Metabolic Insights into *Desulfovibrio* from Genome Sequence

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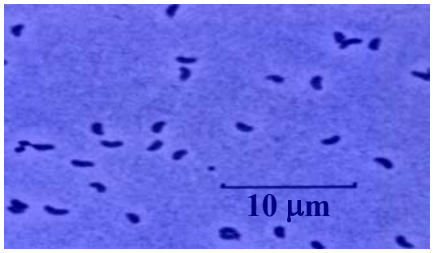
Sequence data obtained from

The Institute for Genomic Research

John L. Heidelberg

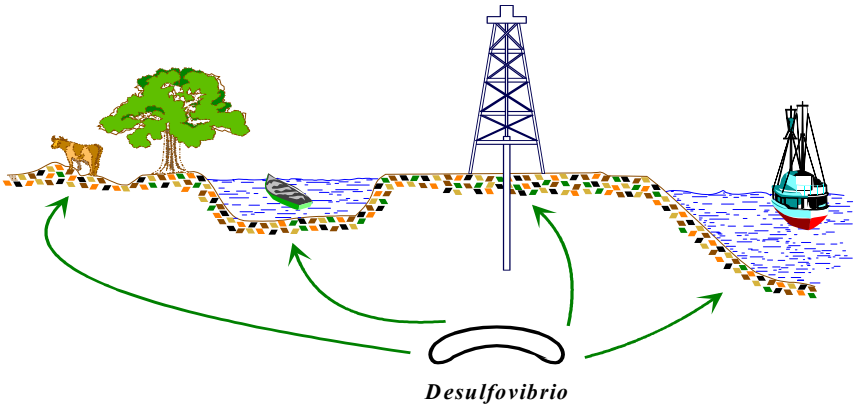
http://www.tigr.org

Desulfovibrio vulgaris

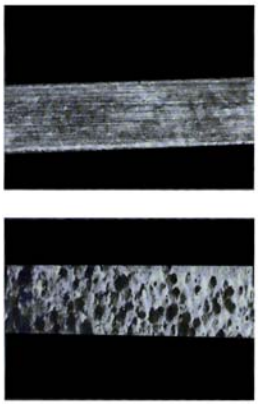


- Gram −
- Anaerobic
- Sulfate Reducing Bacteria (SRB)

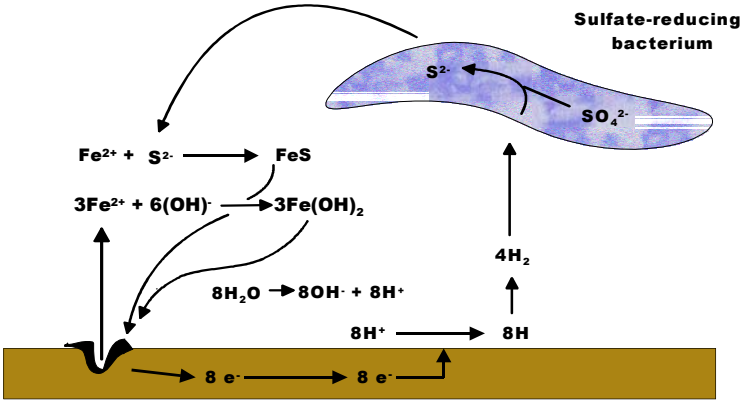
Sulfate-ReducingBacteria in Nature



Mild steel corrosion by
***Desulfovibrio desulfuricans* G20**



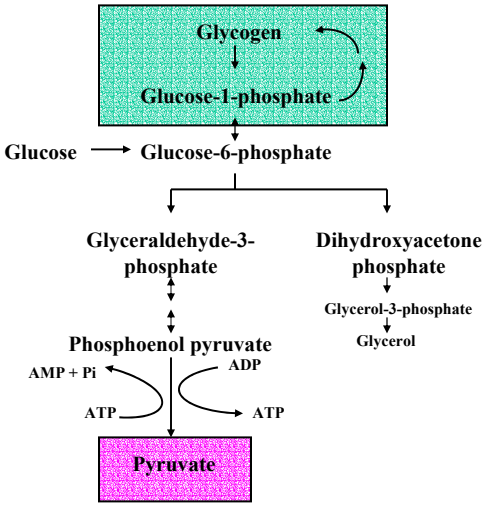
Cathodic Depolarization Model of Metal Corrosion



