



Sources and Impacts of Emerging Contaminants

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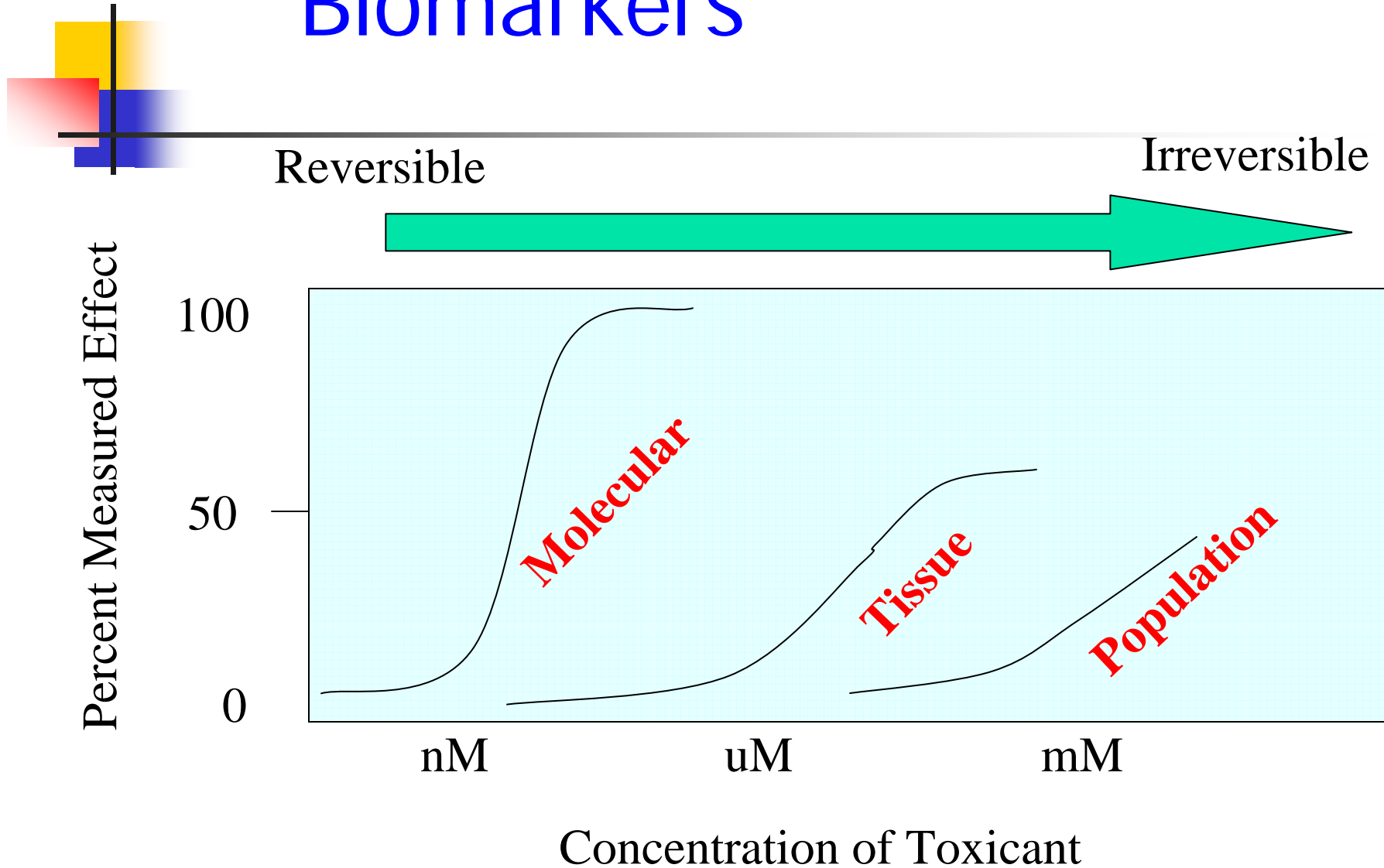
Center for Environmental and
Human Toxicology, UF



