

3D Human Internal Organs Representation Model (Updates)

SIGGRAPH Web3D Standardization Meeting (Korea Chapter)

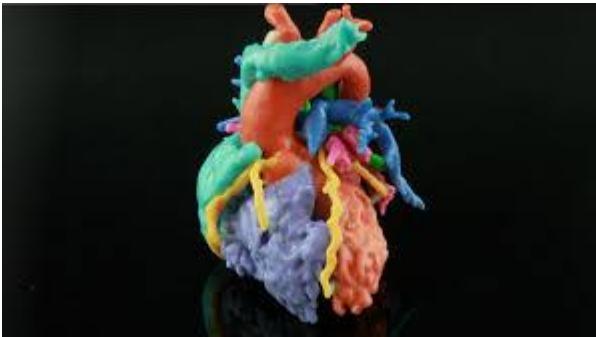
July 29, 2019

Myeong Won Lee (The University of Suwon)

Requirements (1)

- 3D printing and scanning
 - Interface to 3D printers for internal organs
 - Interface to 3D scanners for internal organs

3D
information
model for
3D printing



3dprint.com



3dprintingindustry.com



pinterest.com



imedicin.worpress.com



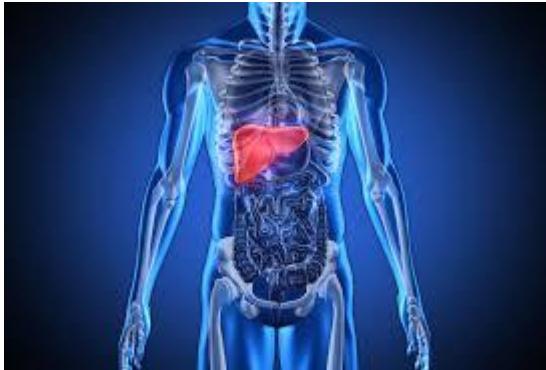
SIGGRAPH Web3D Standardization Meeting
3dprintingindustry.com



en.people.cn

Requirements (2)

- Human health care service applications
 - Internal organs representation
 - Human health device and information service



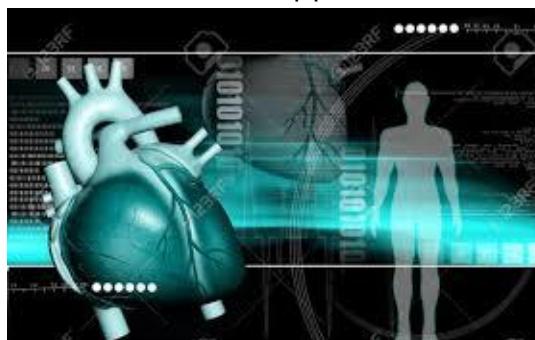
cargocollective.com



123rf.com



imedicalapps.com



123rf.com



3D
information
model for
health care



cargocollective.com



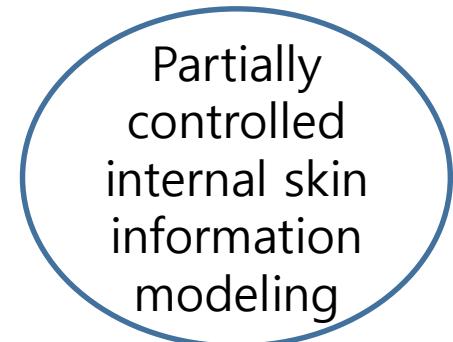
mediafocus.com

3D Digital Human Modeling (1)

- Concepts
 - Provision with digital processing functionalities for an entire human body in 3D using all visual and functional information about internal organs as well as external human surface model and skeleton motion
 - 3D modeling and animation technology for digital information processing that can represent shapes, properties, function, and motion for human bodies, including internal organs
 - Standardized 3D digital information necessary for developing 3D medical and health care applications

3D Digital Human Modeling (2)

- Required technologies
 - Shape modeling of internal and external whole bodies in partial or whole forms using graphics technology
 - Motion modeling of internal and external whole bodies in partial or whole forms using graphics technology
 - For all visual human models, functional properties should be able to be defined and combined for shape and motion modeling of a human model



Partially
controlled
internal skin
information
modeling

Humanoid Body Related Standards

- ISO/IEC 19774 Humanoid Animation: 2006 V1.0 (IS)
- ISO/IEC 19774 Humanoid Animation – Part 1: Architecture V2.0 (FDIS)
- ISO/IEC 19774 Humanoid Animation – Part 2: Motion Capture V2.0 (FDIS)
- ISO 7250-1: 2008 Basic human body measurements for technological design – Part 1: Body measurement definitions and landmarks
- ISO/TR 7250-2: 2010 Basic human body measurements for technological design – Part 2: Statistical summaries of body measurements from national populations
- ISO 7250-3: 2015 Basic human body measurements for technological design – Part 2: Worldwide and regional design ranges for use in product standards

Standardization Topics

- Representation data model for visualizing human internal organs and their functionalities
 - Modeling data exchange format of human internal organs
 - Animation data exchange format of human internal organs
- Interface data model for representing functions of medical and health devices with human internal organ models in 3D scenes

Representation Data Model for Human Internal Organs

- Modeling data model
 - Soft object representation
 - Soft object modeling
 - Landmarks
 - Information model for shape representation
- Animation data model
 - Animation methods
 - Animation parameters
 - Animation definition
 - Information model for animation representation
- Interface data model with medical and health devices

