



Monitoring the Air for Toxic and Genotoxic Compounds

Kim Rogers

Why Are We Interested in Monitoring Toxic Vapors ?

- Industrial Contamination
 - Deliberate
 - Accident
- Homeland Security

Why Toxicity Monitoring ?

- Simple
- Rapid
- Sensitive
- Adaptable from Commercial Sector
- Biochemical / Physiological Relevance

What Compounds Are of Interest ?

- Toxic Industrial Chemicals (TICs)
 - High Risk
 - Toxic Gasses
 - Medium Risk
 - Toxic Volatiles
- Chemical Warfare Agents (CWAs)
- Non-Traditional Agents (NTAs)

Adapt Waste Water Screening Assays for Air Monitoring

- Acute Toxicity

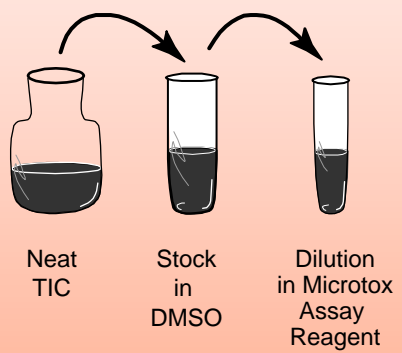
 - Microtox

 - IQ-Tox *Daphnia magna*

- Genotoxicity

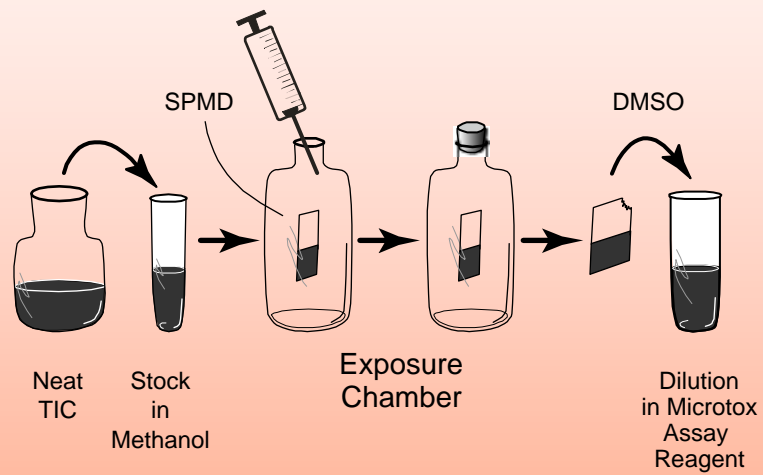
 - DNA Melting/Annealing Analysis

Direct Microtox Assay



EC_{50}

Vapor Accumulation Assay

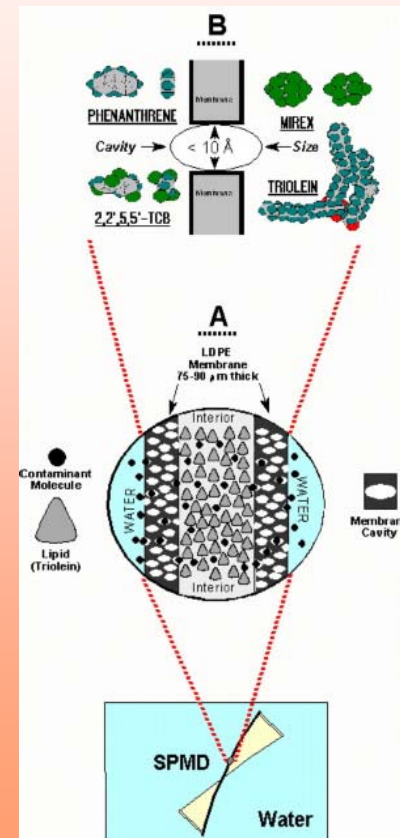


$AppEC_{50}$

SPMD

How Does It Work

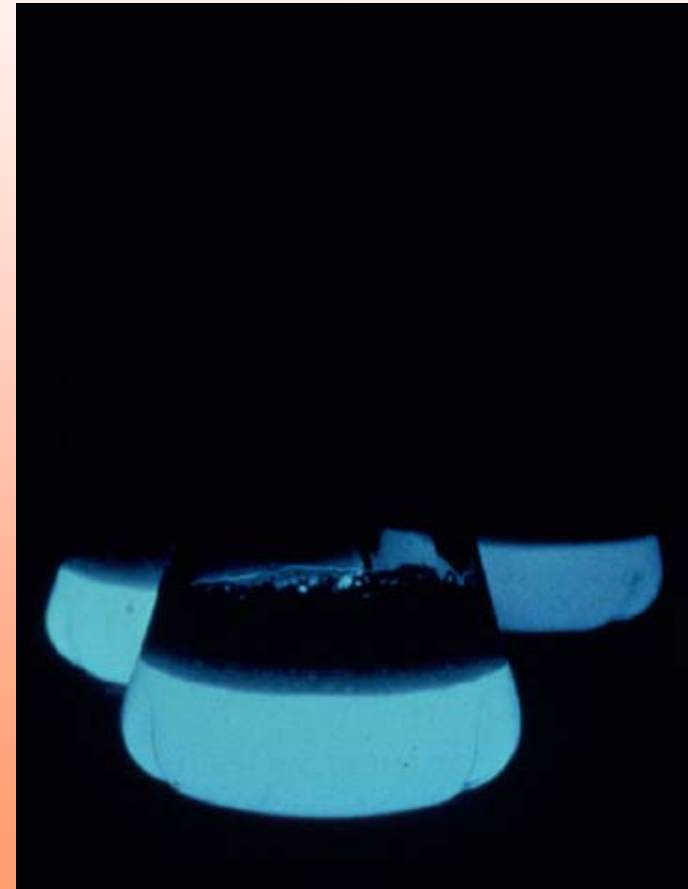
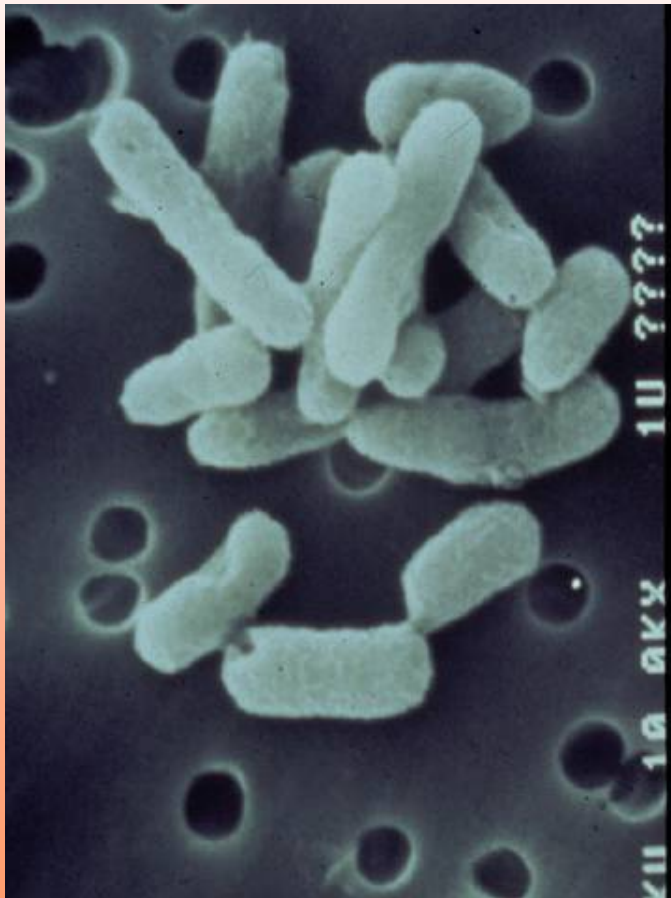
- Low Density Polyethylene
 - 10A pores
- Biological Mimic
 - Triolein, DMSO, Carbon
- After Deployment
 - Direct assay
 - Extract with solvent

