Role of reactive oxygen intermediates in photocatalytic killing of bacterial cells

Dr. Kevin McGuigan, Dr. Siobhán C. Kehoe

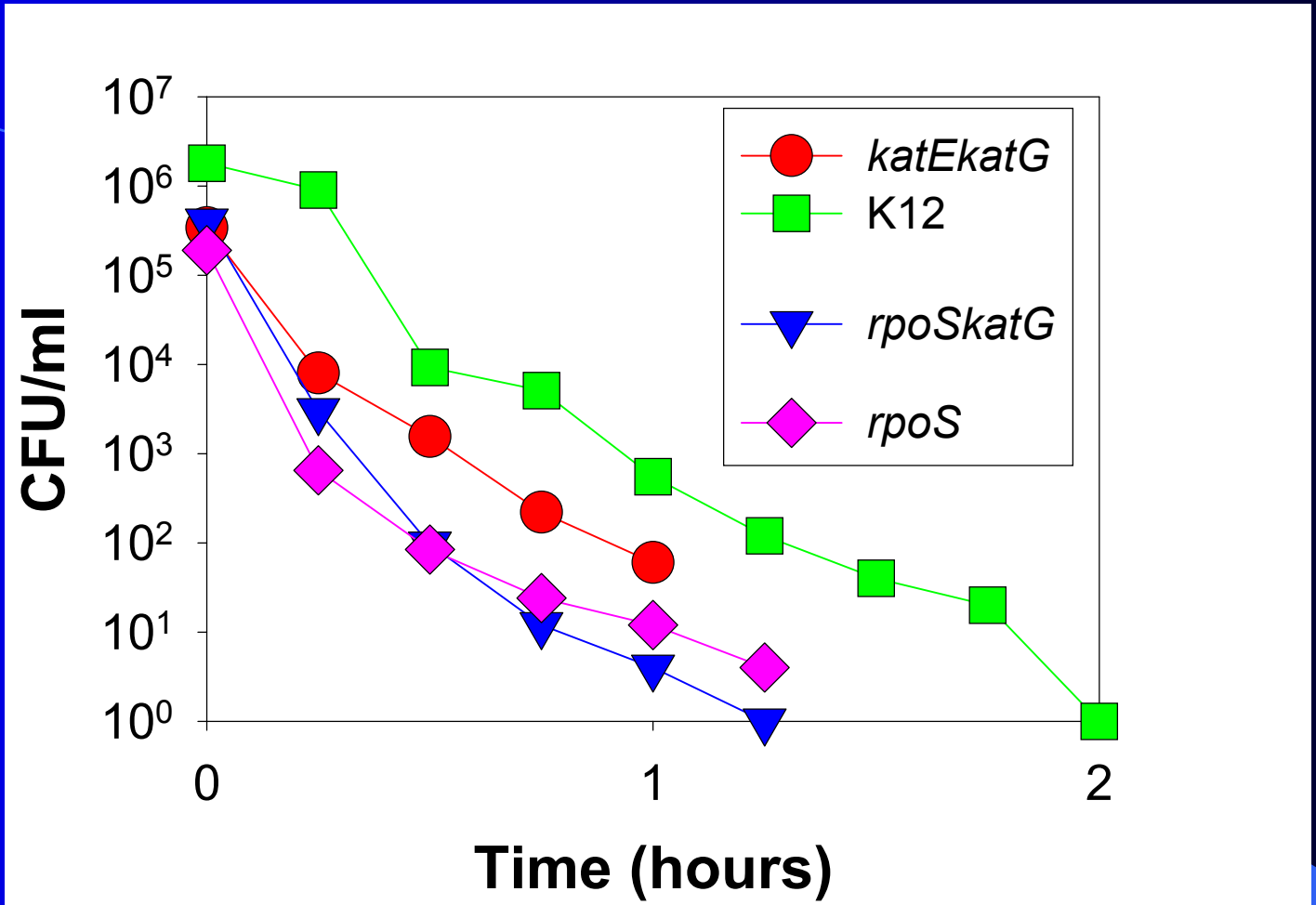
Royal College of Surgeons in Ireland

1. Photocatalysis – Solar Disinfection of Drinking Water

- Expose bottles containing TiO_2 and *E.coli* to simulated sunlight

REACTIVE OXYGEN INTERMEDIATES (ROS)

