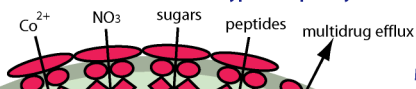


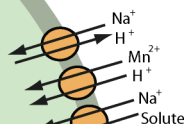
ABC-type Transport Systems



Multi-Drug Efflux Permeases (MFS)

ArsB

As³⁺



Catabolic Functions

beta-lactamase
 protease
 lipases/esterase
 alpha-amylase
 beta-galactosidase
 beta-oxidation (lipids)
 xenobiotics

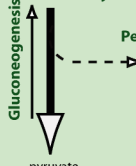
Defense Mechanisms

DNA restriction/modification systems
 superoxide dismutase
 hydrogen peroxide reductase
 cytochrome P450
 mercuric reductase

Cofactor Biosynthesis

cobalamin
 heme
 THF
 pyridoxine
 riboflavin
 ubiquinone
 pantothenate
 coenzyme PQQ

Embden-Meyerhoff Pathway



Pentose Phosphate Pathway (partial)

Protein Translocation

Sec-dependent
 Sec-independent

H⁺-transporting ATP synthase

H^+ H^+ H^+ H^+

heme-copper terminal oxidase

Fe^{3+} sulfocyanin-mediated
 ferrous iron oxidation?

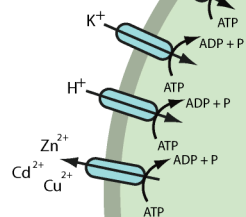
bd-type quinol
 oxidase

Fe^{2+}
 Fe^{2+}

succinate dehydrogenase

NADH:ubiquinone dehydrogenase

P-Type ATPases



Formate Dehydrogenase

Formate

Reductive Acetyl-CoA Pathway

(+THF) CO_2 CO Acetyl-CoA

(+CoA) CO Acetyl-CoA

macromolecular biosynthesis

NADPH

SO_3^{2-} $\text{ADP} + \text{P}$ Sulfite Oxidase ? ATP SO_4^{2-}

NAD^+ NADH

Formate Hydrogenlyase Complex

$\text{CO}_2 + \text{H}_2$

osmolyte

Voltage-gated Channel

osmolyte

Citric Acid Cycle

NAD^+ NADH

NAD^+ NADH

NAD^+ NADH

NAD^+ NADH

NAD^+ NADH

NAD^+ NADH

NAD^+ NADH

NAD^+ NADH

NAD^+ NADH