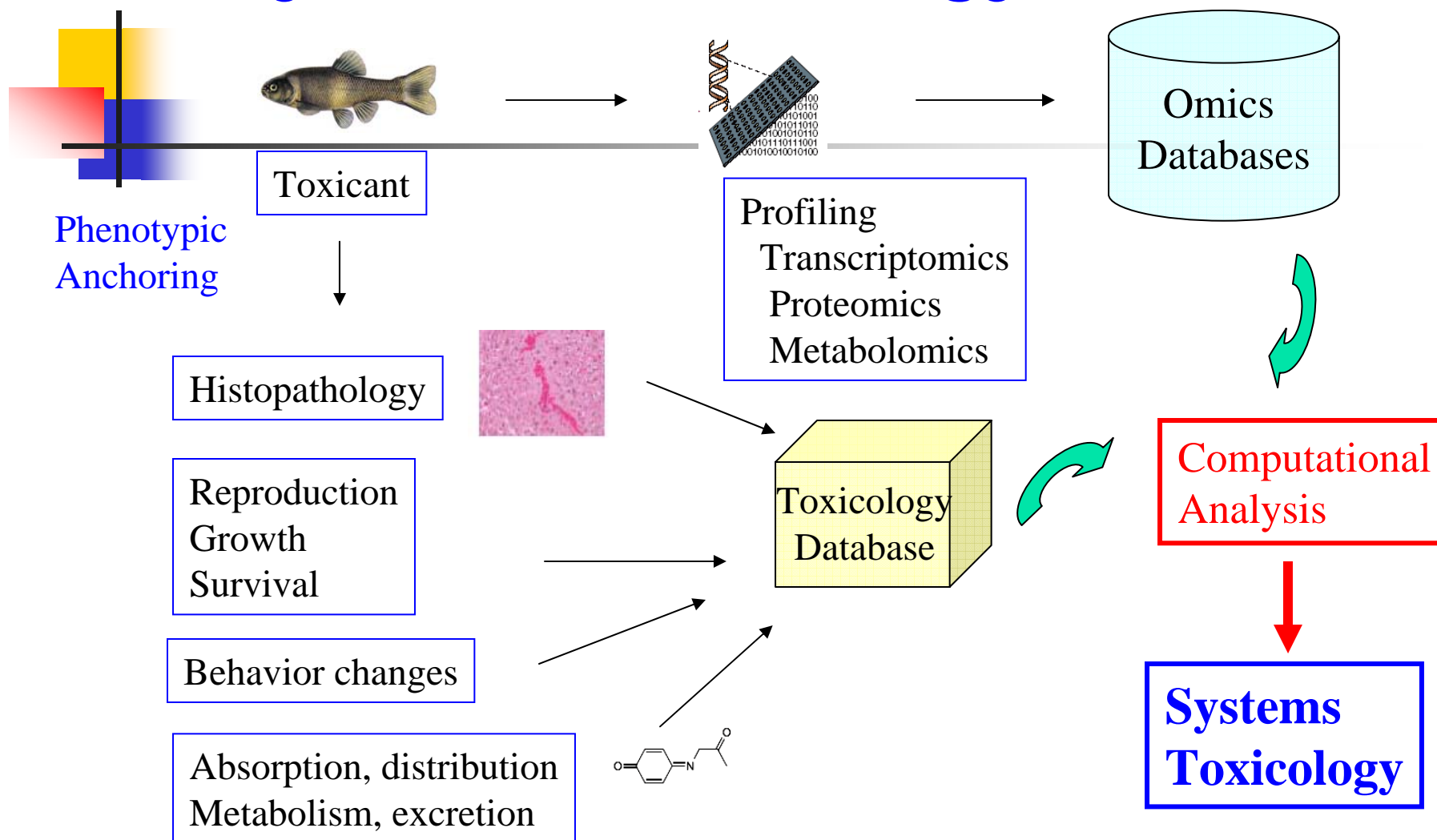
Relationship between ECs and EDCs

- Emerging contaminants may have different modes of action
- Some may target the endocrine system
- It is important to determine not only the presence of the contaminants – but also that they cause biological effects in aquatic species
- It is important to determine whether the contaminants target growth, reproduction and susceptibility to disease

