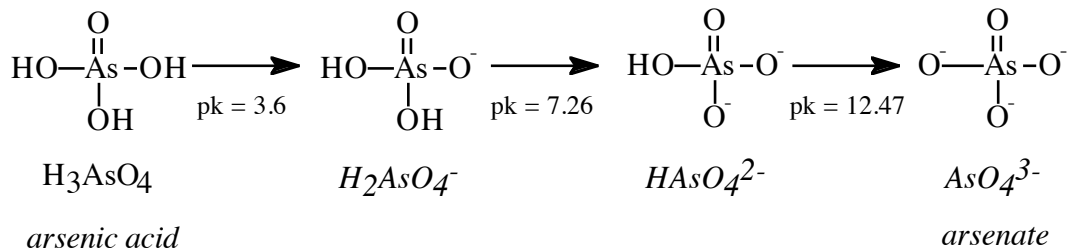*Generally Increasing pH* →

Generally Decreasing Eh ↓
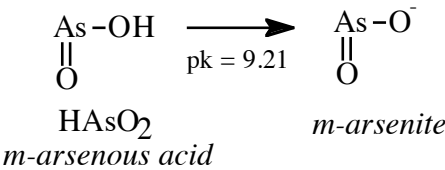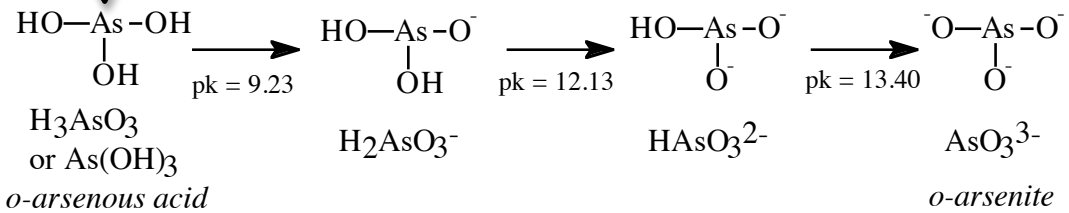
ARSENATE FORMS
VALENCE = +5
$(H_NAsO_4^{3-N})$

$$HO-\overset{\overset{O}{\|}}{\underset{OH}{As}}-OH \xrightarrow{pk = 3.6} HO-\overset{\overset{O}{\|}}{\underset{OH}{As}}-O^- \xrightarrow{pk = 7.26} HO-\overset{\overset{O}{\|}}{\underset{O^-}{As}}-O^- \xrightarrow{pk = 12.47} O^--\overset{\overset{O}{\|}}{\underset{O^-}{As}}-O^-$$

H_3AsO_4 $H_2AsO_4^-$ $HAsO_4^{2-}$ AsO_4^{3-}

arsenic acid   *arsenate*

Reduction
Biotic Abiotic ↓

ARSENITE FORMS
VALENCE = +3
$(H_NAsO_3^{3-N})$

$$HO-\overset{}{\underset{OH}{As}}-OH \xrightarrow{pk = 9.23} HO-\overset{}{\underset{OH}{As}}-O^- \xrightarrow{pk = 12.13} HO-\overset{}{\underset{O^-}{As}}-O^- \xrightarrow{pk = 13.40} {}^-O-\overset{}{\underset{O^-}{As}}-O^-$$

H_3AsO_3
or $As(OH)_3$ $H_2AsO_3^-$ $HAsO_3^{2-}$ AsO_3^{3-}
o-arsenous acid   *o-arsenite*

$$\overset{}{\underset{\|}{\underset{O}{As}}}-OH \xrightarrow{pk = 9.21} \overset{}{\underset{\|}{\underset{O}{As}}}-O^-$$

$HAsO_2$ *m-arsenite*
m-arsenous acid

DEMETHYLATION
↑
↓
BACTERIAL METHYLATION

$$HO-\overset{\overset{O}{\uparrow}}{\underset{OH}{As}}-CH_3 \xrightarrow{pk = 4.1} {}^-O-\overset{\overset{O}{\uparrow}}{\underset{OH}{As}}-CH_3$$