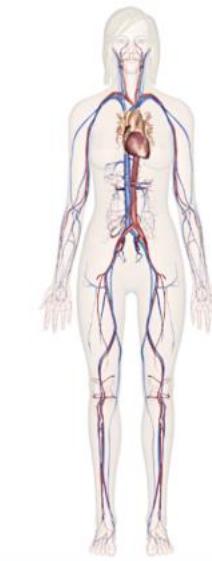
Skeletal System



Muscular System



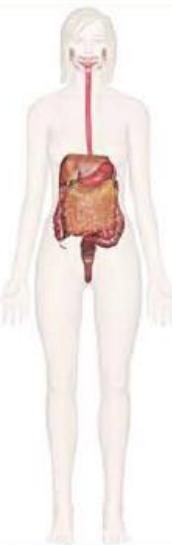
Cardiovascular System



innerbody

Human
Anatomy
System

Digestive System



Endocrine System



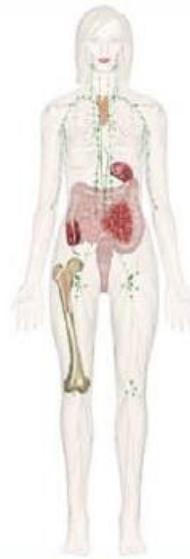
Nervous System



Respiratory System



Immune / Lymphatic Systems



Urinary System



innerbody

Human
Anatomy
System

Female Reproductive System



Male Reproductive System

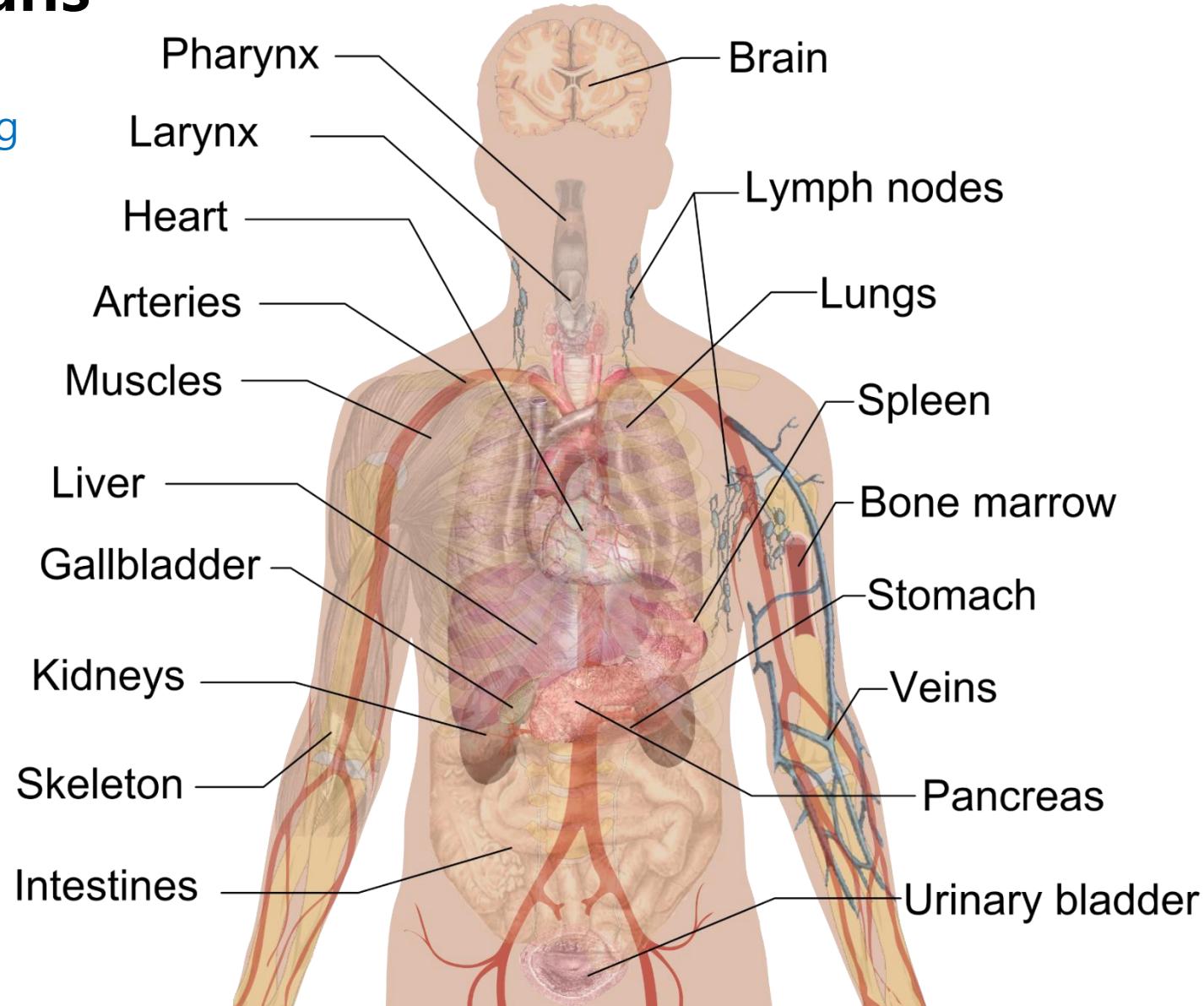


Integumentary System



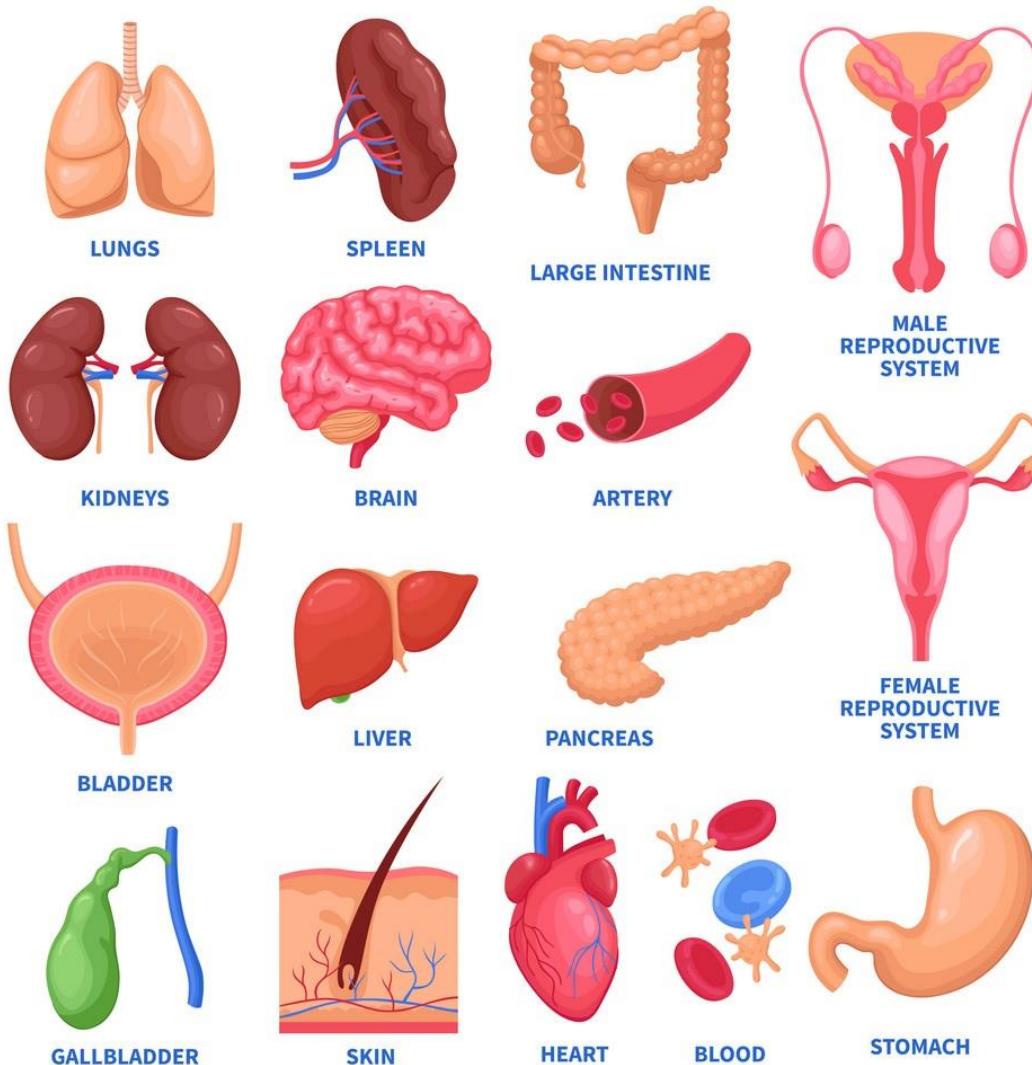
Internal Organs

commons.wikimedia.org

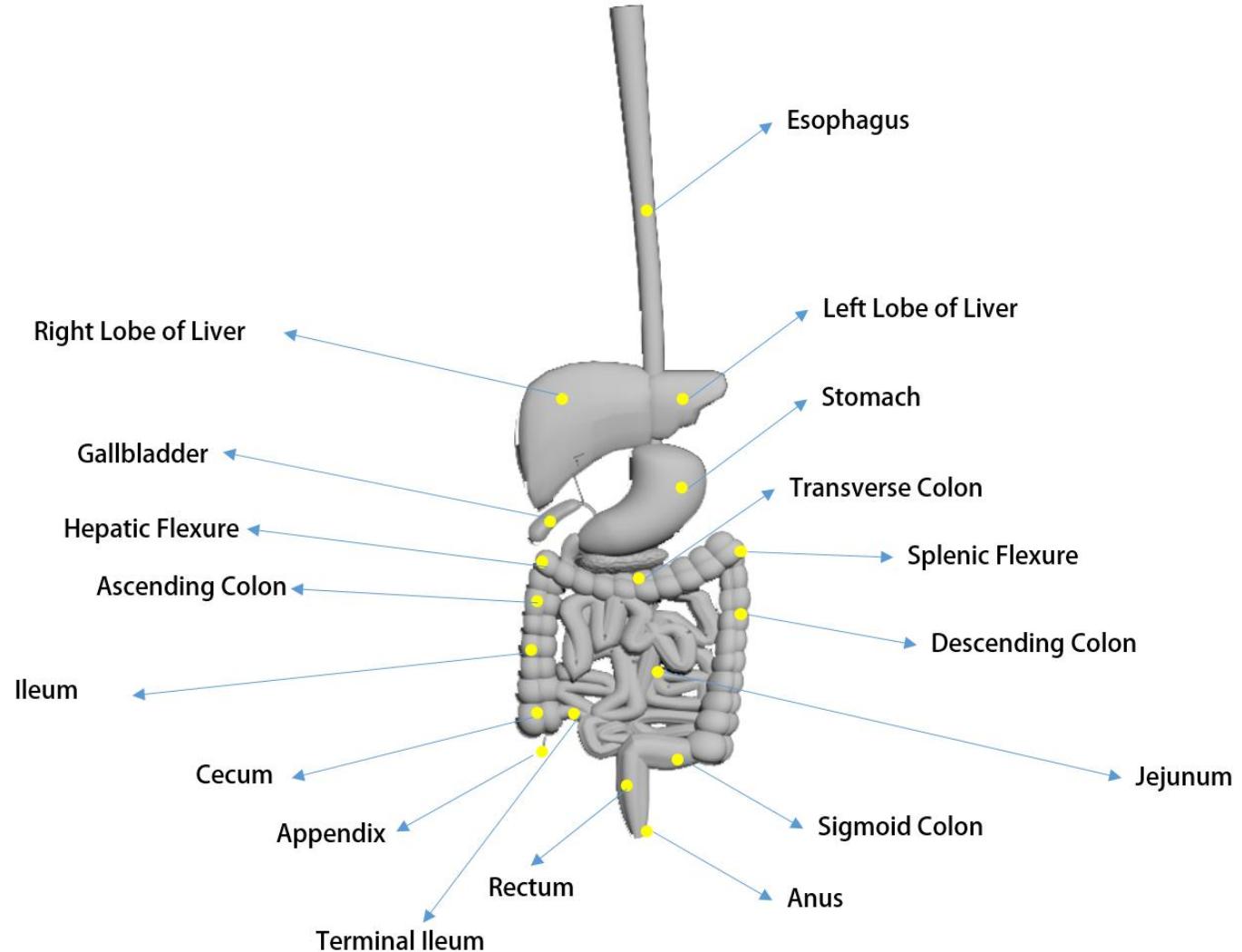


