 _'	2811	329.7901	2811x1 cell	2811x1 double	2811x7 t...	1737	4.4303e+03
'_ 1 -1 _'	2178	367.7089	2178x1 cell	2178x1 double	2178x7 t...	1163	3.7233e+03
'_ 1 4 -4 -1 _'	131	965.9542	131x1 cell	131x1 double	131x7 ta...	6	1.3267e+03
'_ 4 1 -1 -4 _'	82	1.5890e+03	82x1 cell	82x1 double	82x7 table	2	460
'_ 1 4 -1 -4 _'	37	1.0646e+03	37x1 cell	37x1 double	37x7 table	0	NaN
'_ 4 1 -4 -1 _'	35	846.8571	35x1 cell	35x1 double	35x7 table	0	NaN
'_ 5 -4 -1 _'	24	467.5000	24x1 cell	24x1 double	24x7 table	0	NaN
'_ 1 4 -5 _'	22	727.2727	22x1 cell	22x1 double	22x7 table	1	1080
'_ 5 -5 _'	21	367.1429	21x1 cell	21x1 double	21x7 table	0	NaN

1	2	3	4	5	6	7
Events	Total_Duration	Time_Points	Delta_t	Time_first	Time_last	File
[1,4,-4,-1]	240	[25120,25270,25350,25360]	[150,80,10]	150	10	'25 tr1001.dwt'
[1,4,-4,-1]	210	[5860,5980,6000,6070]	[120,20,70]	120	70	'25 tr1014.dwt'
[1,4,-4,-1]	420	[26970,27320,27340,27390]	[350,20,50]	350	50	'25 tr1047.dwt'
[1,4,-4,-1]	970	[6170,6480,6500,7140]	[310,20,6...]	310	640	'25 tr105.dwt'
[1,4,-4,-1]	90	[10660,10670,10690,10750]	[10,20,60]	10	60	'25 tr1077.dwt'
[1,4,-4,-1]	480	[32470,32620,32770,32950]	[150,150,...]	150	180	'25 tr1143.dwt'



Methods & Data

- What model fits the DATA better?
 - Single or Double Exponential
- What are the constants that result in the best fit?
 - Rate constants determine probability of the event

Any Questions?