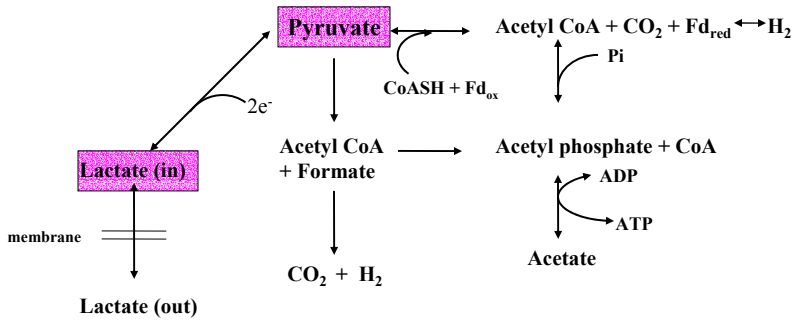
Desulfovibrio vulgaris
Hildenborough

Chromosome:	**3.57 Mb** **63.2% GC** **3527 ORFs**
Megaplasmid:	**203 Kb** **65.7% GC** **147 ORFs**

Central Carbon Metabolism



Preferred Carbon Substrates of *Desulfovibrio*



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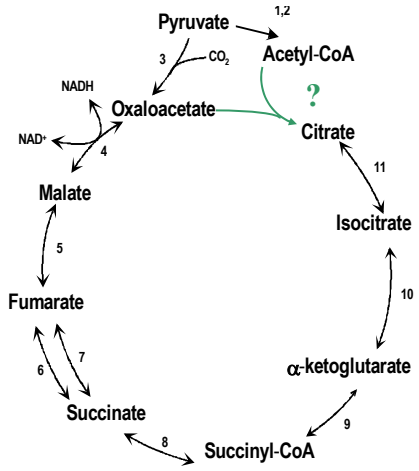
TCA Cycle



Initial model of *Desulfovibrio* reduction of uranium

Lovley et al., 1993

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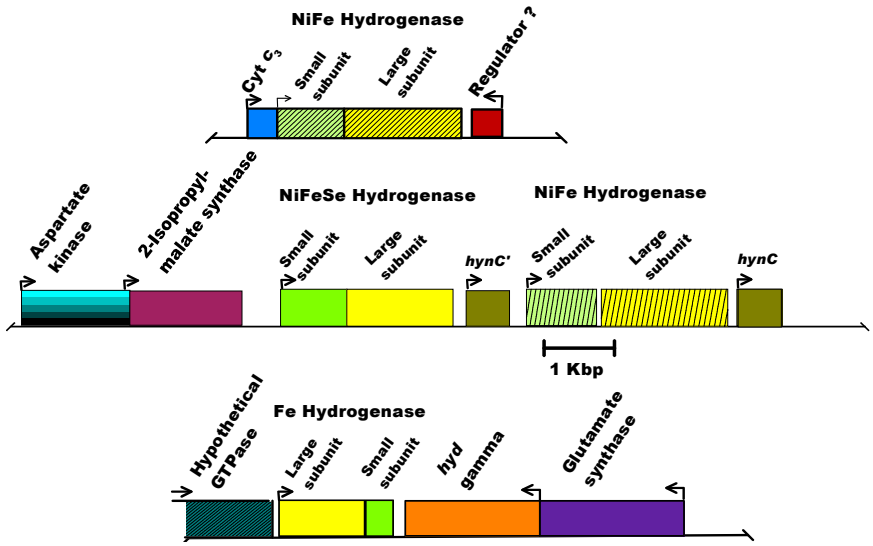
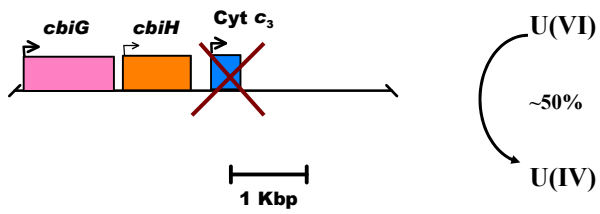
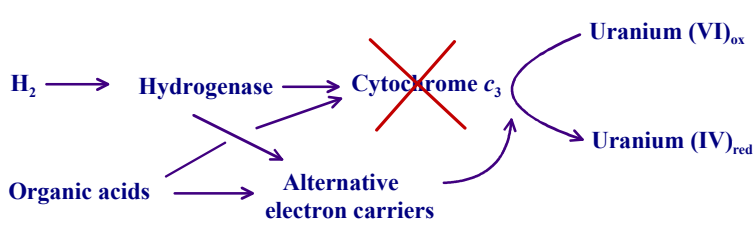


Desulfovibrio Tetraheme Cytochrome c_3



Modified model of *Desulfovibrio* reduction of uranium



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Tetraheme *c*-type Cytochromes