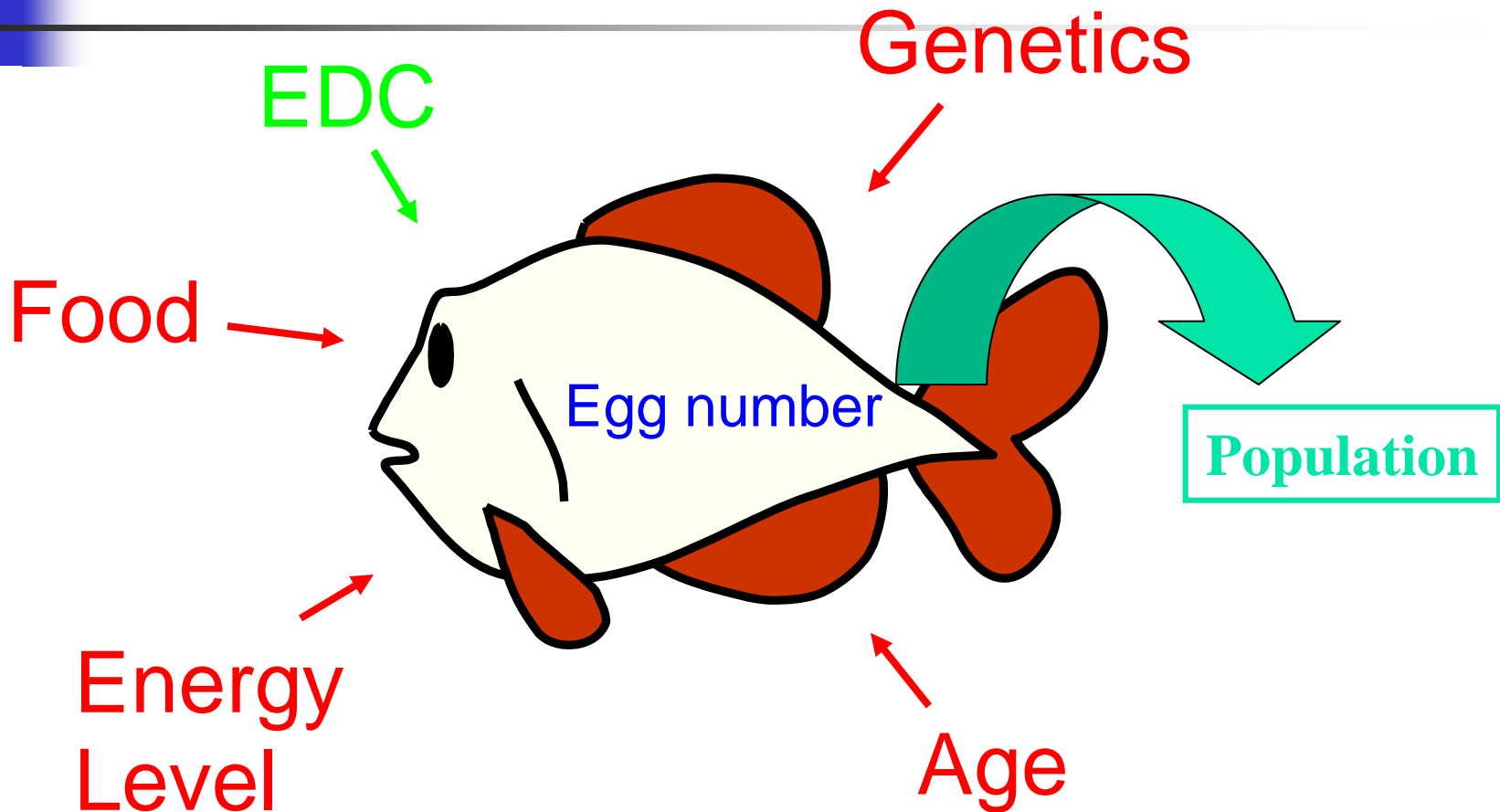
Biomarkers



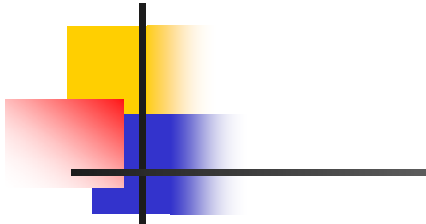
Systems Toxicology



Effect of EDCs on Reproductive Endpoints with High Ecological Value



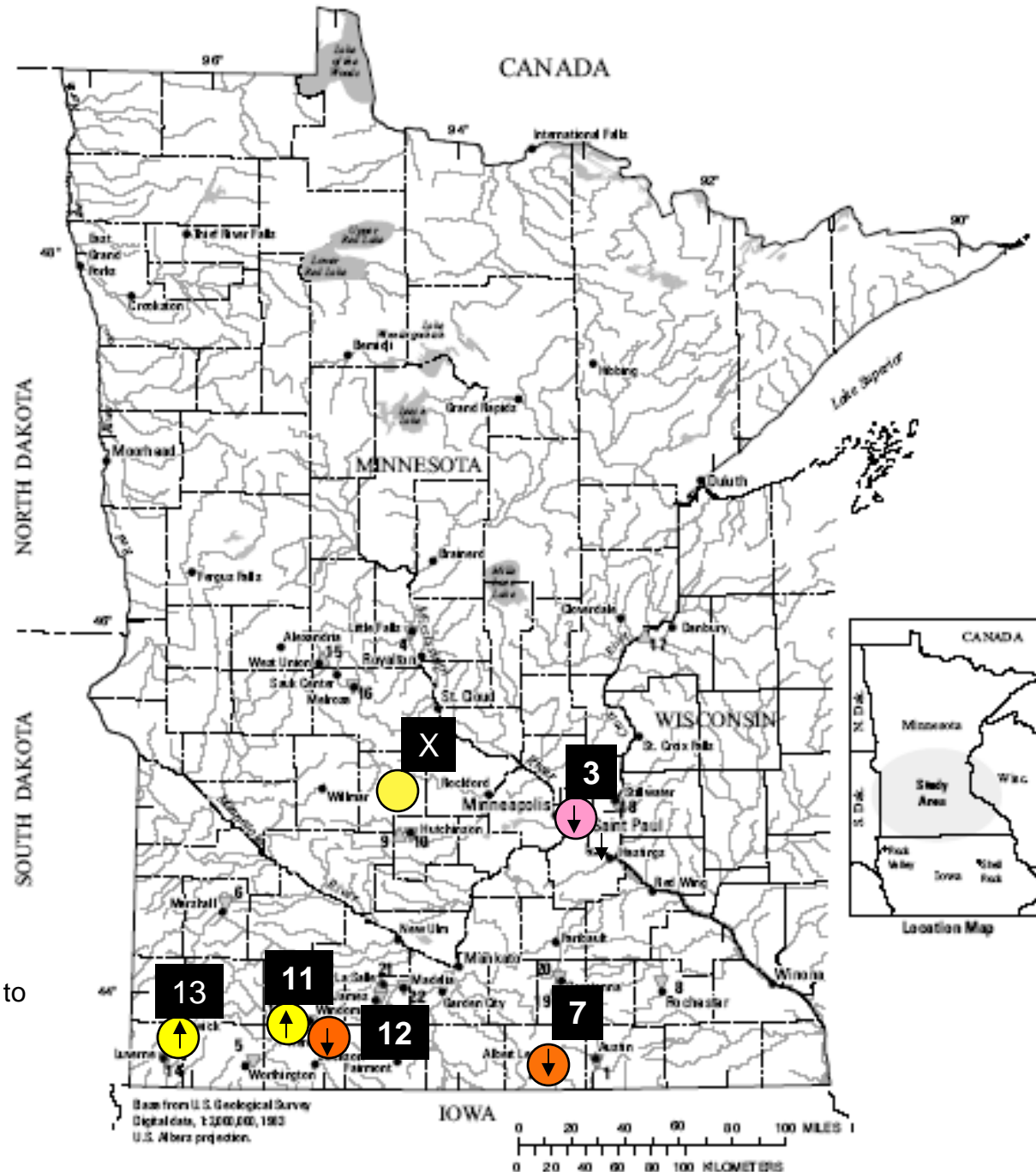
Field study