Internal Organs Set

vectorStock.com



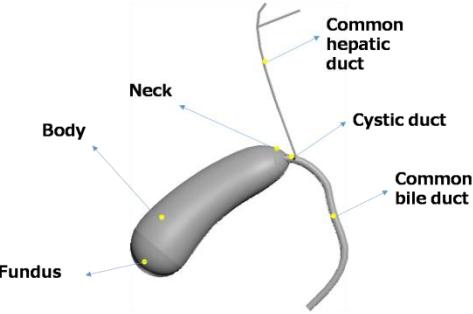
Digestive System



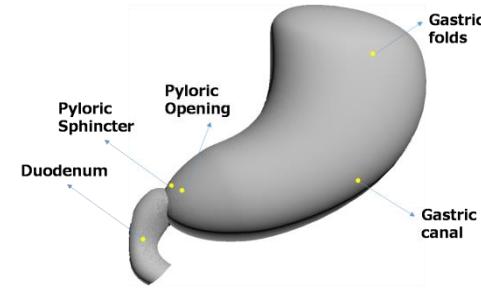
Digestive organs



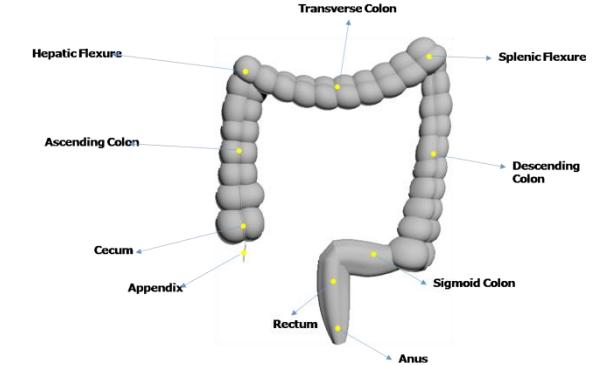
Esophagus



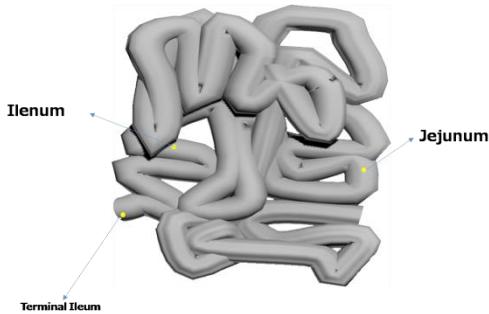
Gallbladder



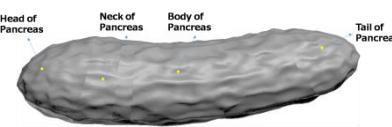
Stomach



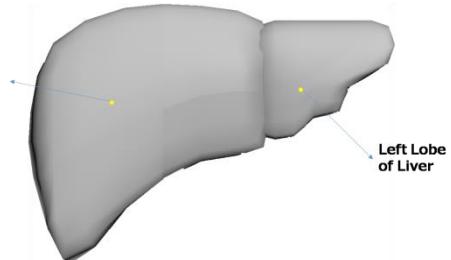
Large intestine



Small intestine



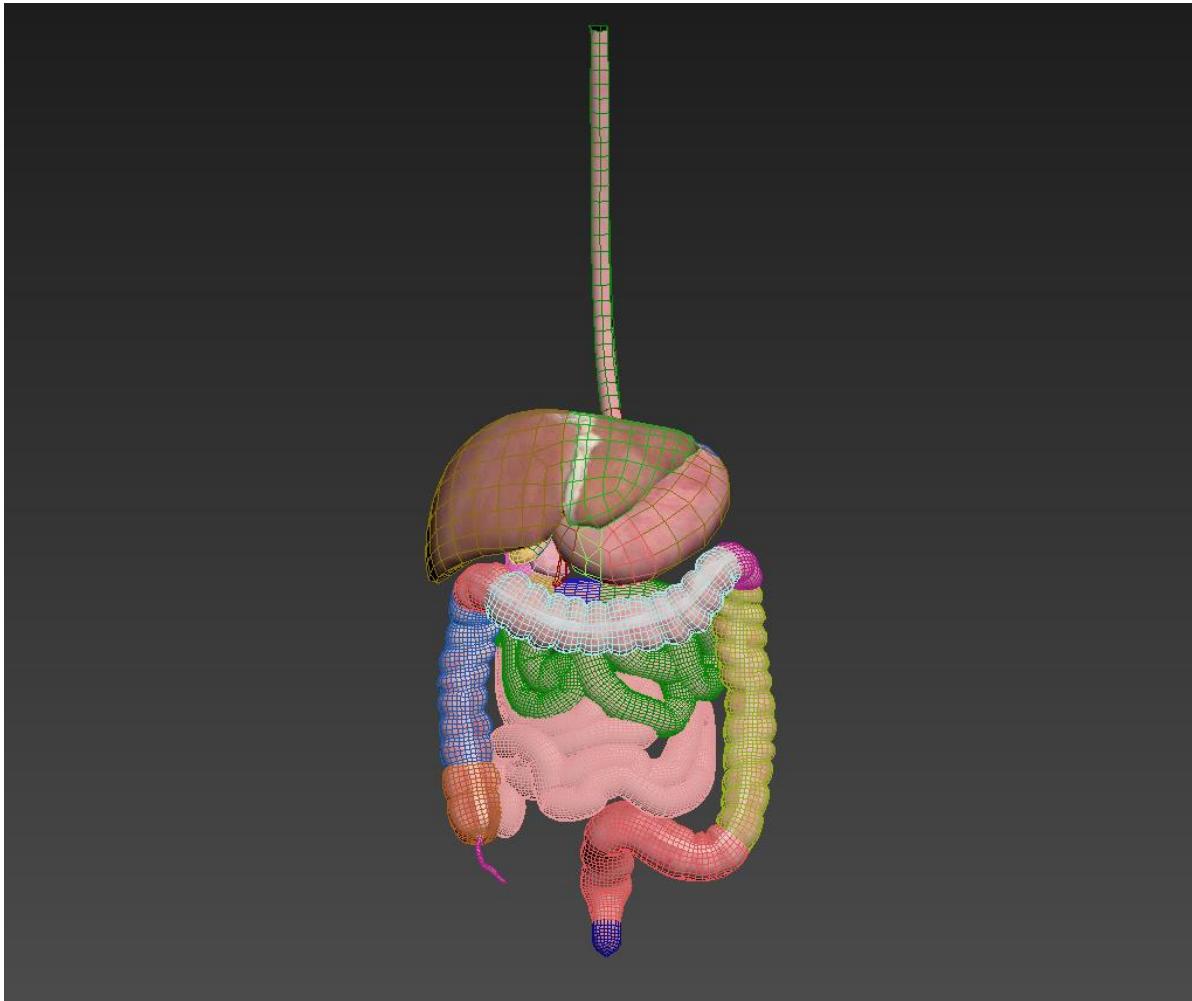
Pancreas



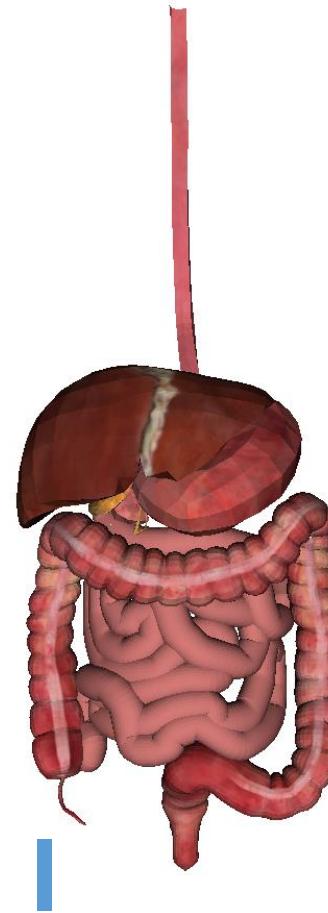
Liver

Digestive System Modeling

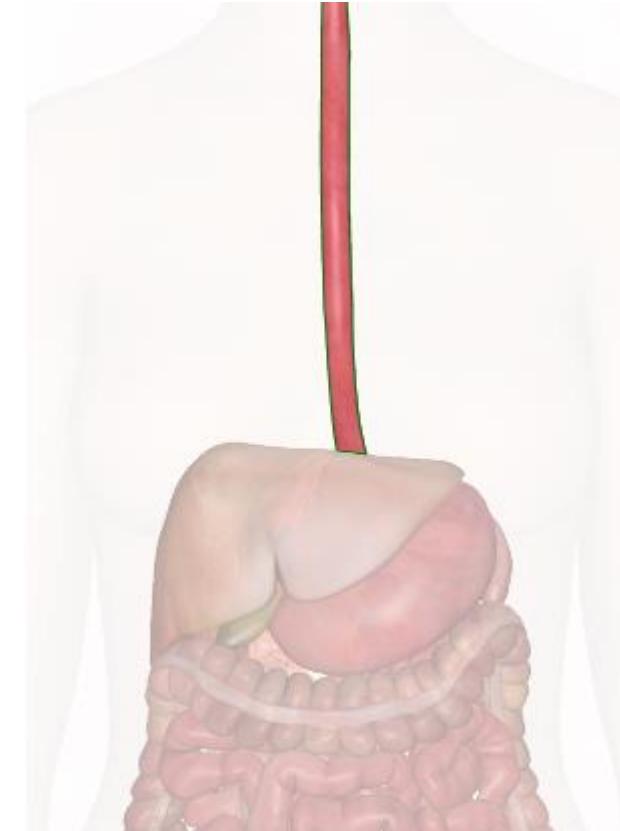
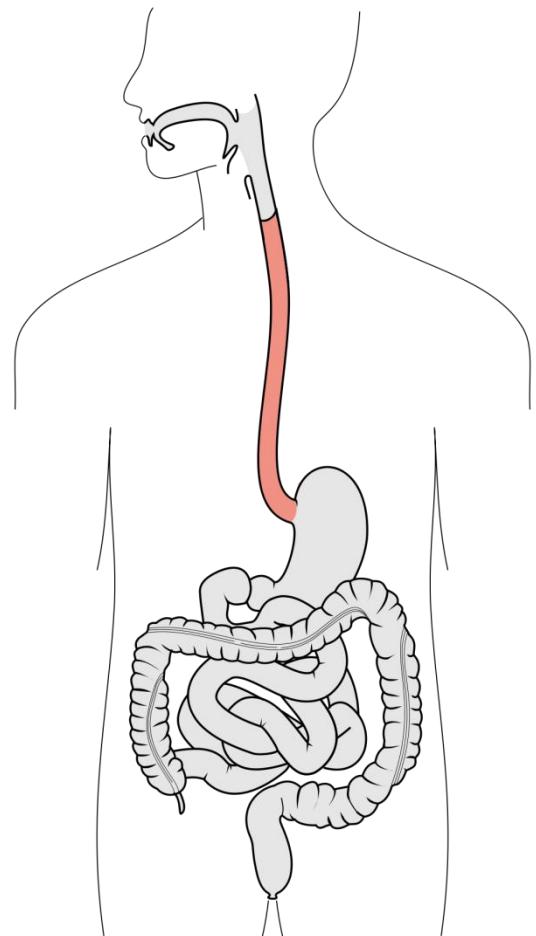
| 3ds Max Viewport Shot



