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Supporting information for article:

Development of a microsecond X-ray protein footprinting facility at the Advanced Light Source

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Figure S1 **R**adiolysis of water and the timescale of sequence of events reproduced from *Liljenzin, J., Radiation Effects on Matter, in Radiochemistry and Nuclear Chemistry, 2002, Butterworth-Heinemann.*

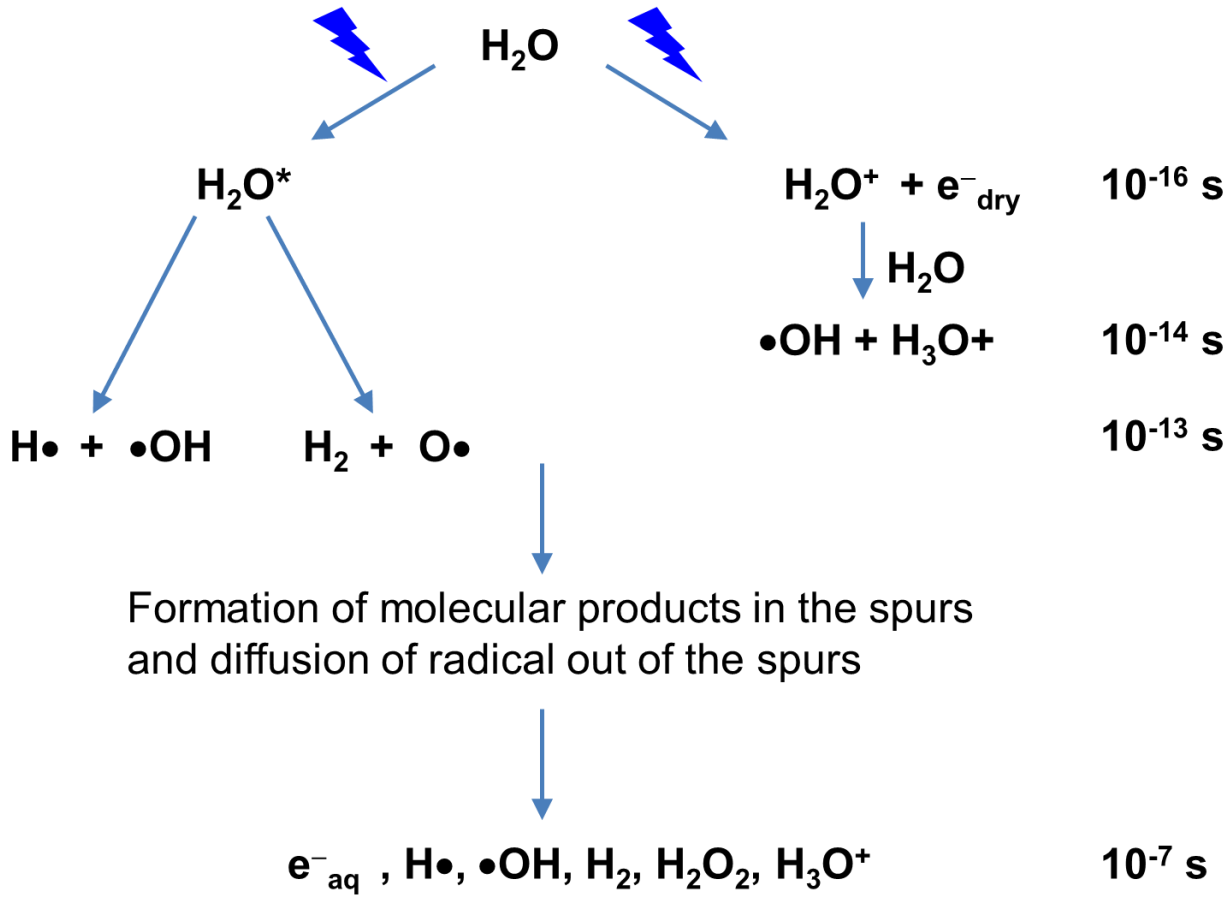

Figure S2 List of recombination reactions during the spur diffusion process, which lead to the formation of molecular or secondary radical products. The scheme is adapted from *Liljenzin, J., Radiation Effects on Matter, in Radiochemistry and Nuclear Chemistry, 2002, Butterworth-Heinemann*.