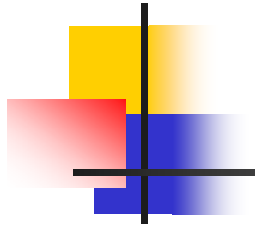
Location of sites

- no diff in behavior
- aggressive behavior
- feminized behavior

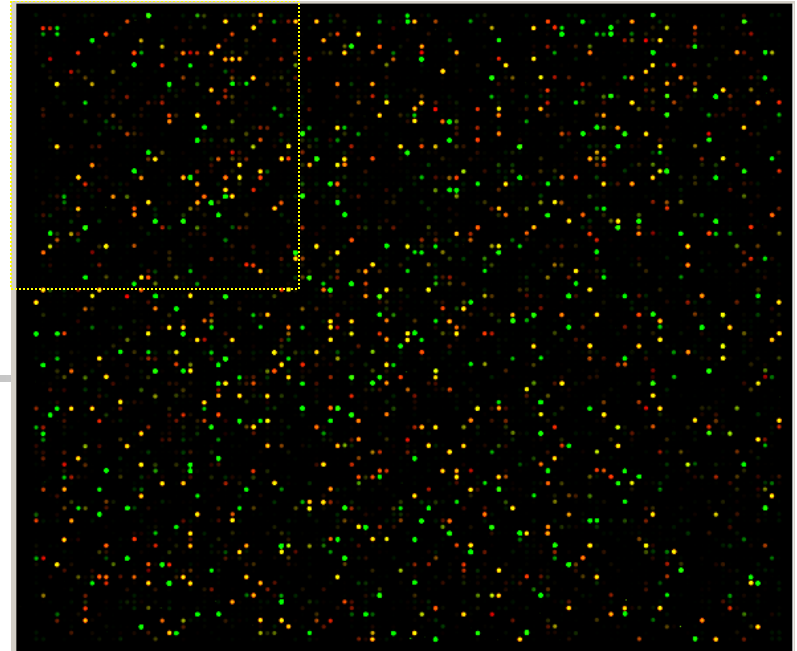
Arrows point direction relative to sewage treatment facility