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ORF03638     .......... ..LNRS.... .....TLMRY LVIS...... ....LFAVSL 19
ORF05080     .......... ..LTRHGGHN TIPLGKSLTY LCEGGSSIMR K...LFFCGV 35
ORF03170     .......... VRSHRTPLTE KTPCLYHGRY IRHHGGSAMR S...AIRWGL 37
ORF04250     MAAWRTSSTI TNWGCTPSSS ATSSTTAWRS PVRSSARPTK ENAMFRRIGT 50

ORF03638     LMAGSALVGN AADAAKAPKK AIELKHGTSK R......MHV MFNHTTH... 60
ORF05080     LALAVAFALP VVAAPKAPAD GLKMEA..TK .......QPV VFNHSTH... 73
ORF03170     LTL..VLLSP ALAAAYDVPK EIEIKRPAKN KPVASWVGPV KFPHGFH... 82
ORF04250     VMLAFATLAL LLAVAFARTD TPRLEPEALK PQQR...PAA VFDHDAHNEK 97

ORF03638     KDIA.CEQCH HDSPAPDKP. .....YASCT DNDCHATPGP RERDTMSMFV 103
ORF05080     KSVK.CGDCH HPVNGKED.. .....YRKCG TAGCHDSMDK KDKSAKGYYH 115
ORF03170     AIHNPCKACH HEESDKSLGS FLP.....CS ..QCHNKPGD AEQMSFYRAW 125
ORF04250     AKLENCAVCH HDAKDGKIVP EGSSEGTPCA ..DCHAKAAT KGTHLVNAYH 145

ORF03638 AYHAKD.TDR SCYGCHKKMA ....AQHPEF TGCRP..CHM SQQARKEAAA SEKK 15
ORF05080 VMHDKNTKFK SCVGCHVEVA GADAAKKKDL TGCKKSKCHE ..........      15
ORF03170 ..H..NDKAY SCMGCHRQKR LLK..QGEPP ISCTR.GCHP LPTGGAQ         16
ORF04250 ......RQ.. .CMNCHKTSG .......KGP TSCGG..CHV RD               16
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ORF03638 – Downstream of FDH operon
ORF05080 – Acidic isozyme
ORF03170 – Upstream of NiFe Hydrogenase genes
ORF04250 – Dominant cytochrome c_3

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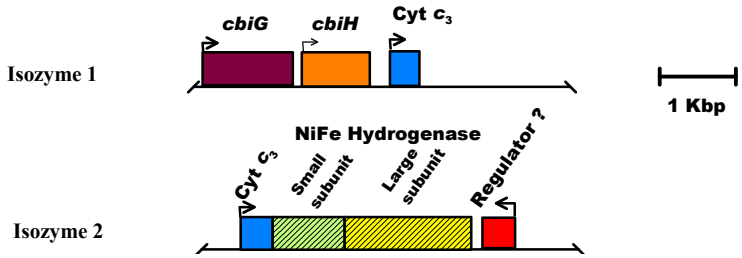
Tetraheme Cytochromes *c*



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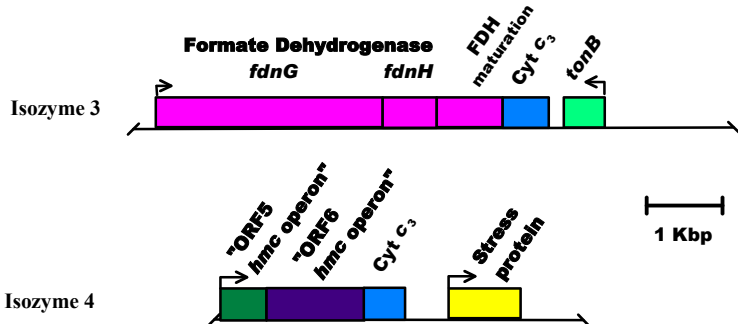
Tetraheme Cytochromes *c*



Putative Terminal Reductases of *Desulfovibrio vulgaris* Hildenborough

Sulfate Reductase

Sulfite Reductase

Thiosulfate Reductase

Fumarate Reductase

Dimethyl Sulfoxide Reductase

Nitrite Reductase

Nitrate Reductase (?)

Rubredoxin Oxygen Oxidoreductase

Cytochrome c Oxidase

Cytochrome bd Ubiquinol Oxidase

Pathogenic Features ???

Hemolysin	**2 ORFS (One upstream of an ABC transport system)**
Cytolysin	**RtxD-like (Associated with an ABC transport system)**
Type III secretion	**Eight ORFs located on the megaplasmid**
Hemagglutinin	
Adhesion lipoprotein	