x3d Viewer



Digestive System - Esophagus

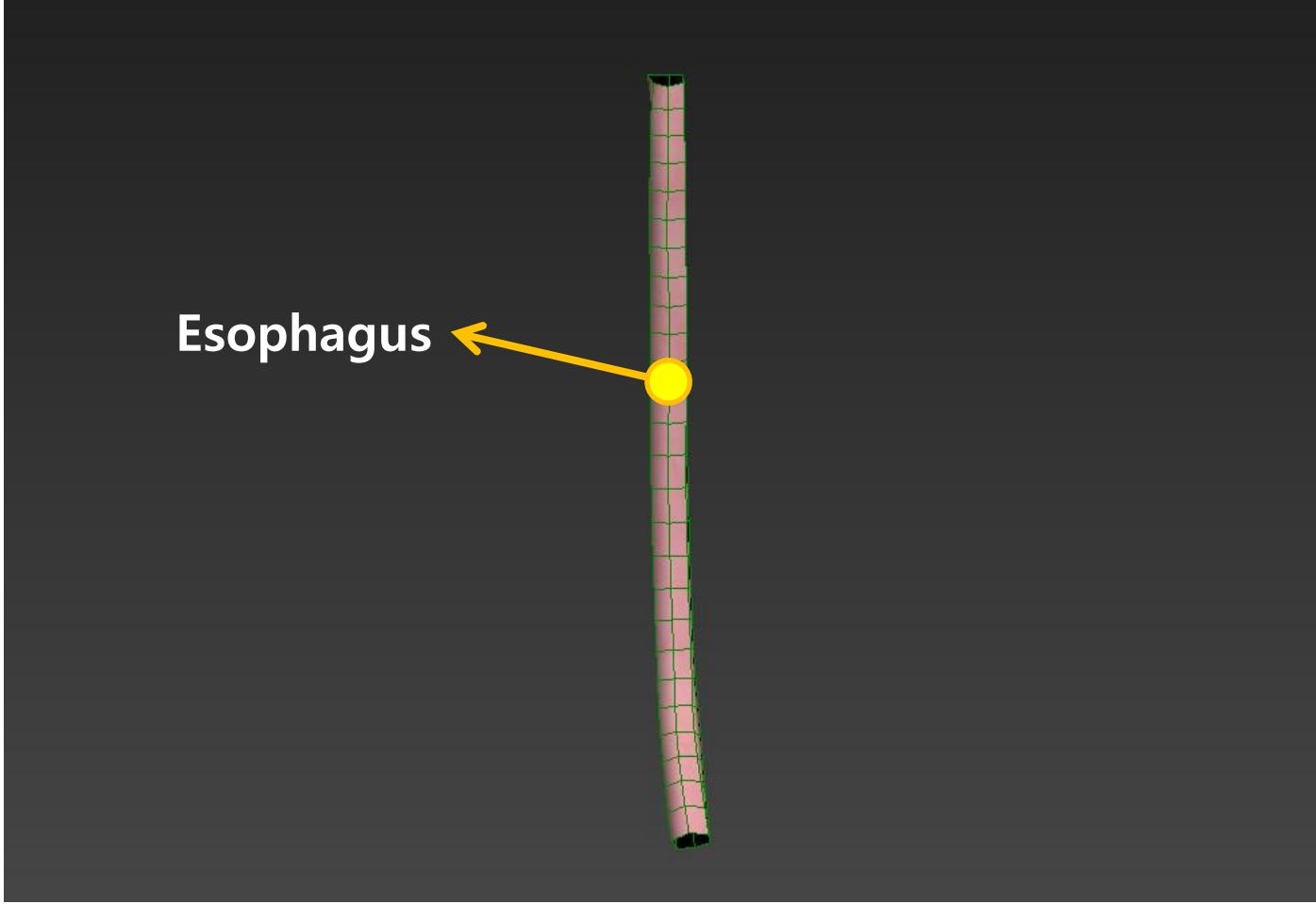


<http://www.wikipedia.com/>

https://www.innerbody.com/image_dige01/dige03-new2.html

Esophagus Modeling

3ds Max Viewport Shot

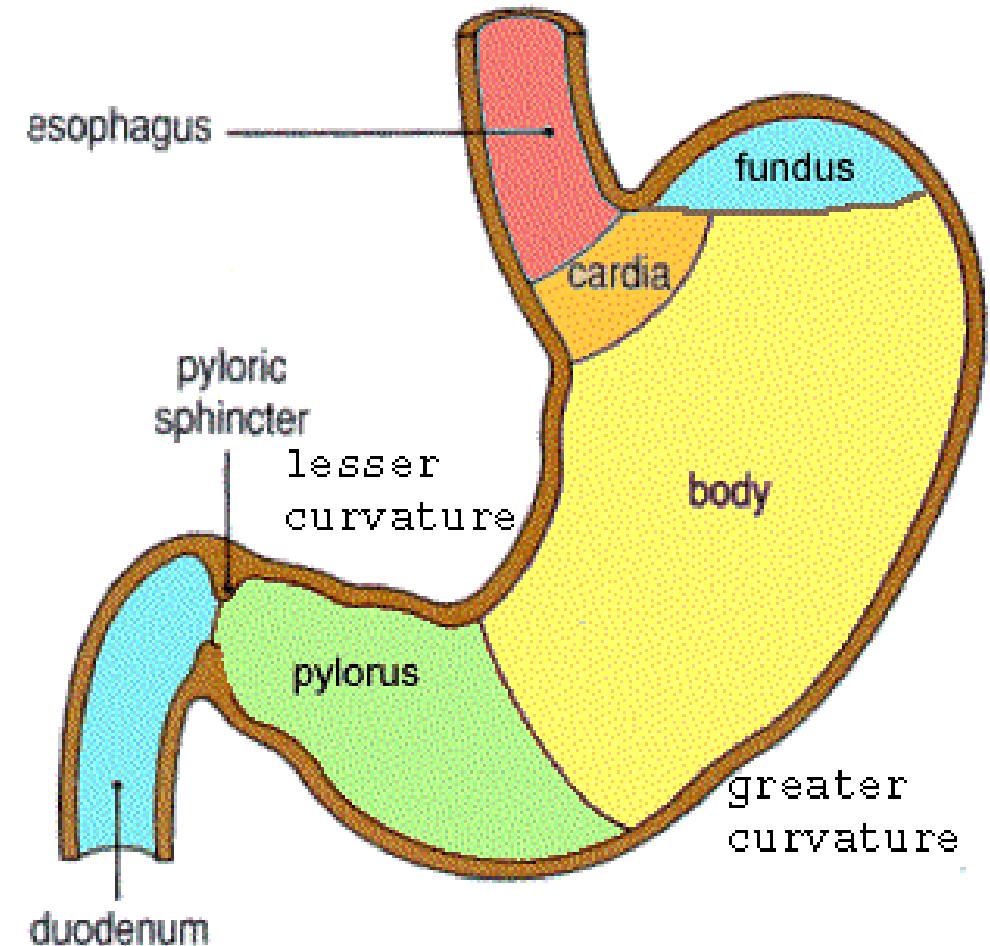
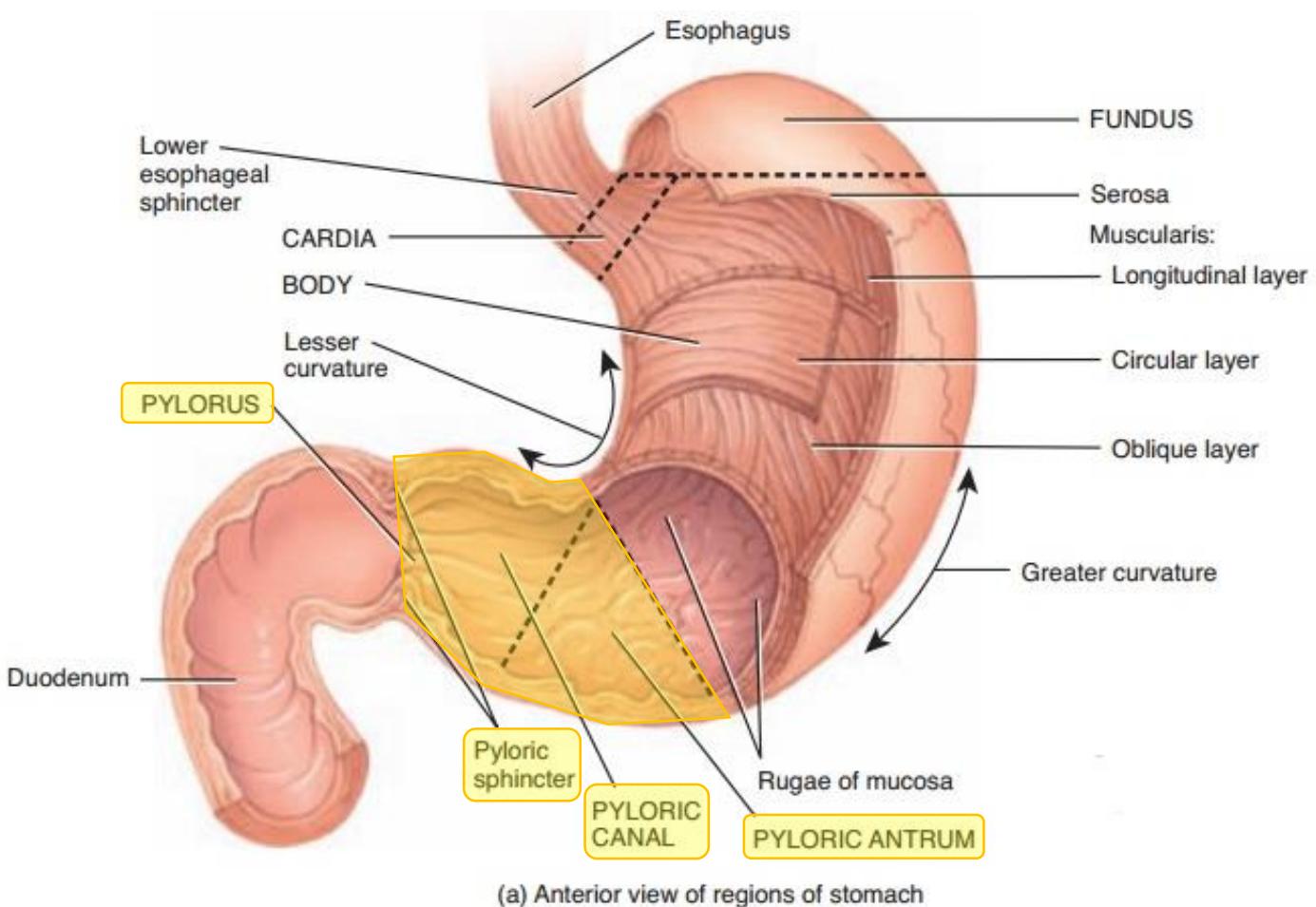