$$e_{aq}^{-} + e_{aq}^{-} = H_2 + 2OH^{-}$$

$$e_{aq}^{-} + \bullet OH = OH^{-}$$

$$e_{aq}^{-} + H_3O^{+} = H\bullet + H_2O$$

$$e_{aq}^{-} + O_2 = \bullet O_2^{-}$$

$$H\bullet + H\bullet = H_2$$

$$H\bullet + O_2 = \bullet HO_2$$

$$\bullet OH + \bullet OH = H_2O_2$$

$$\bullet OH + H\bullet = H_2O$$

$$H_3O^{+} + OH^{-} = H_2O$$

Figure S3 Molecular oxygen is necessary for radiolytic modification

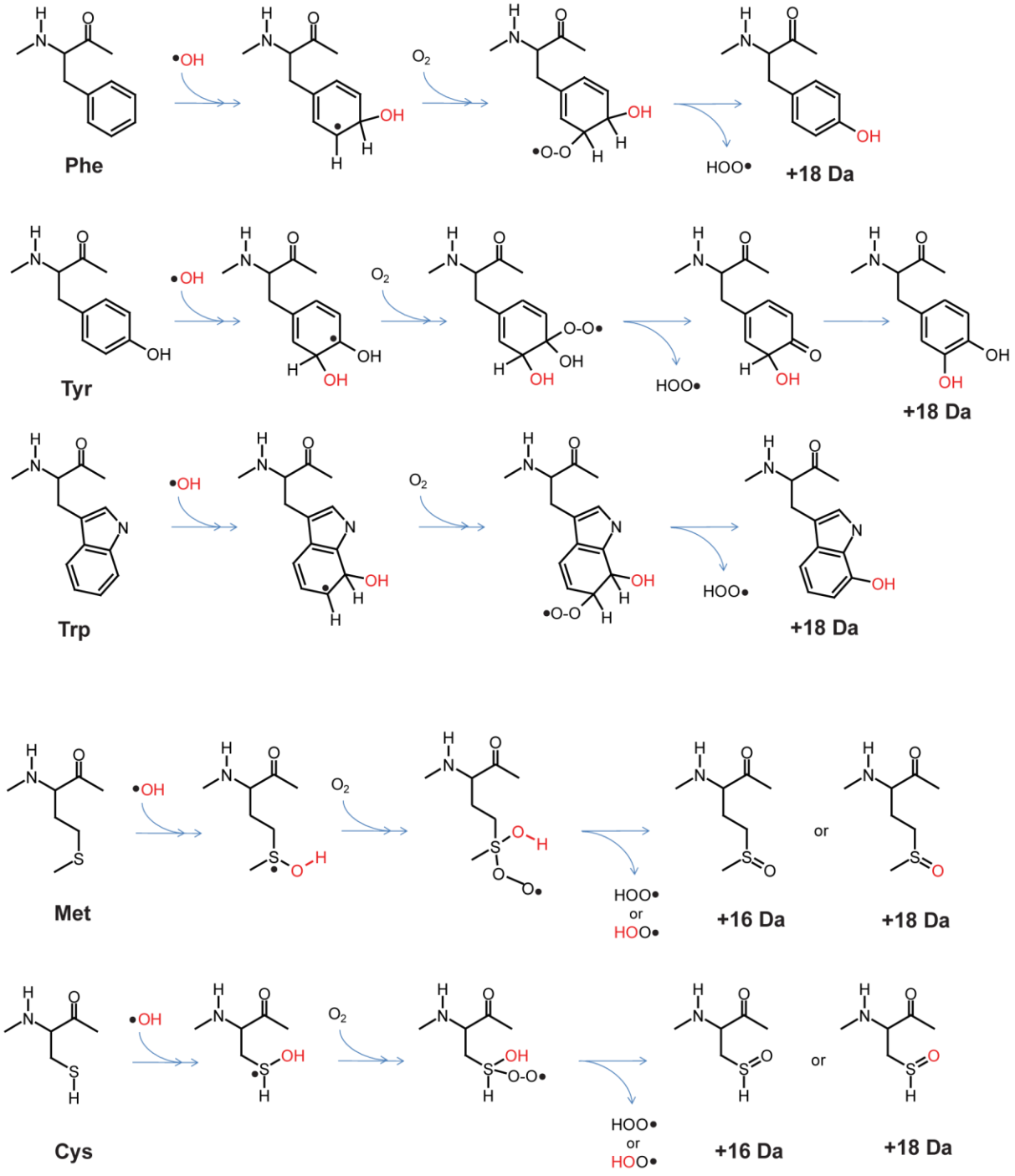

Figure S4 Alexa dose response of the buffer used for mmcpn sample exposure. The solid lines represent single exponential fits with rate constants k = 2061 sec^{-1} (black) and 740 sec^{-1} (red) for the buffers 10 mM Na-Phosphate pH 7 and 10 mM sodium cacodylate containing 1mM TCEP, 1mM ATP, ~ 5% glycerol and 120 mM NaCl.