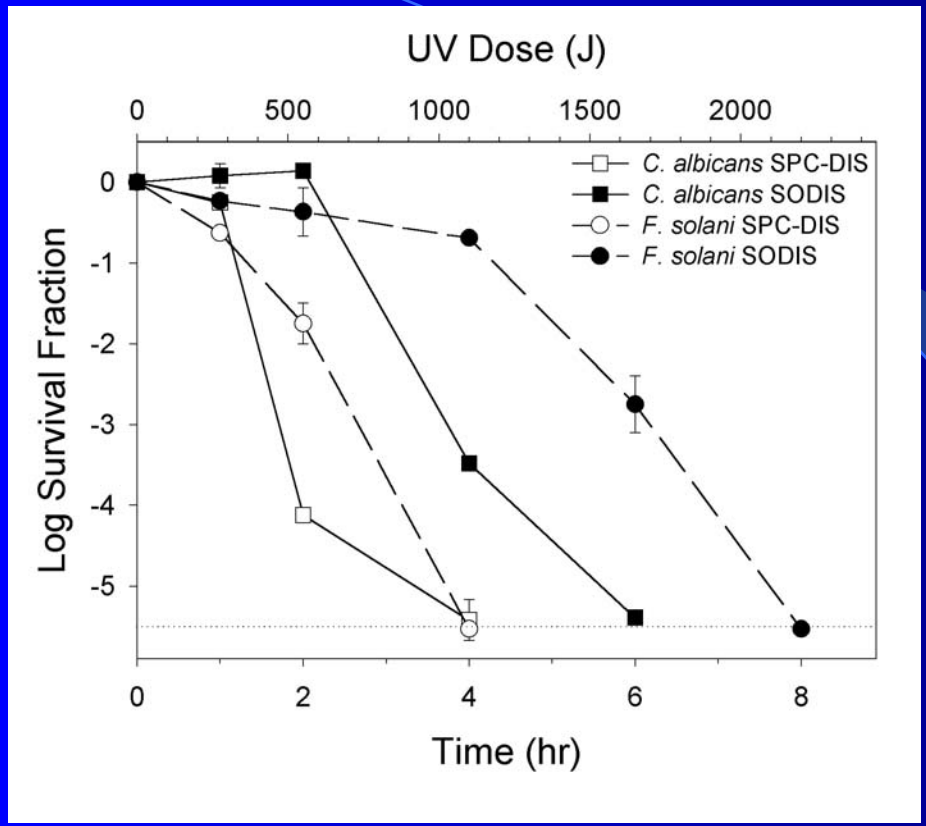
ROS	**Bacterial Response**
H_2O_2	Catalase – *katE* - *katG* (exogenous H_2O_2) *dps*
Superoxides	Superoxide dismutase – *sodA* - *sodB*
Hydroperoxides (ROOH, H^+)	Glutathione oxidoreductase
Oxidative stress (*rpoS*)	*dps*
	xthA
	katF (katE)