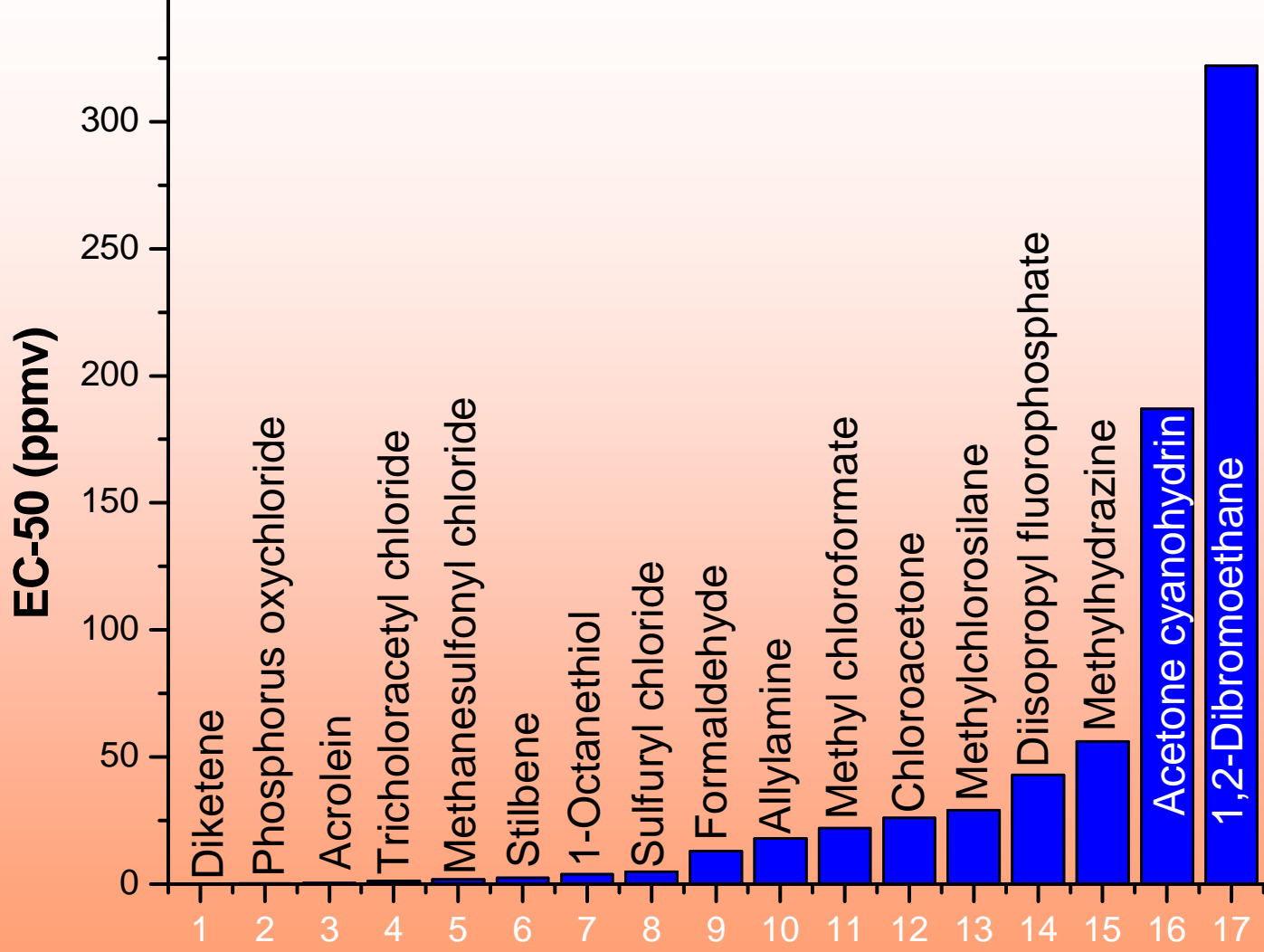


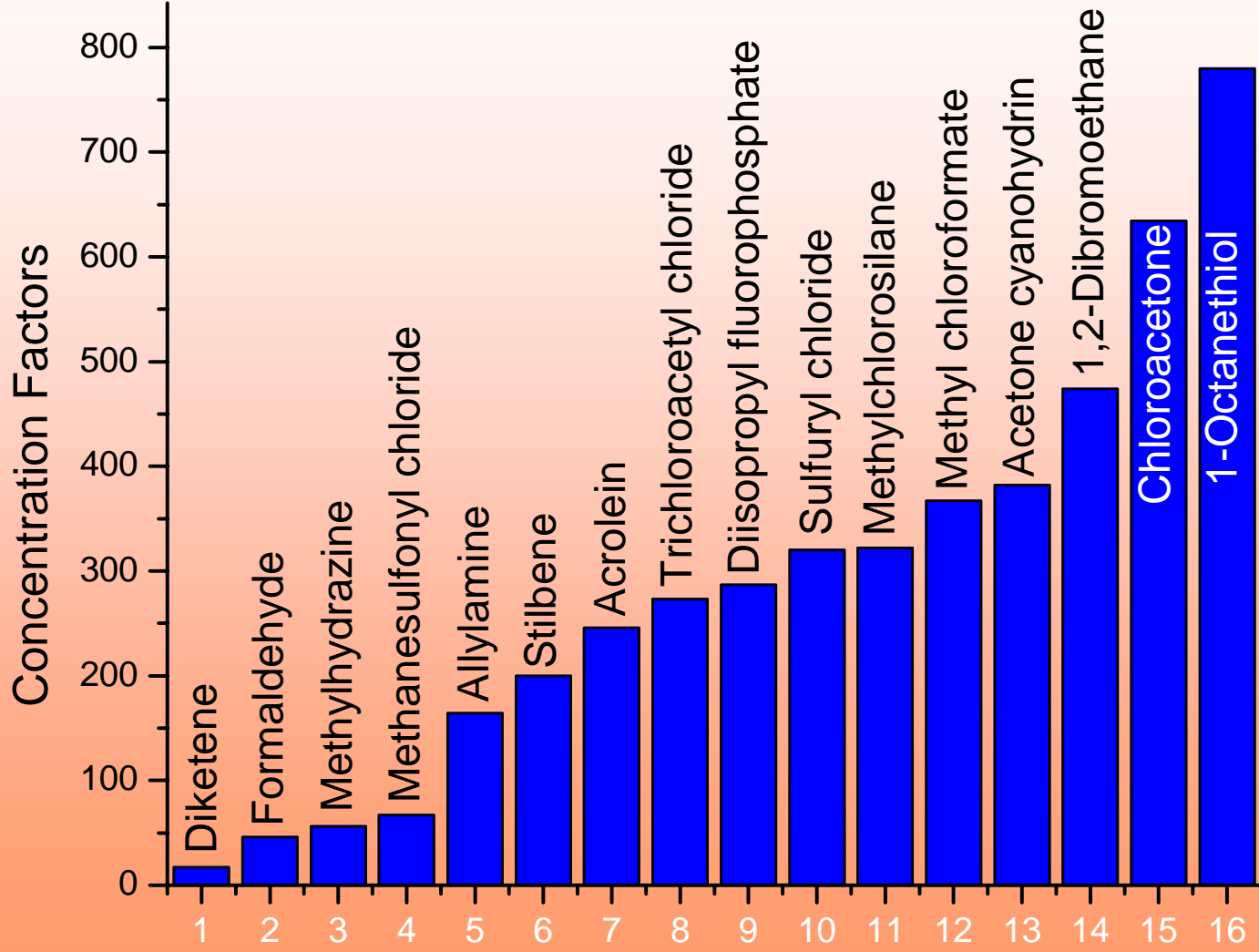
SPMD in 40 mL and 4L Exposure Chambers



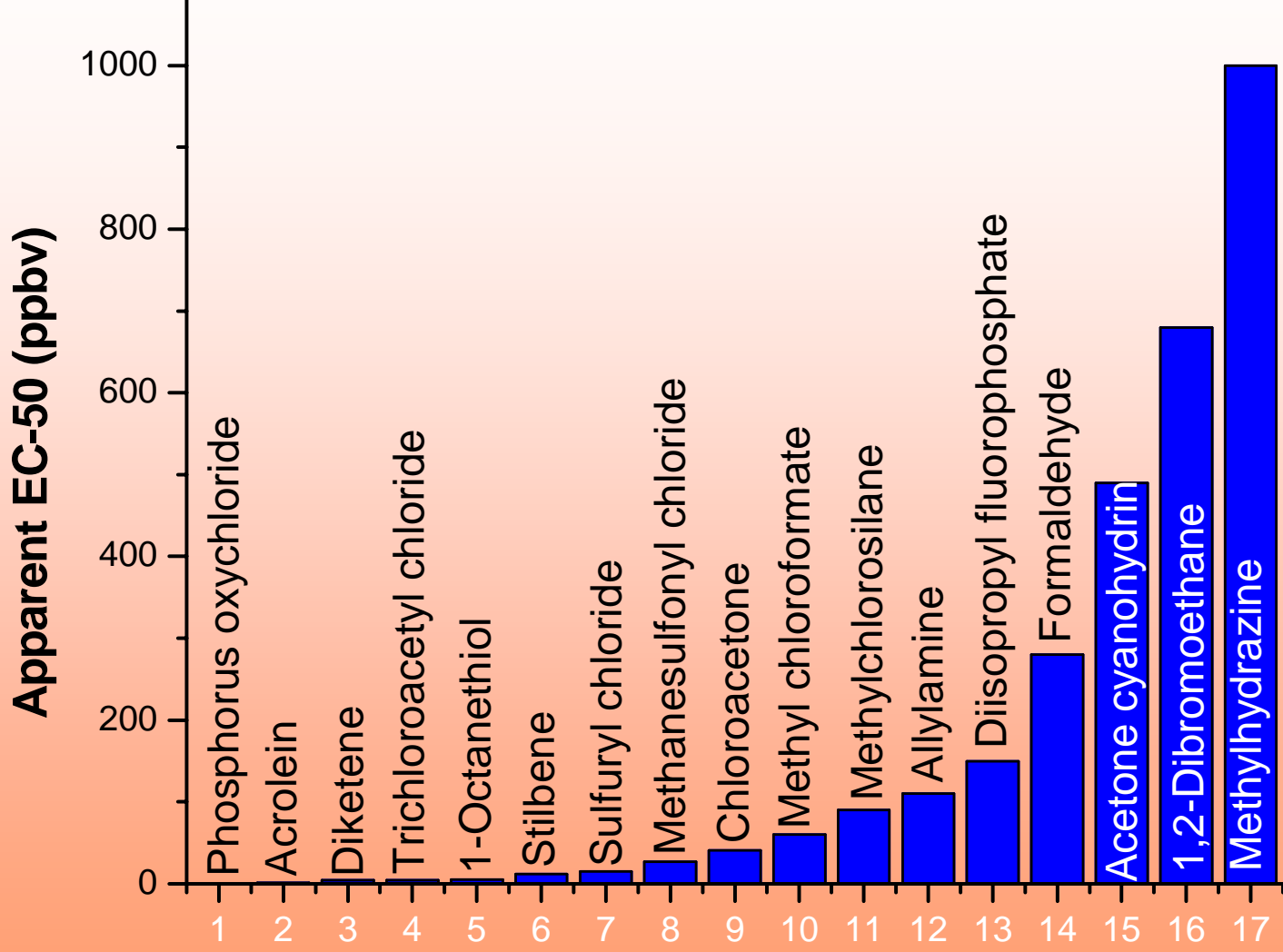
Microtox Reagent (bacterium)
Photobacterium vibrio