Analysis by microarray



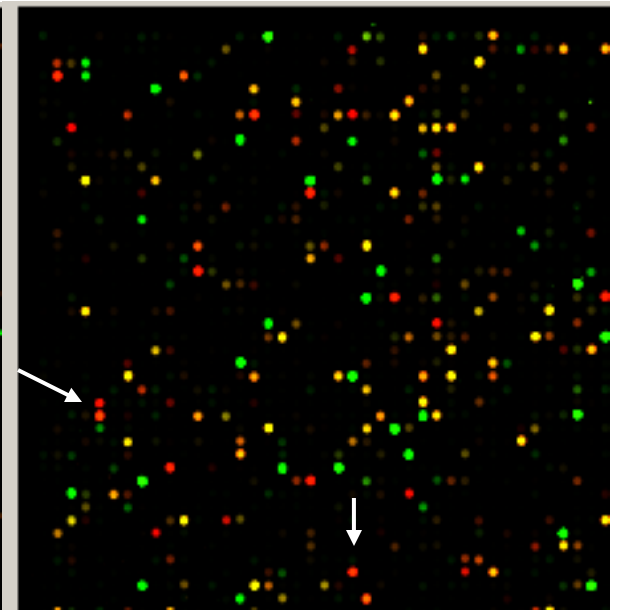
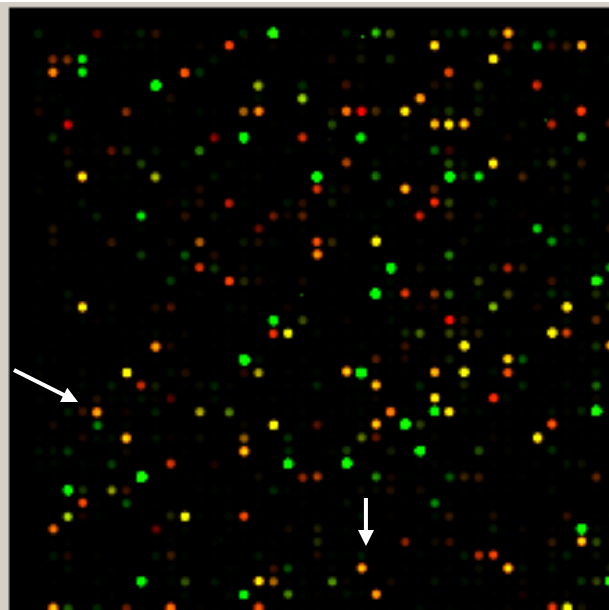
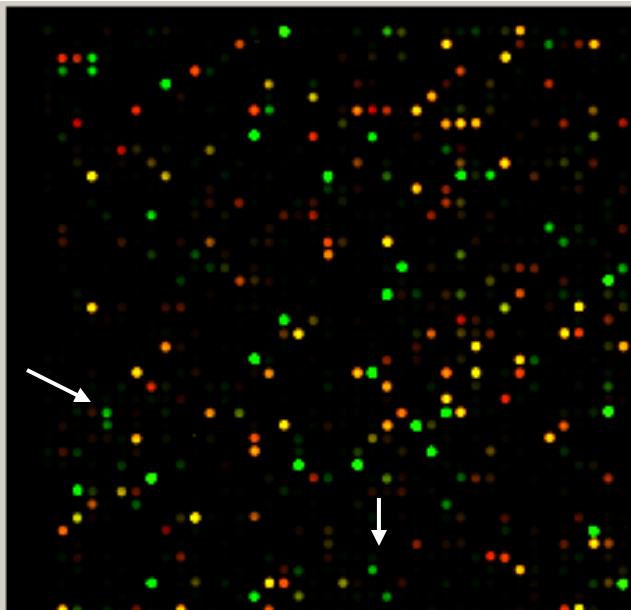
Fish \pm treatment \rightarrow organ \rightarrow total RNA \rightarrow cDNA \rightarrow array