x3d Viewer

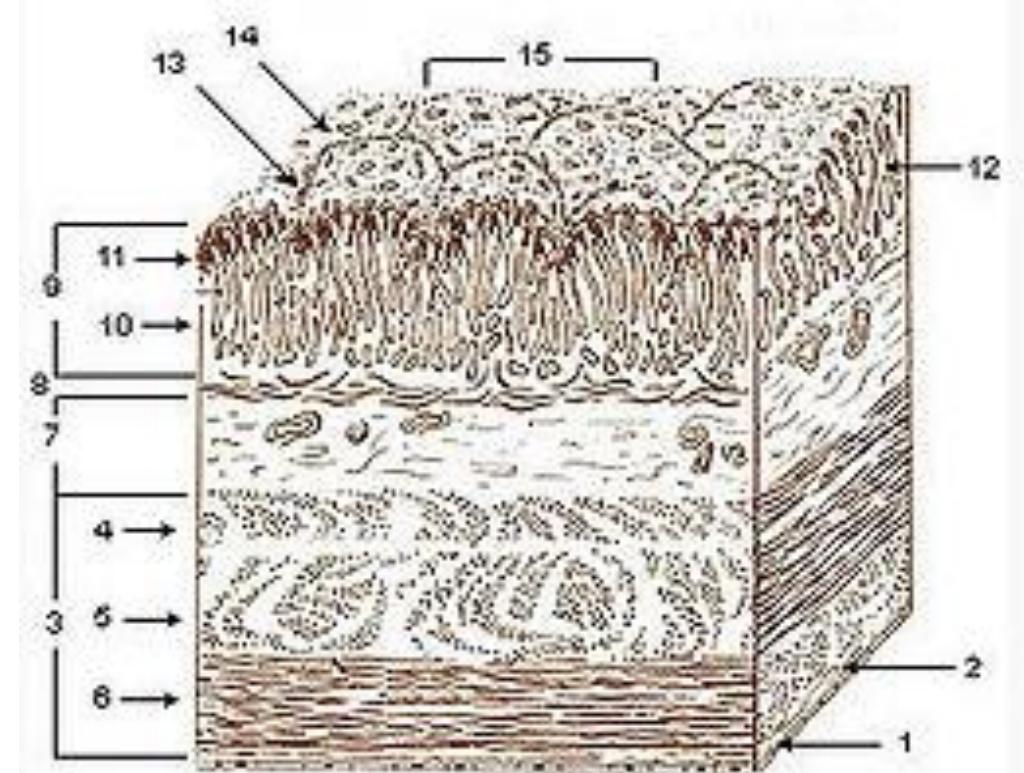
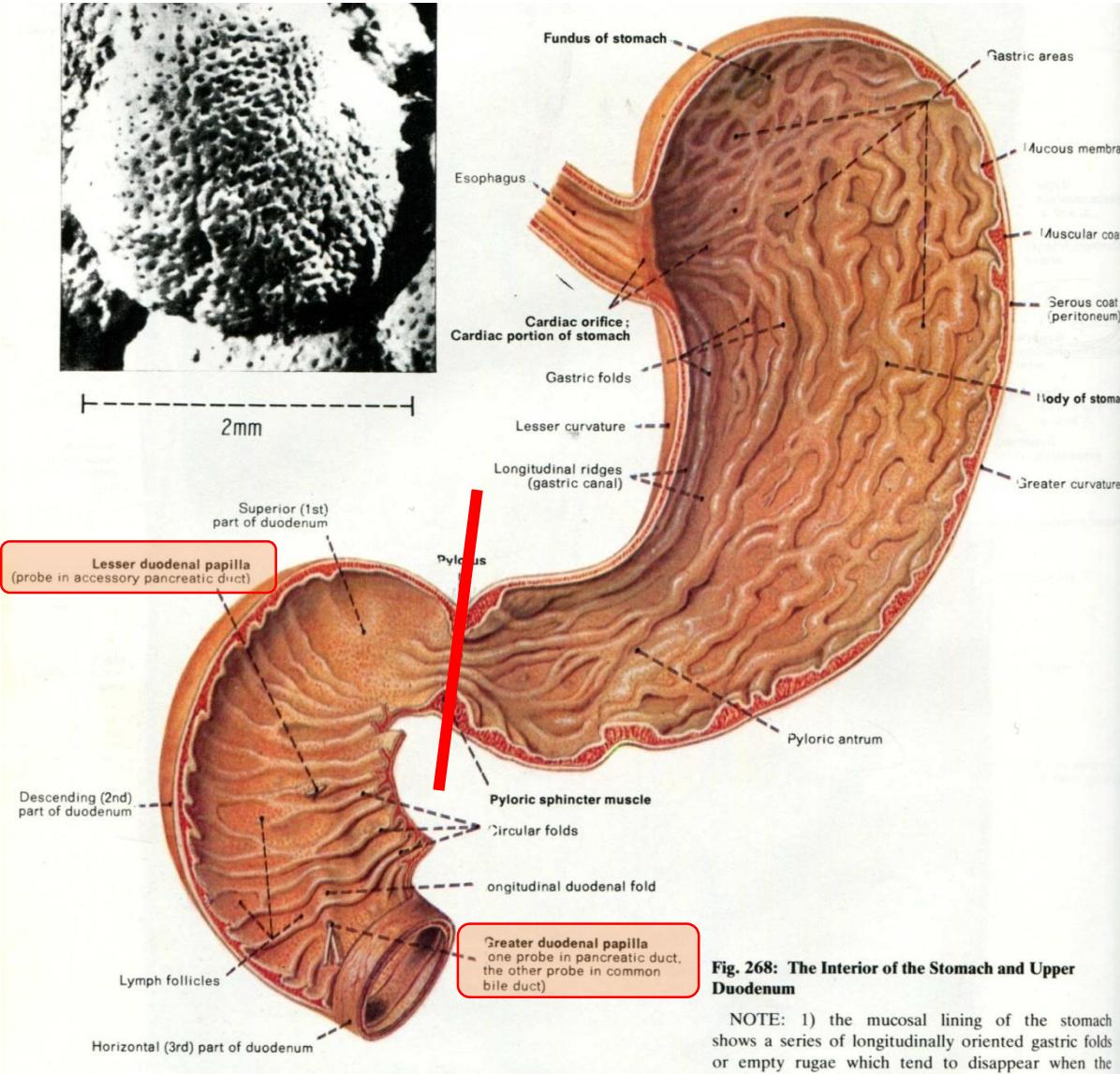
Esophagus X3D Structure

```
<?xml version='1.0' encoding='UTF-8'?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.2//EN" "http://www.web3d.org/specifications/x3d-3.2.dtd">
<X3D version='3.2' profile='Immersive' xmlns:xsd='http://www.w3.org/2001/XMLSchema-instance' xsd:noNamespaceSchemaLocation='http://www.web3d.org/specifications/x3d-3.2.xsd'>
  <head>
    <meta name='title' content='esophagus.x3d'/>
    <meta name='description' content='*enter description here, short-sentence summaries preferred'/'>
    <meta name='creator' content='*enter name of original author here'/'>
    <meta name='translator' content='*if manually translating VRML-to-X3D, enter name of person translating here'/'>
    <meta name='created' content='*enter date of initial version here'/'>
    <meta name='version' content='*enter version here'/'>
    <meta name='reference' content='*enter reference citation or relative/online url here'/'>
    <meta name='reference' content='*enter additional url/bibliographic reference information here'/'>
    <meta name='requires' content='*enter reference resource here if required to support function, delivery, or coherence of content'/'>
    <meta name='rights' content='*enter copyright information here* Example: Copyright (c) Web3D Consortium Inc. 2006'/'>
    <meta name='drawing' content='*enter drawing filename/url here'/'>
    <meta name='image' content='*enter image filename/url here'/'>
    <meta name='MovingImage' content='*enter movie filename/url here'/'>
    <meta name='photo' content='*enter photo filename/url here'/'>
    <meta name='subject' content='*enter subject keywords here'/'>
    <meta name='accessRights' content='*enter permission statements or url here'/'>
    <meta name='warning' content='*insert any known warnings, bugs or errors here'/'>
    <meta name='generator' content='Vrml97ToX3dNist, http://ovrt.nist.gov/v2_x3d.html'/'>
    <meta name='generator' content='X3D-Edit, https://savage.nps.edu/X3D-Edit'/'>
    <meta name='license' content='../../license.html'/'>
  </head>
  <Scene>
    <Viewpoint position='0 0 1200'>
    <Background groundColor='1 1 1' skyColor='1 1 1'>
    <Transform DEF="esophagus" translation="0.0 0.0 0.0">
      <Shape>
        <Appearance>
          <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
          <ImageTexture url="stomach.jpg"/>
        </Appearance>
        <IndexedFaceSet DEF="esophagus-FACES" coordIndex=" 0 1 2 -1 2 3 0 -1 4 5 6 -1 6 7 4 -1 8 9 7 -1 7 10 8 -1 6 11 12 -1 12 13 6 -1 11 6 5 -1 5 14 11 -1 15 16
          <TextureCoordinate DEF="esophagus-TEXCOORD" point="0.0664 0.9326, 0.0684 0.9645, 0.0394 0.9652, 0.036 0.9332, 0.0956 0.8604, 0.0616 0.8606, 0.0592 0.
          <Coordinate DEF="esophagus-COORD" point="-5.253 150.4 35.17, -5.253 162.7 38.67, -12.76 163.5 37.29, -13.01 151.3 33.29, 3.252 125.5 25.17, -5.253 124.
        </IndexedFaceSet>
      </Shape>
    </Transform>
  </Scene>
</X3D>
```