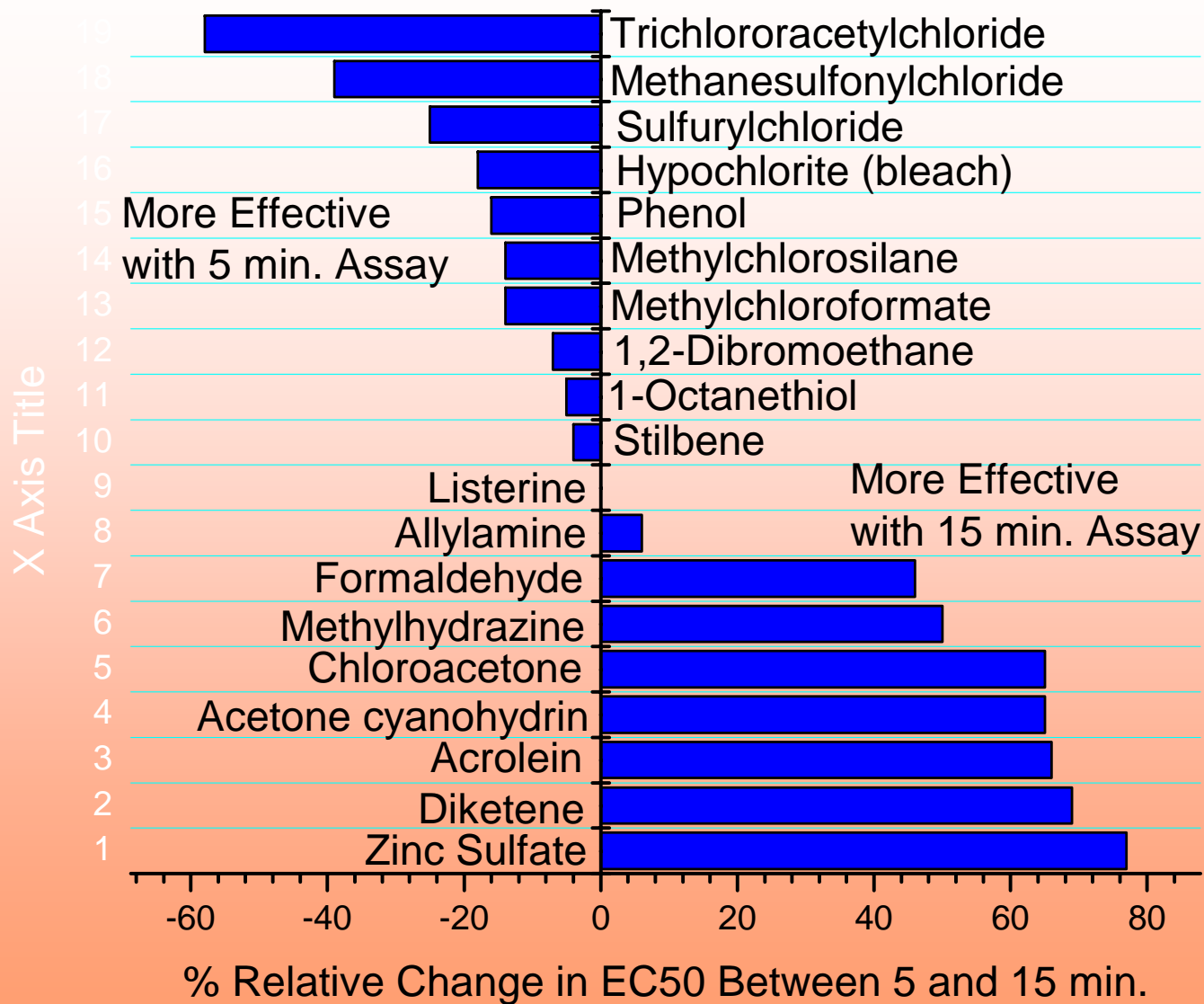


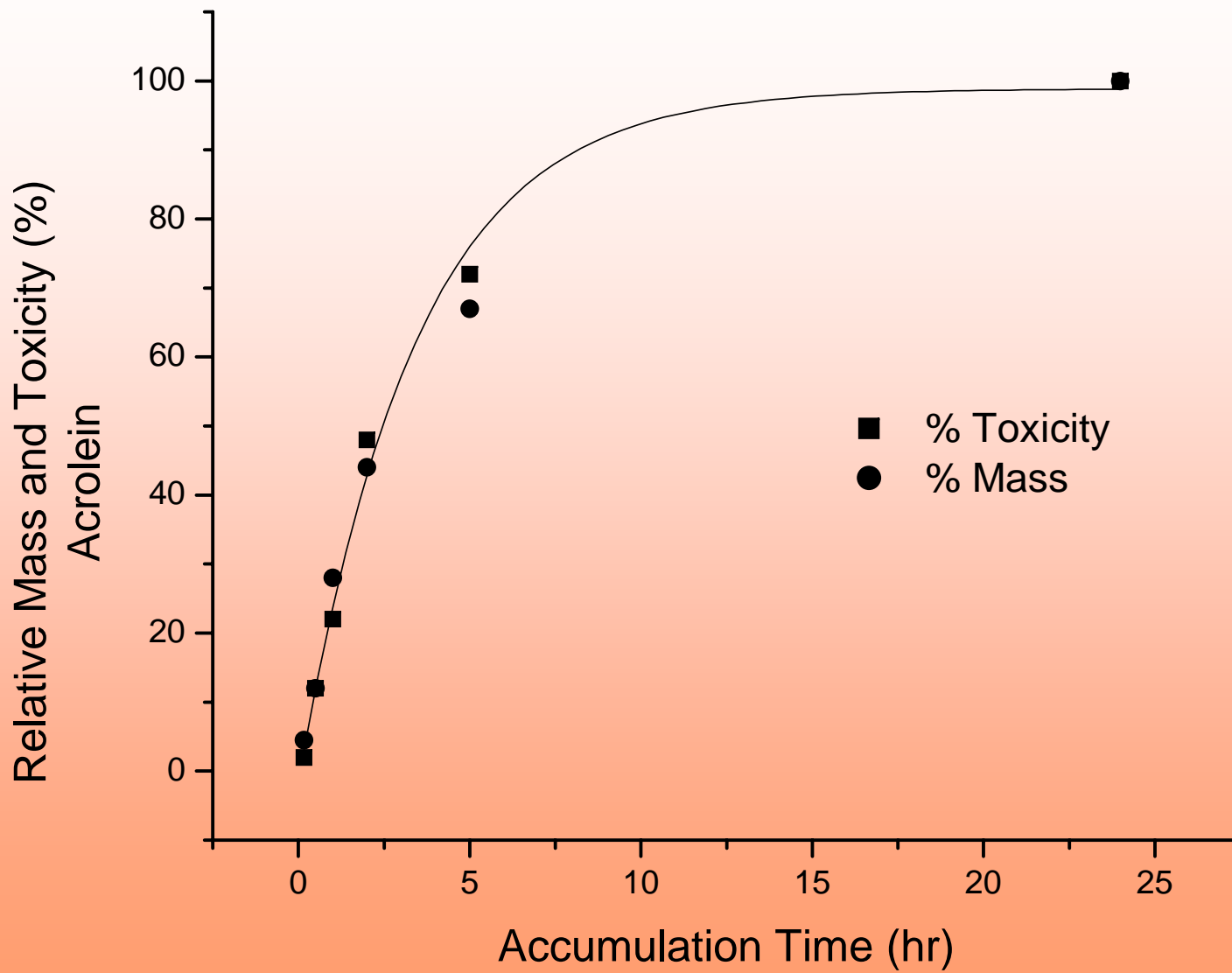




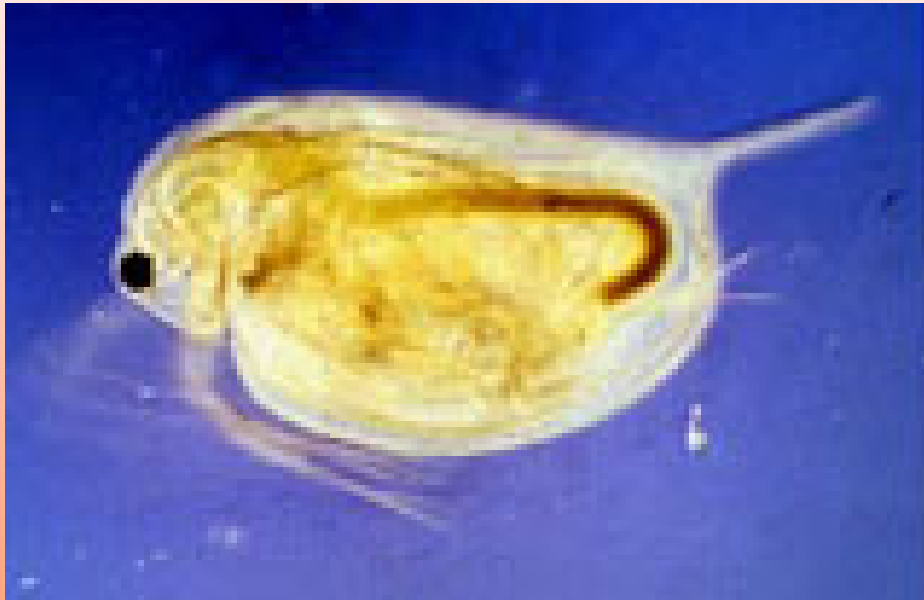
Phosphorus oxychloride -- 5,400

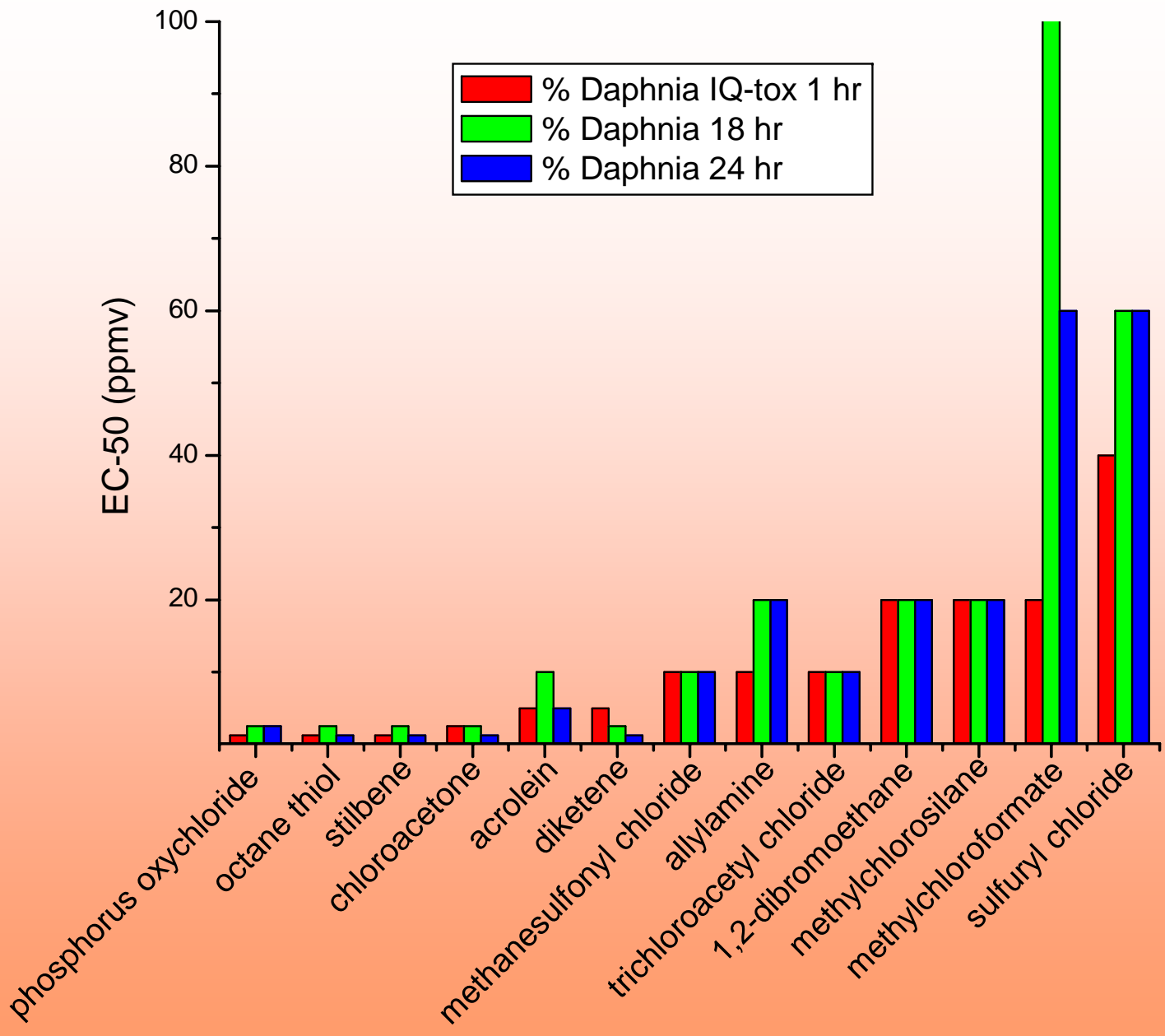