*monomethylarsonic
acid (MMAA, MMA
or MAA)*   *monomethylarsonate*

Bacterial
Reduction

$$HO-\overset{\overset{O}{\uparrow}}{\underset{CH_3}{As}}-CH_3 \xrightarrow{pk = 6.2} {}^-O-\overset{\overset{O}{\uparrow}}{\underset{CH_3}{As}}-CH_3$$

*dimethylarsinic
acid
(cacodylic acid, DMAA,
or DMA)*   *dimethylarsenate*
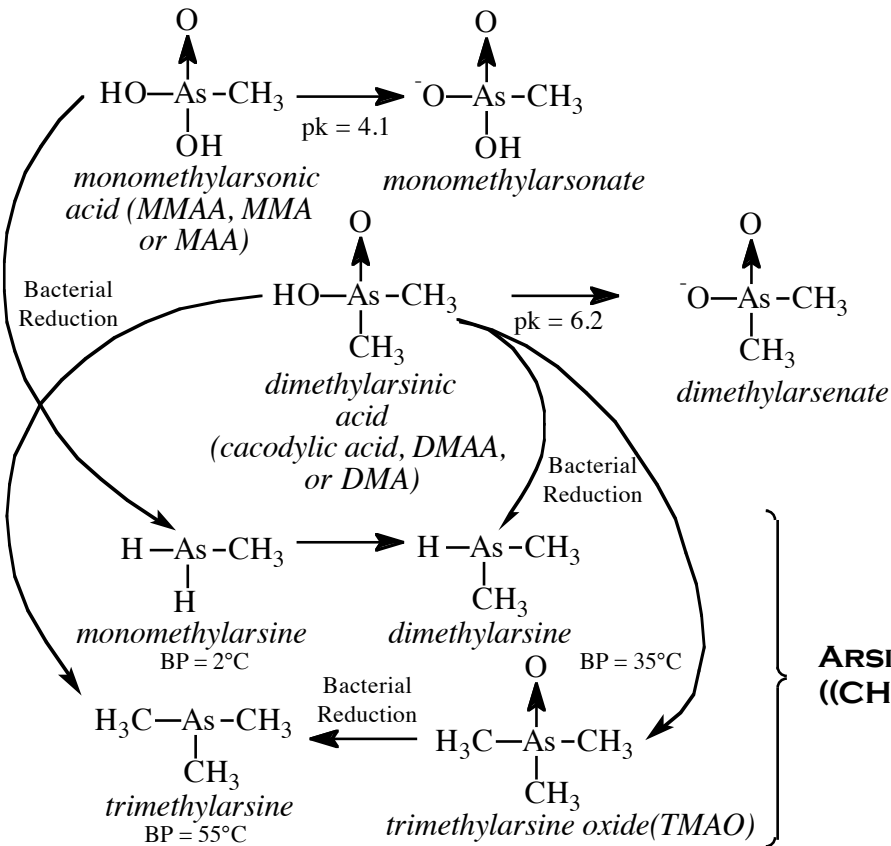
Bacterial
Reduction

Reduction
Bacterial/Fungi

$$H-\overset{}{\underset{H}{As}}-H$$

AsH_3
Arsine
BP = - 55°C

$$H-\overset{}{\underset{H}{As}}-CH_3 \longrightarrow H-\overset{}{\underset{CH_3}{As}}-CH_3$$

monomethylarsine   *dimethylarsine*
BP = 2°C   BP = 35°C

Bacterial
Reduction

$$\overset{}{\underset{\uparrow}{\underset{O}{As}}}$$
$$H_3C-\overset{}{\underset{CH_3}{As}}-CH_3$$
trimethylarsine oxide(TMAO)

Bacterial
Reduction

$$H_3C-\overset{}{\underset{CH_3}{As}}-CH_3$$
trimethylarsine
BP = 55°C

ARSINE FORMS
$((CH_3)_NH_{3-N}As)$