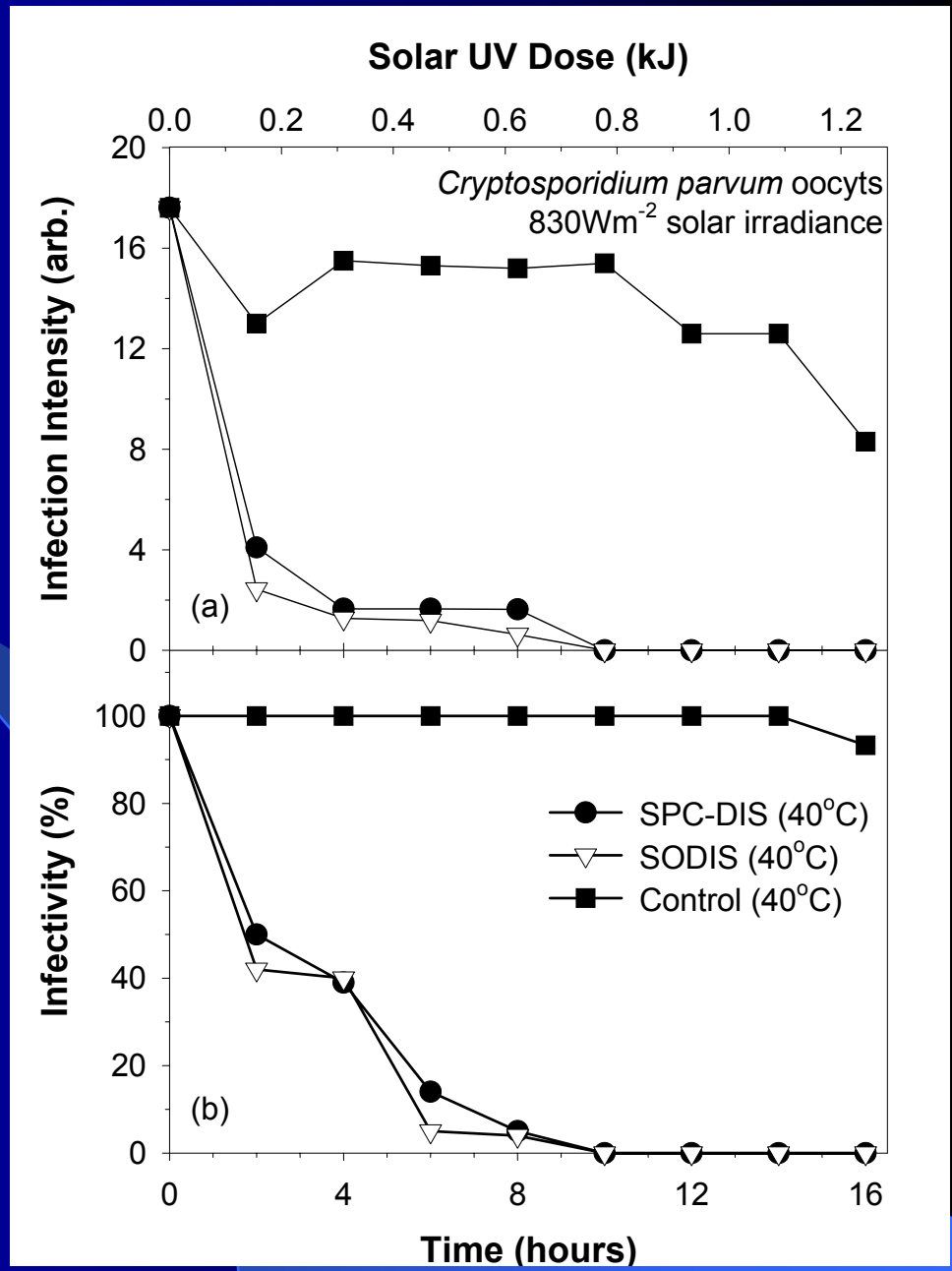


rpoS*katG* more sensitive than double catalase mutant

No significant difference between *rpoS* and *rpoSkatG*

2. Photocatalytic Disinfection of non-bacterial pathogens





Future Work:

1. Measurement of changes in endogenous antioxidant enzyme activity
2. Measurement of the expression of each enzyme by RT-PCR.
3. A cDNA array to measure complete *E. coli* K-12 gene expression before and after photocatalysis
4. Measurement of direct membrane damage
5. SPC-DIS of Viral pathogens.
6. Pathogenic biofilm inactivation on medical implant surfaces.