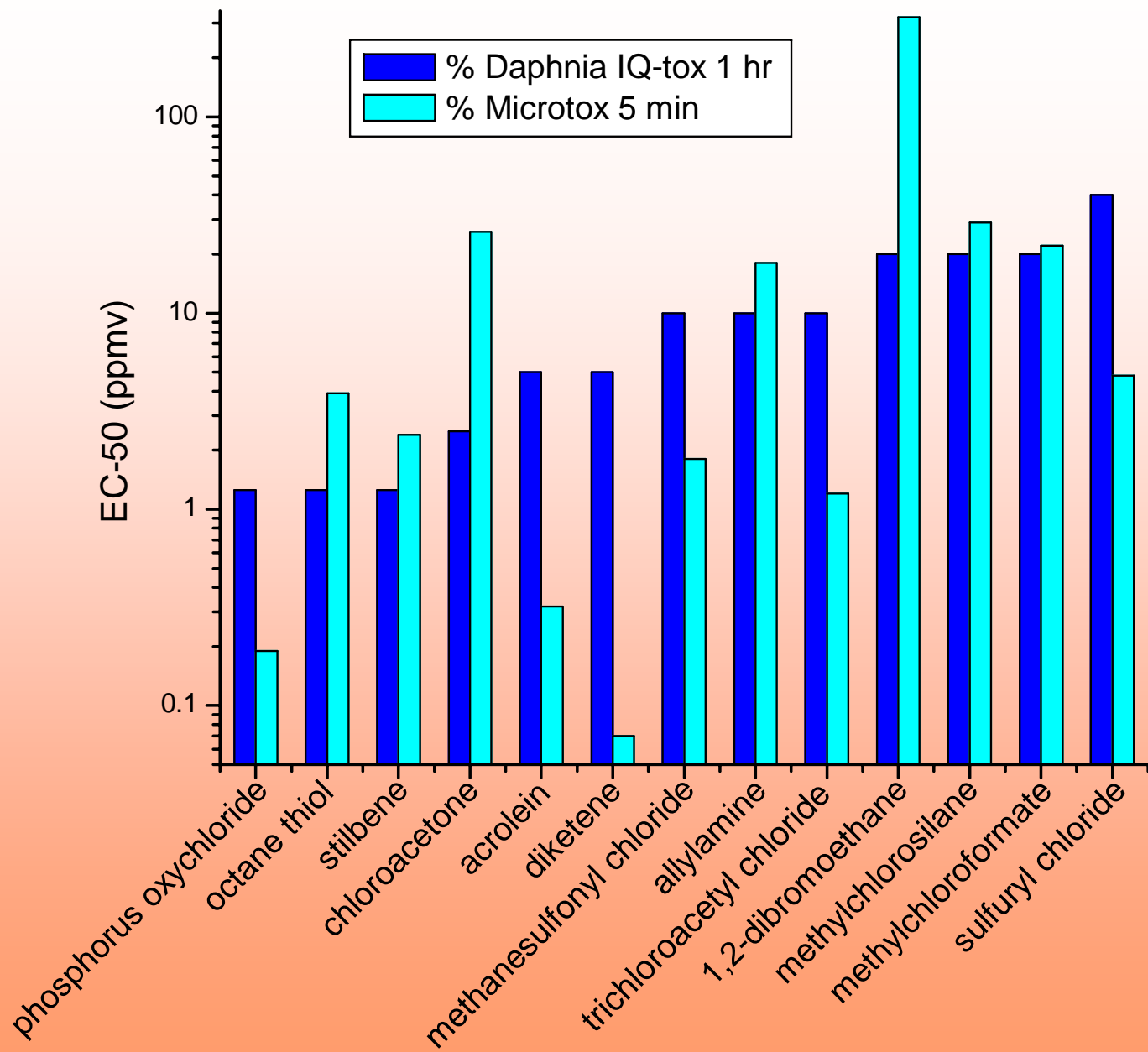




Daphnia magna Used in the IQ-Tox Test

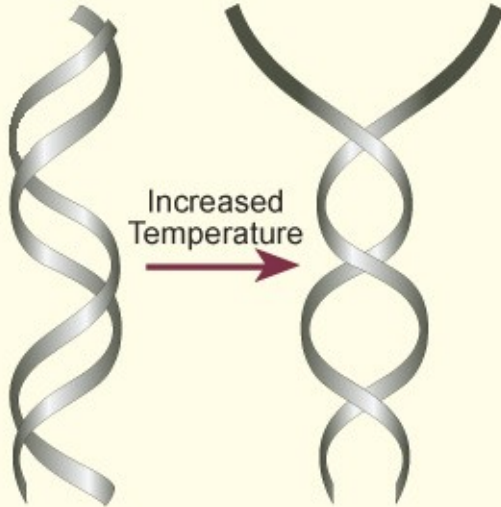






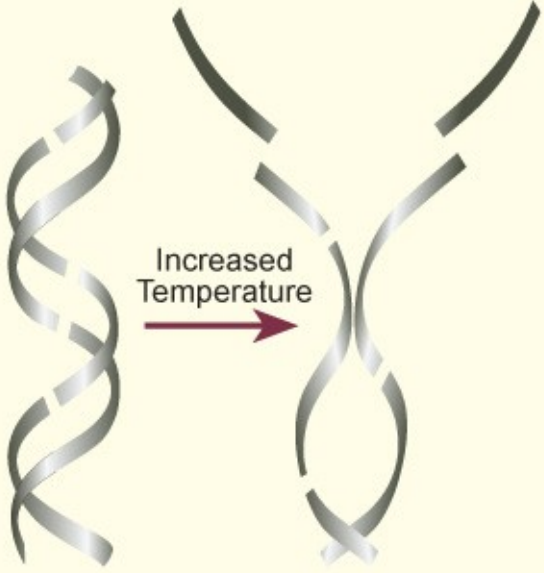
Control DNA