Digestive System - Stomach



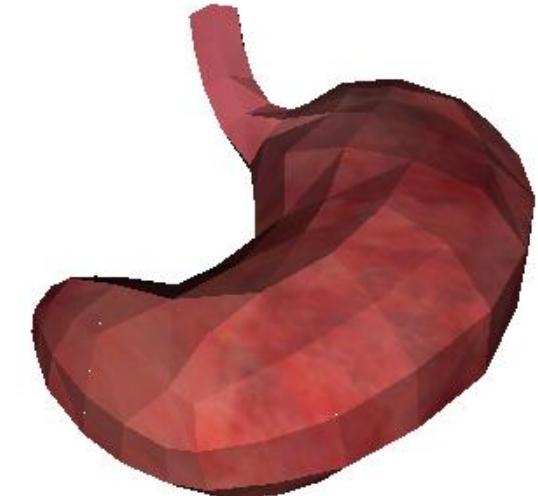
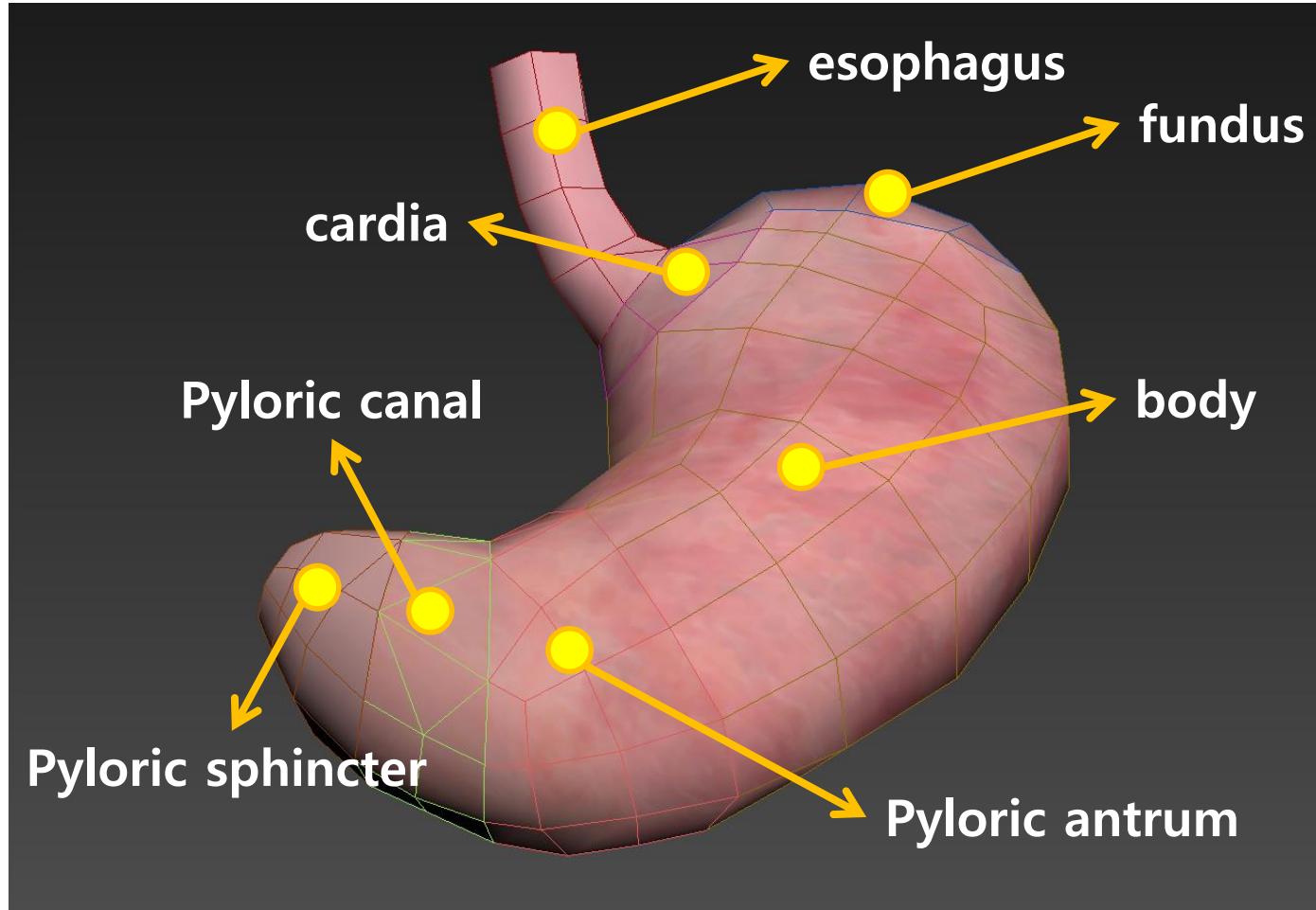
Digestive System - Stomach



Layers of Stomach Wall:

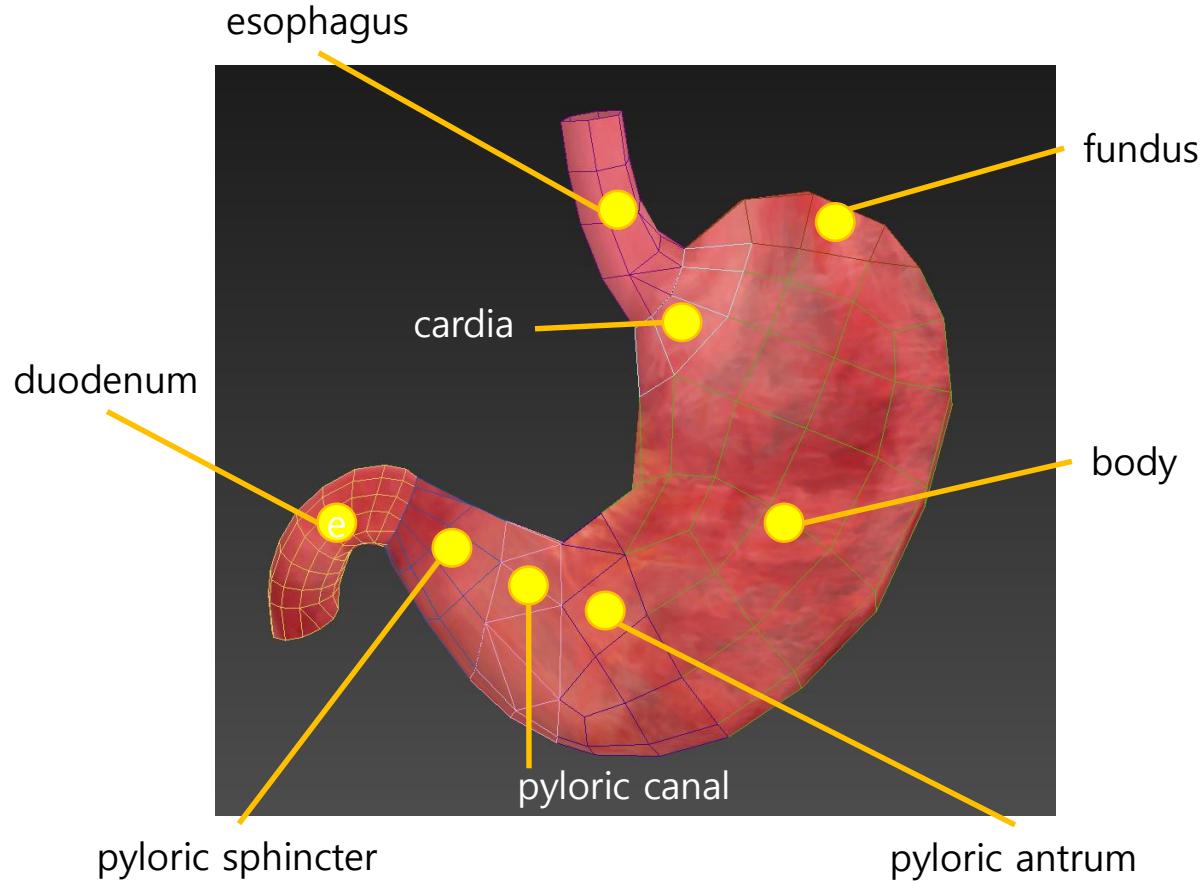
Stomach Modeling

3ds Max Viewport Shot

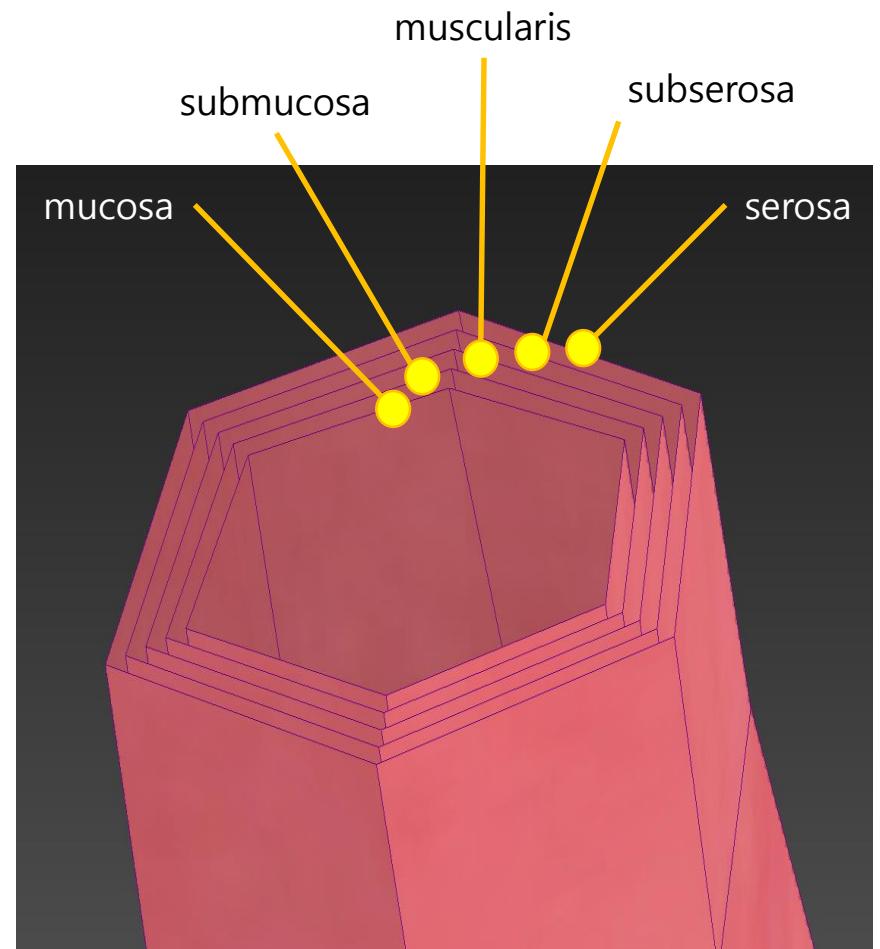


x3d Viewer Image

Stomach Modeling



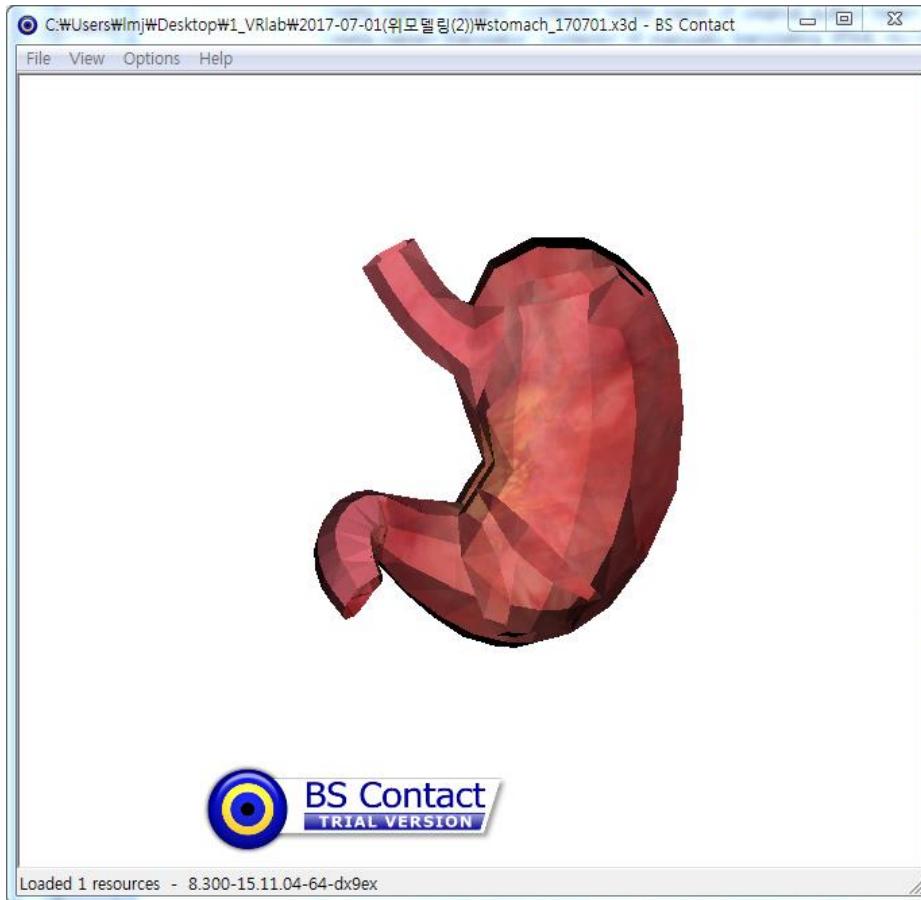
Stomach



Stomach layer

Stomach X3D

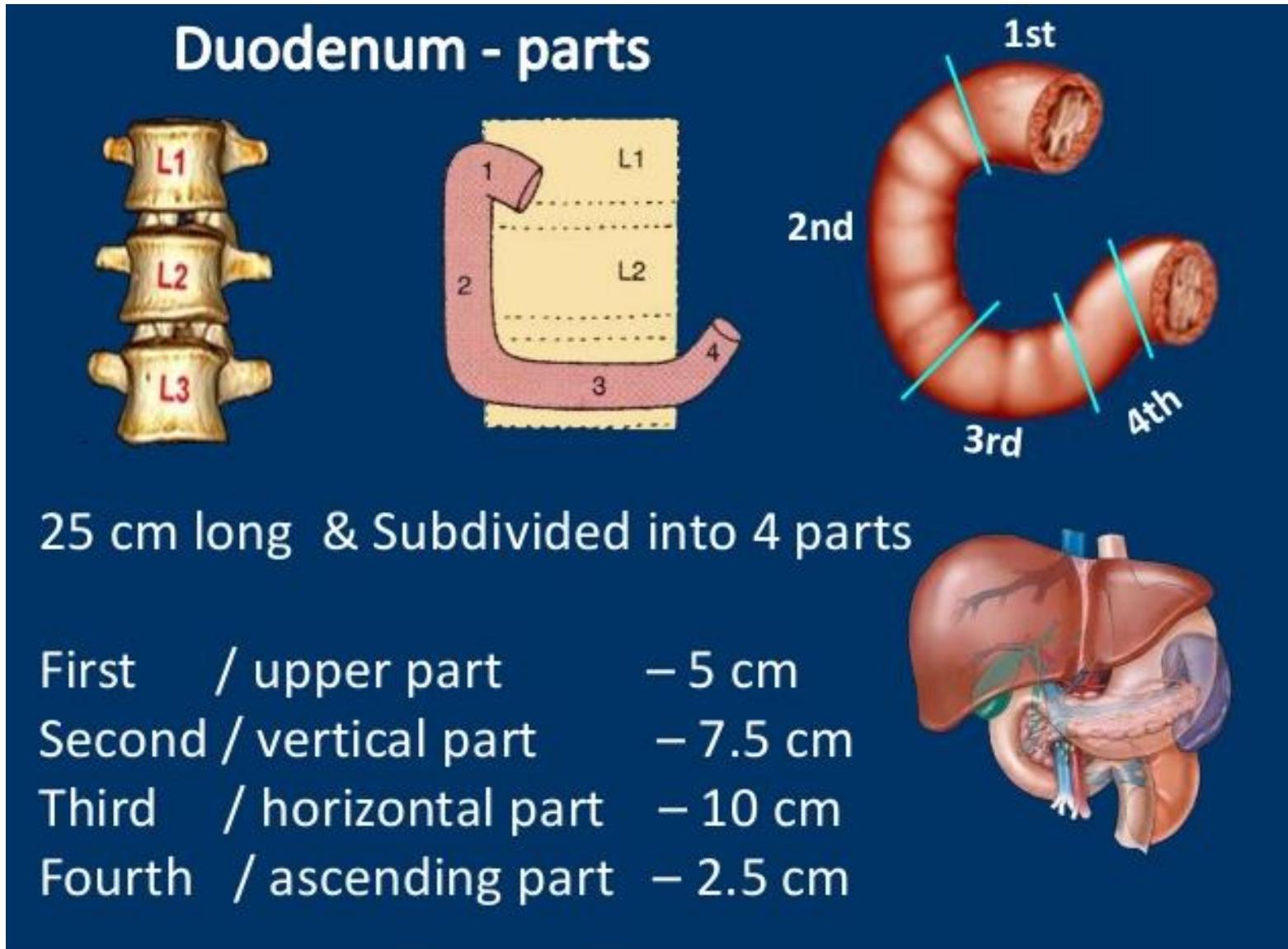
Problem in layers
modeling:
Some polygons turned
outside and intermingled