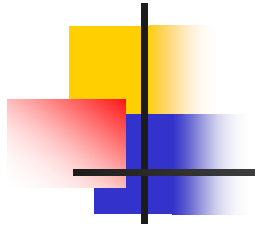


Control

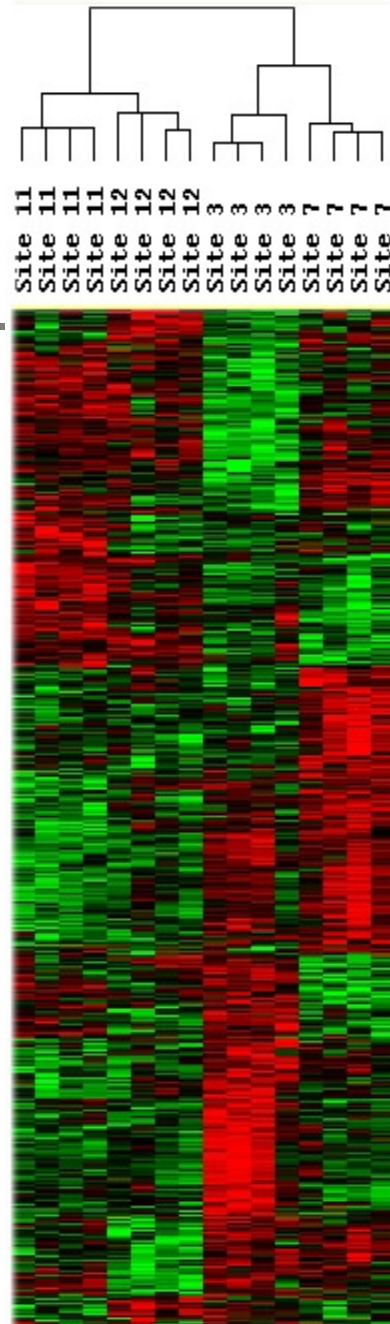
20 ng/L E2

100 ng/L E2

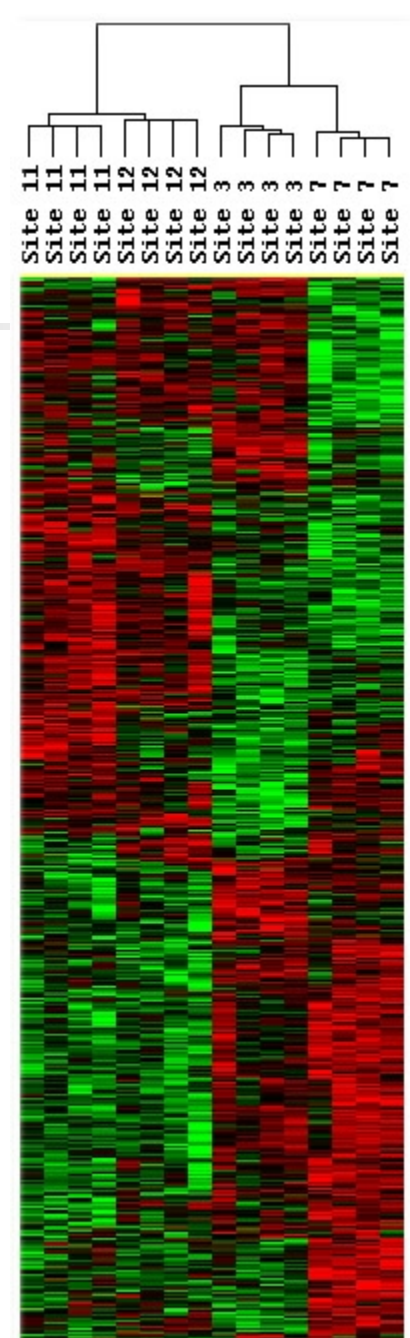




Liver



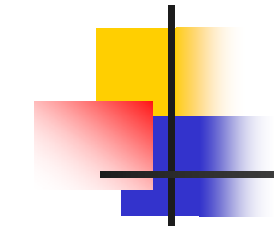
Gonad



Field Sites
Gene expression
profiles $P < 0.01$

Gonad

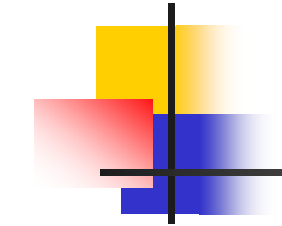
Biological Processes up-regulated site #12 vs site #11



- | | |
|------------------------------------|---------------------------------------|
| 1 Ras protein signal transduction | 13 mitotic spindle checkpoint |
| 2 female meiosis I | 14 regulation of protein kinase activ |
| 3 acetylcholine receptor signaling | 15 regulation of transferase activity |
| 4 activation of JNKK activity | 16 glutathione biosynthesis/metabol |
| 5 cholesterol absorption | 17 phototransduction, visible light |
| 6 lipid digestion | 18 I-kappaB kinase/NF-kappaB cas |
| 7 intestinal absorption | 19 detection of visible light |
| 8 sensory perception of taste | 20 negative regulation of protein kin |
| 9 cell communication | 21 negative regulation of transferas |
| 10 male meiosis | 22 protein kinase cascade |
| 11 signal transduction | 23 neural crest cell migr/develop/dif |
| 12 activation of MAPKK activity | 24 aromatic amino acid family meta |

Gonad

Biological Processes **down-regulated** site #12 vs site #11



1 innate immune response	19 nucleotide-excision repair
2 response to stress	21 female meiosis chrom segregation
3 cellular physiological process	22 reg. insulin receptor signaling
4 complement activation, alternative	23 regulation of cellular metabolism
5 iron ion homeostasis	26 immune response
6 transition metal ion homeostasis	27 response to wounding
7 cation homeostasis	28 cell proliferation
10 pre-replicative complex formation	39 endoderm formation
11 UDP-galactose transport	45 embryonic development
13 embryonic genitalia morphogenesis	57 regulation of cell growth
17 regulation of transcription	69 nitric oxide metabolism
18 complement activation	70 genitalia development



Conclusions

- Exposure of FHM for 48 hr to effluent is sufficient to get gene expression changes
- Changes in profiles suggest that fish could be adversely affected.
- A more thorough investigation of site #12 should be enacted to determine risk to aquatic organisms