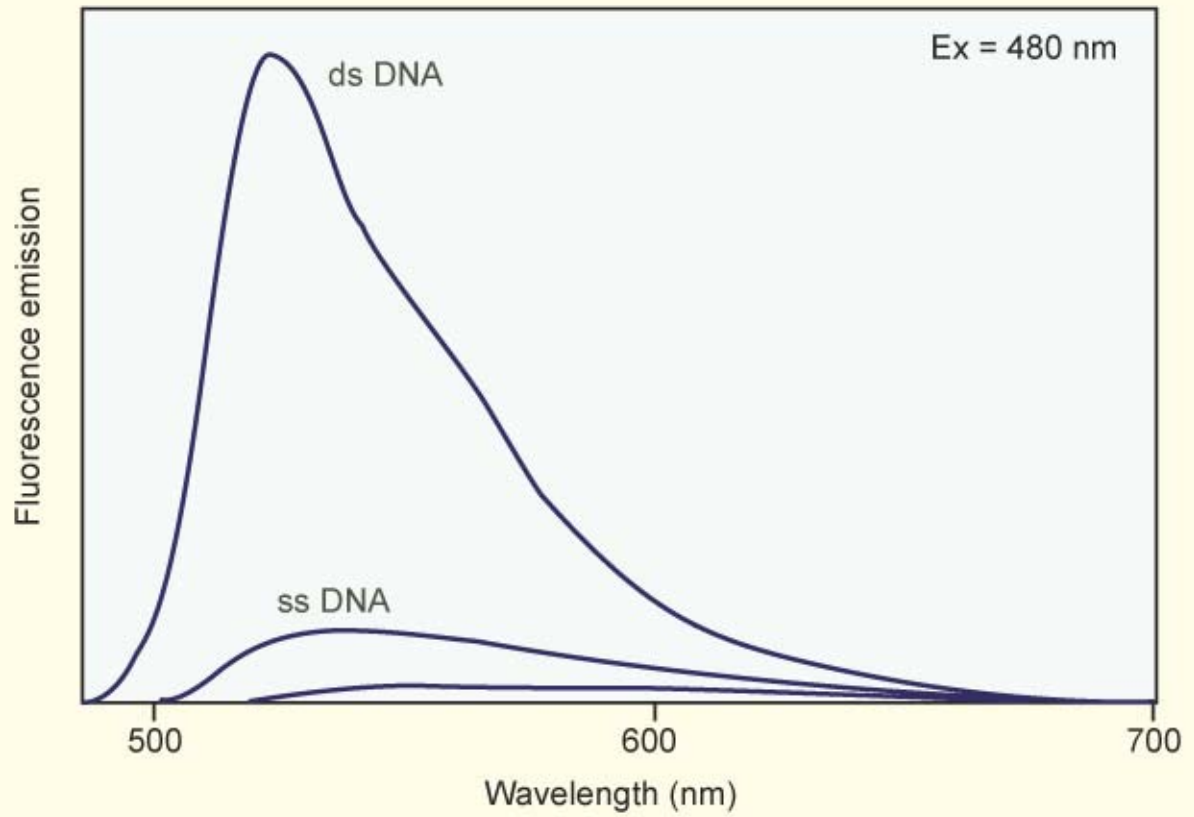
Increased Temperature

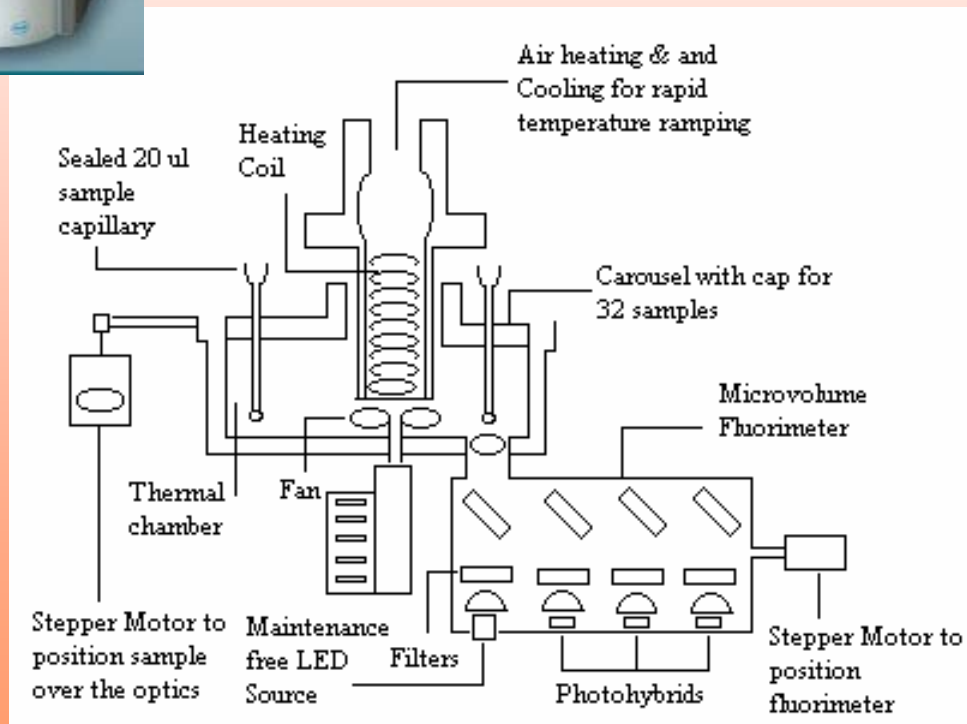


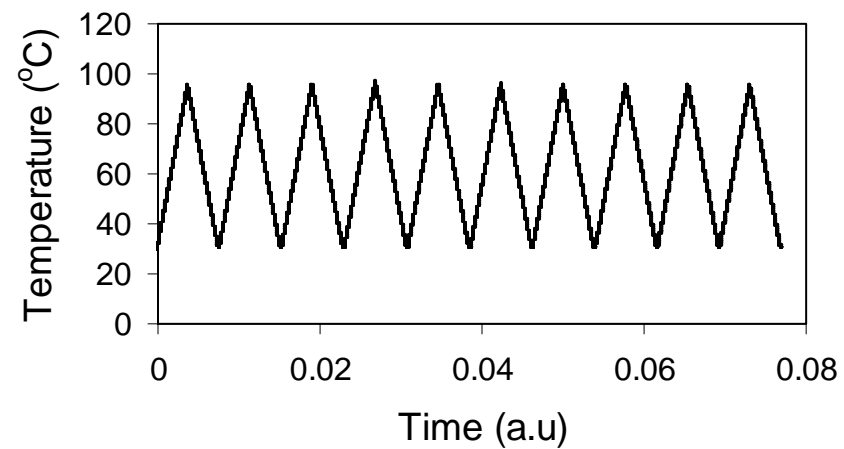
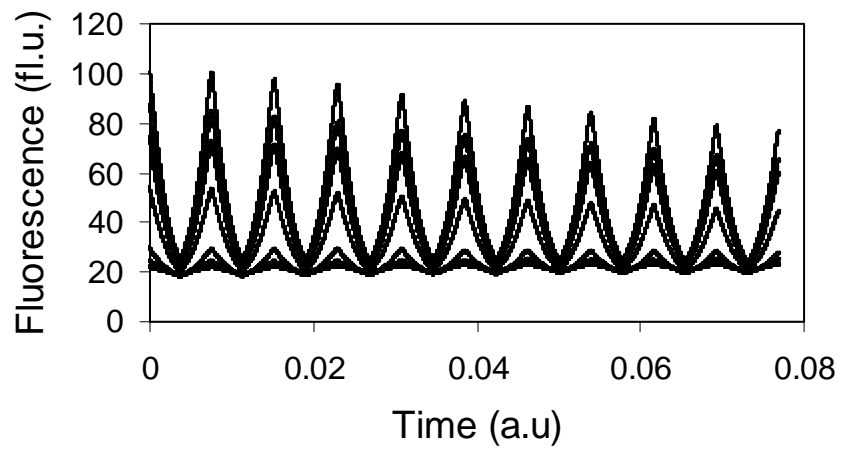
Damaged DNA

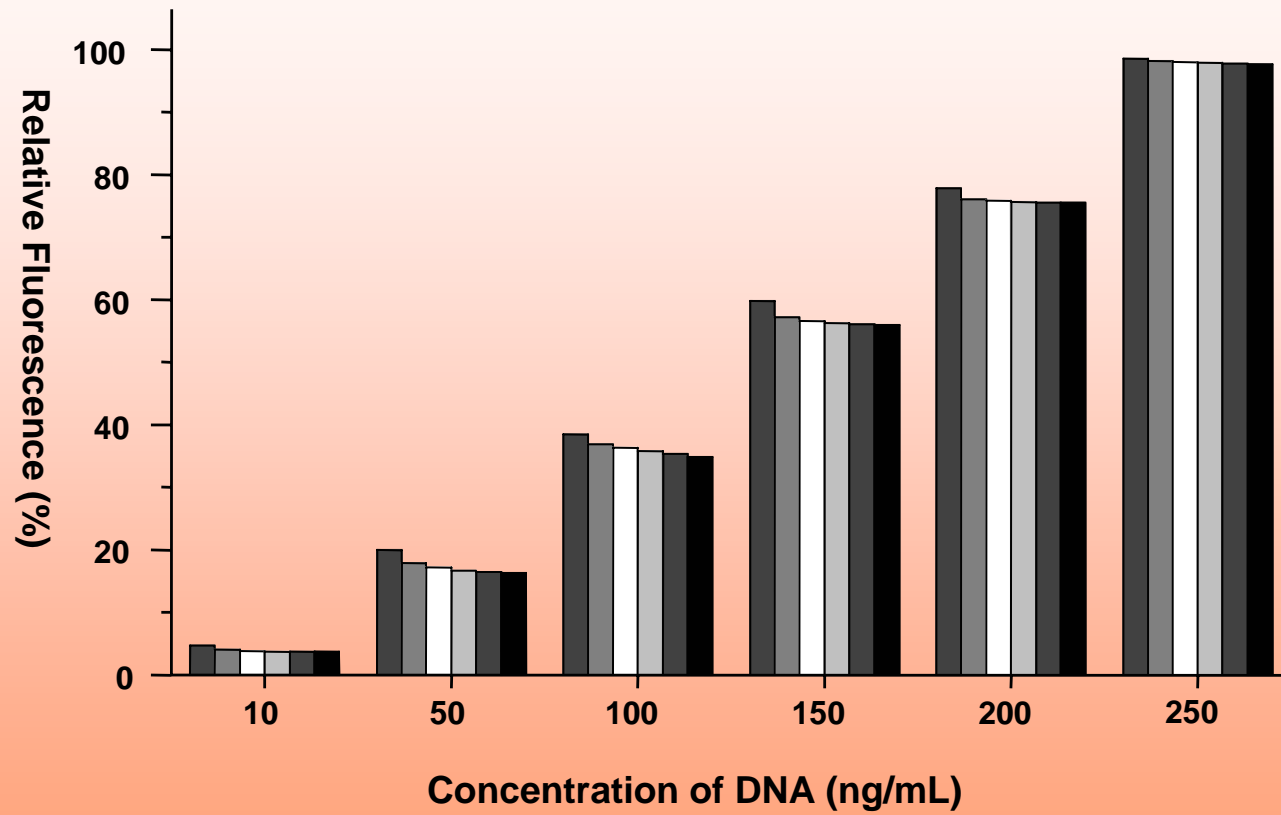
Increased Temperature

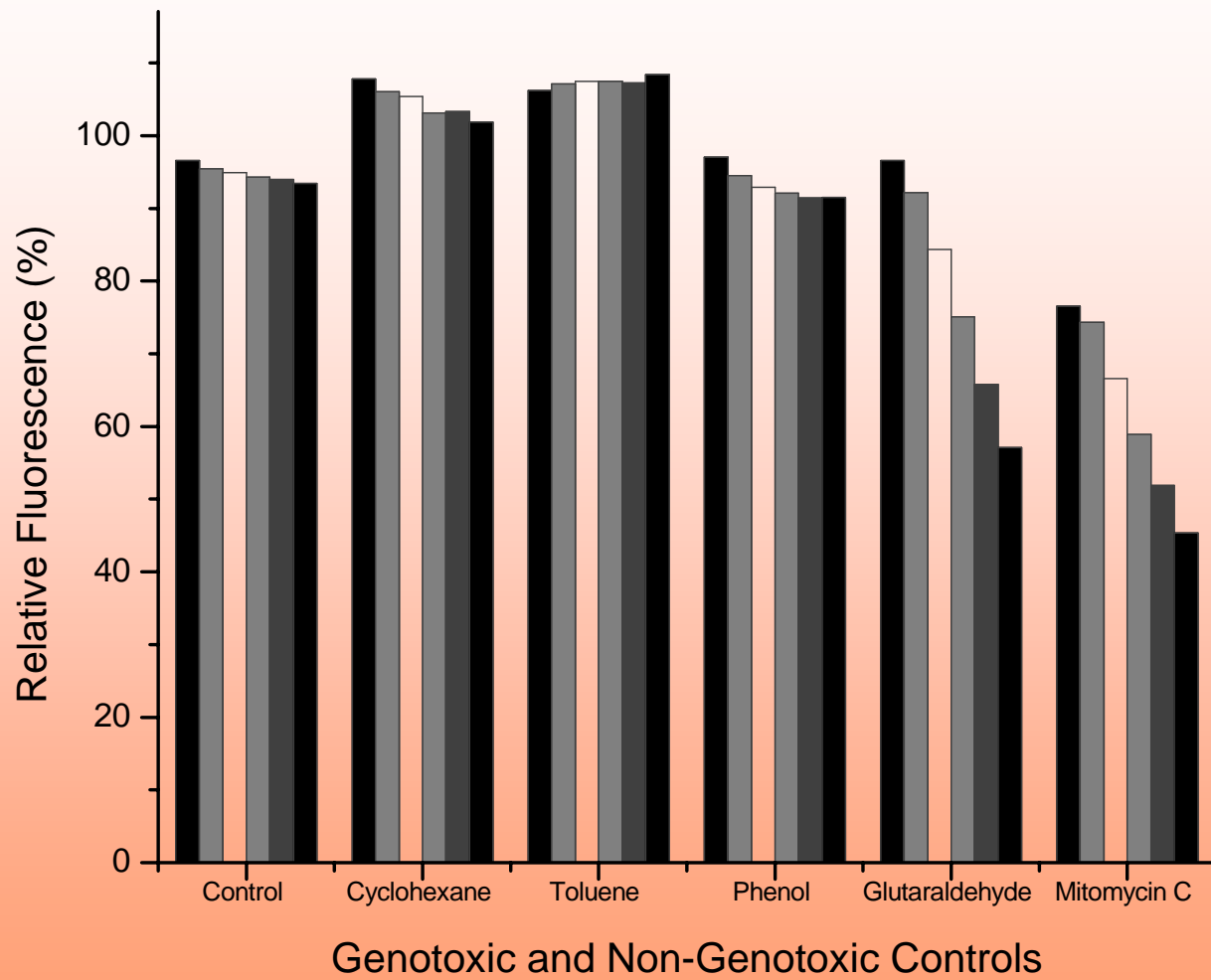


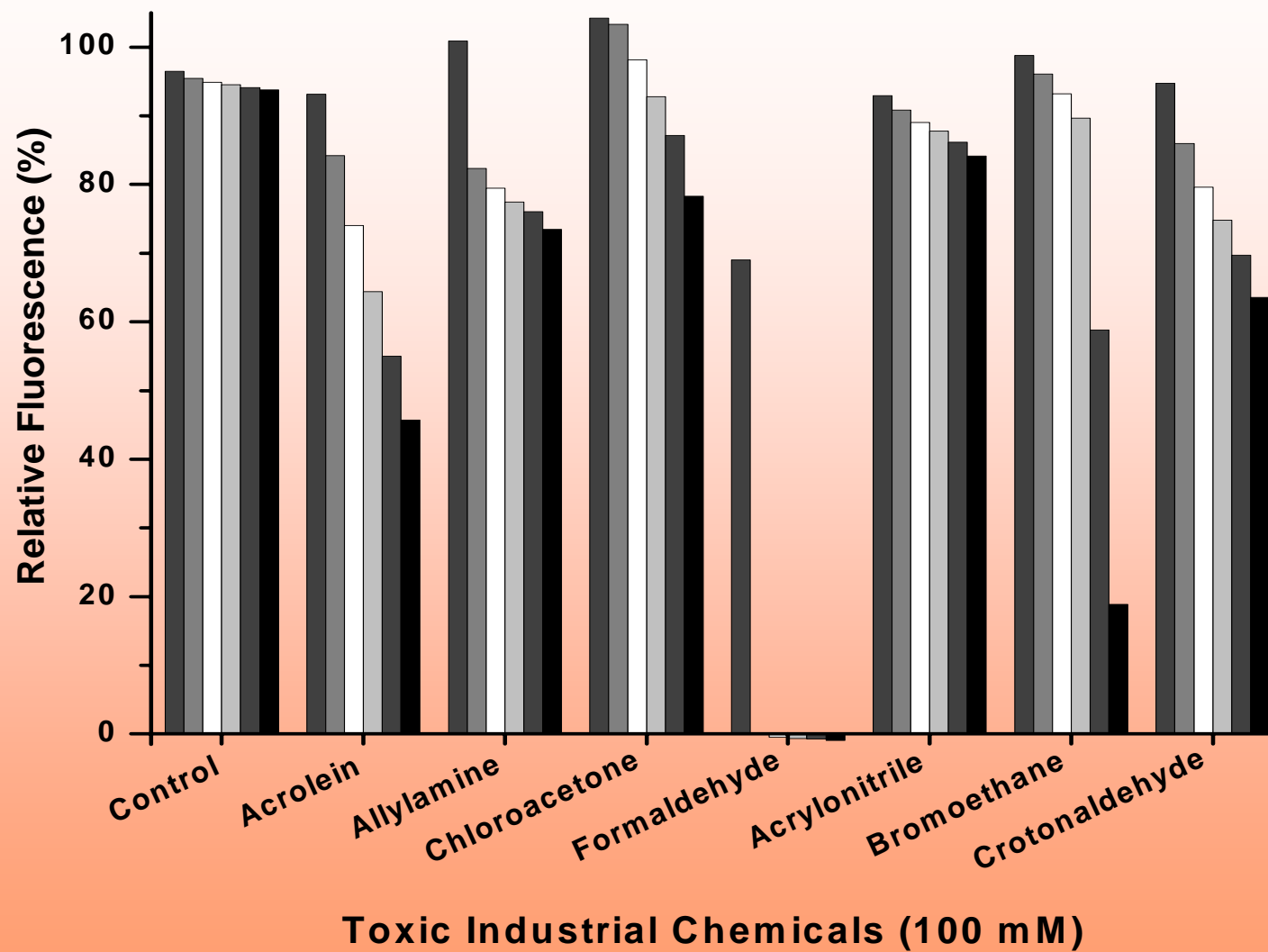


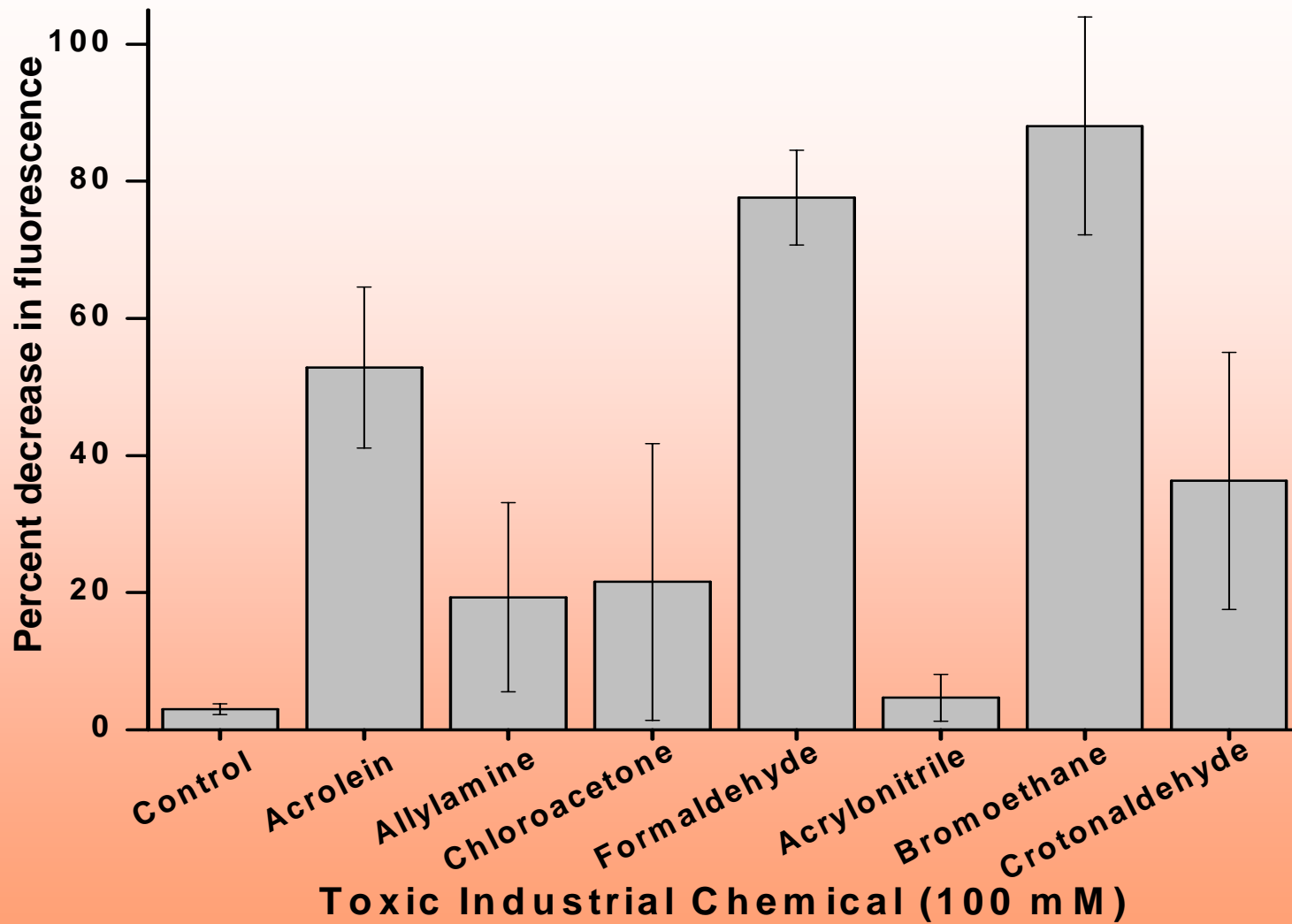


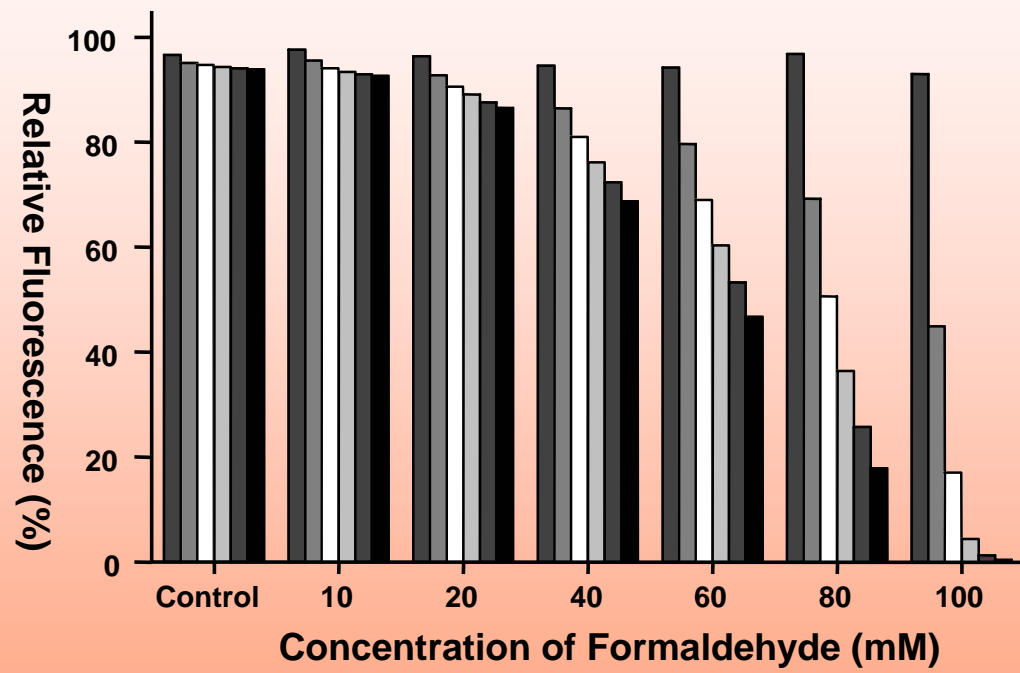


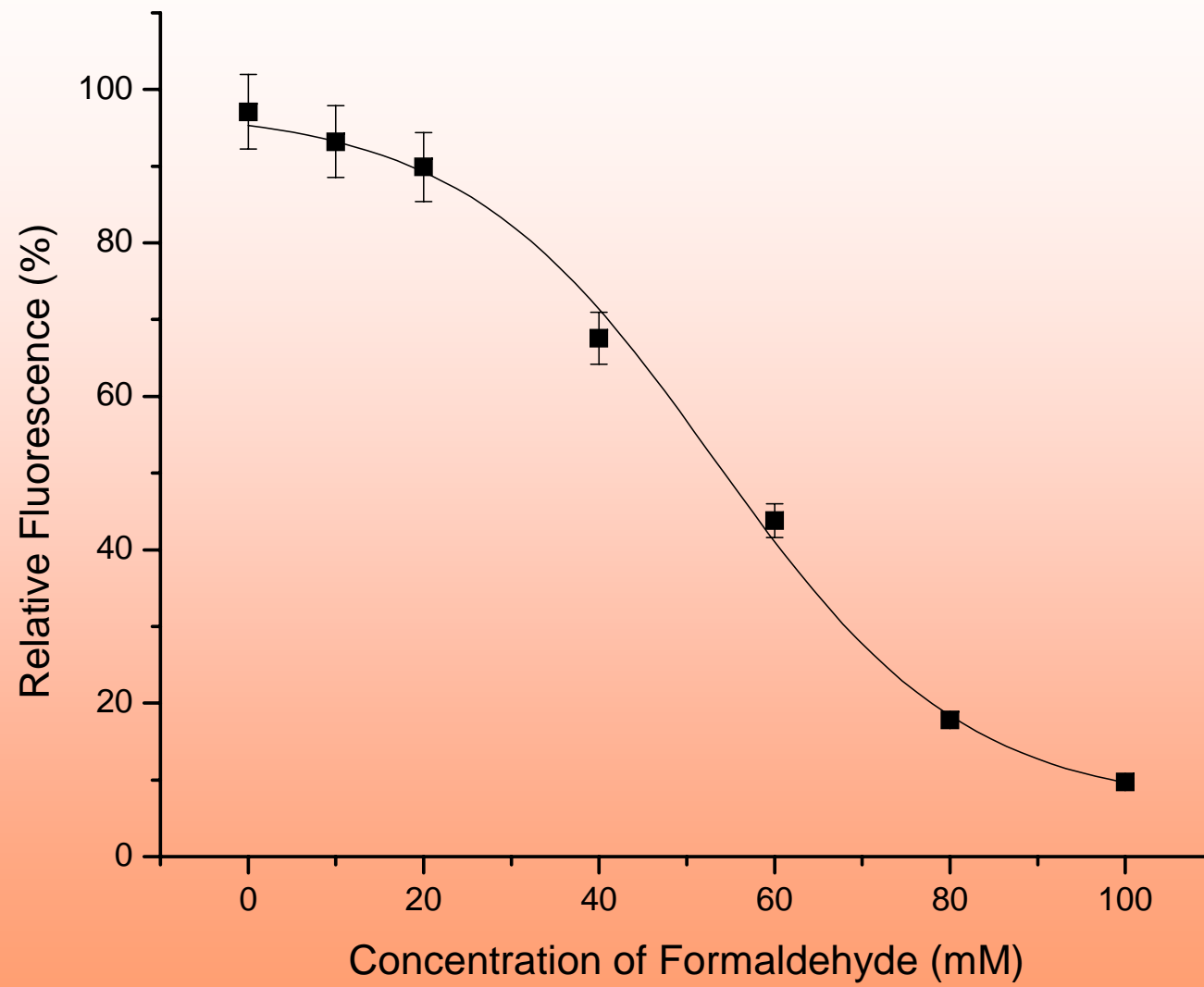












Summary

- Air Sampling
- Toxicity
 - Microtox
 - IQ-Tox
- Genotoxicity
 - DNA Melting Annealing Analysis

Future Directions

- Sampling
 - Carbon Fabric
 - Sensitivity
- Bioassay
 - Genetically Engineered Yeast
 - Cytotoxicity & Genotoxicity
- Environmental Pollutants
 - Nanaomaterials
- Environmental Applications
 - Vapor, Water, Sediment

Acknowledgements

- Kumar Ramanathan NRC-Postdoc
- Srividia Kailasam NRC-Postdoc
- Stacey Harper EPA-Postdoc

- Jim Petty USGS, CERC, MO
- Jim Huckins
- Robert Gale