Stomach X3D Structure

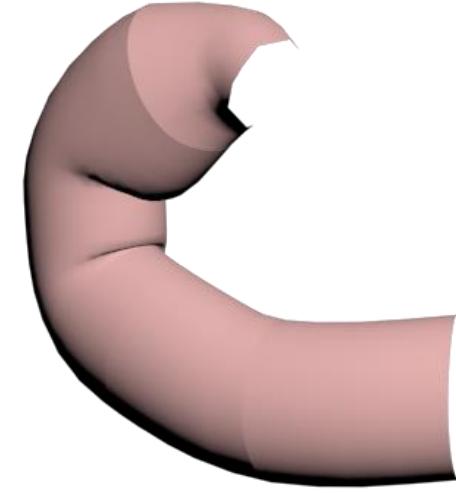
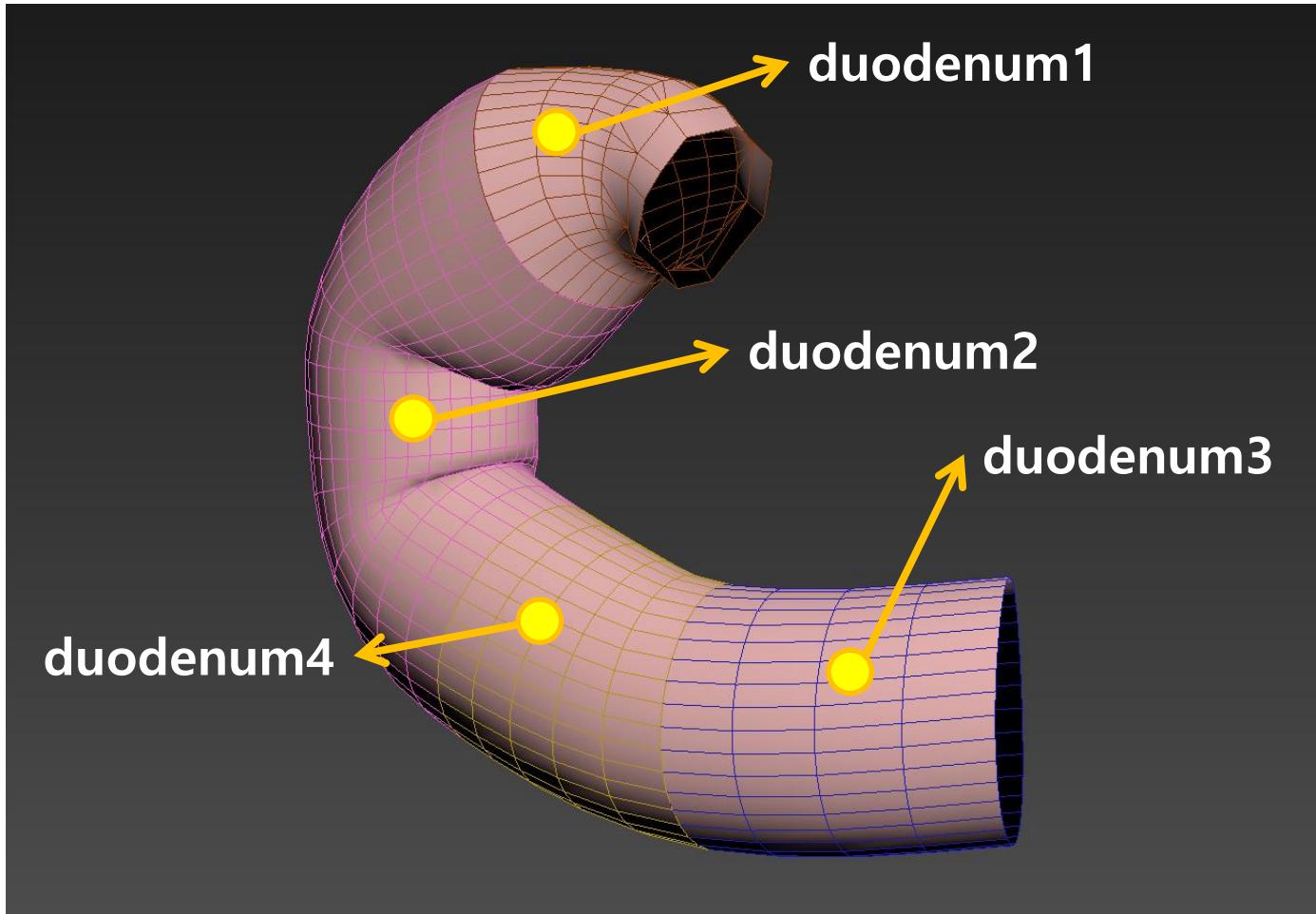
```
<?xml version='1.0' encoding='UTF-8'?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.2//EN" "http://www.web3d.org/specifications/x3d-3.2.dtd">
<X3D version='3.2' profile='Immersive' xmlns:xsd='http://www.w3.org/2001/XMLSchema-instance' xsd:noNamespaceSchemaLocation='http://www.web3d.org/specifications,
<head>
  <meta name='title' content='stomach.x3d'/>
  <meta name='description' content='*enter description here, short-sentence summaries preferred*'/>
  <meta name='creator' content='*enter name of original author here*'/>
  <meta name='translator' content='*if manually translating VRML-to-X3D, enter name of person translating here*'/>
  <meta name='created' content='*enter date of initial version here*'/>
  <meta name='version' content='*enter version here*'/>
  <meta name='reference' content='*enter reference citation or relative/online url here*'/>
  <meta name='reference' content='*enter additional url/bibliographic reference information here*'/>
  <meta name='requires' content='*enter reference resource here if required to support function, delivery, or coherence of content*'/>
  <meta name='rights' content='*enter copyright information here* Example: Copyright (c) Web3D Consortium Inc. 2006'/>
  <meta name='drawing' content='*enter drawing filename/url here*'/>
  <meta name='image' content='*enter image filename/url here*'/>
  <meta name='MovingImage' content='*enter movie filename/url here*'/>
  <meta name='photo' content='*enter photo filename/url here*'/>
  <meta name='subject' content='*enter subject keywords here*'/>
  <meta name='accessRights' content='*enter permission statements or url here*'/>
  <meta name='warning' content='*insert any known warnings, bugs or errors here*'/>
  <meta name='generator' content='Vrml97ToX3dNist, http://ovrt.nist.gov/v2_x3d.html'/>
  <meta name='generator' content='X3D-Edit, https://savage.nps.edu/X3D-Edit'/>
  <meta name='license' content='..../license.html'/>
</head>
<Scene>
  <Viewpoint position='0 0 500'/>
  <Background groundColor='1 1 1' skyColor='1 1 1'/>
  <Transform DEF="stomach_body" translation="39.87 -6.485 8.21">
    <Shape>
      <Appearance>
        <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
        <ImageTexture url="stomach.jpg"/>
      </Appearance>
      <IndexedFaceSet DEF="stomach_body-FACES" coordIndex=" 2 3 0 -1 0 1 2 -1 7 4 5 -1 5 6 7 -1 9 4 7 -1 7 8 9 -1 13 10 11 -1 11 12 13 -1 6 14 15 -1 15 16 6 -1 20 17 18 -1 1
        <TextureCoordinate DEF="stomach_body-TEXCOORD" point="0.7425 0.4708, 0.6715 0.4546, 0.6943 0.387, 0.7623 0.4158, 0.5116 0.3272, 0.5173 0.2539, 0.5857 0.2649, 0.5
        <Coordinate DEF="stomach_body-COORD" point="-14.01 52.61 -19.09, -30.17 38.51 -8.225, -11.49 39.36 5.513, -1.641 51.84 -12.8, -44.94 2.537 34.66, -38.38 -5.331 54.
      </IndexedFaceSet>
    </Shape>
  </Transform>
  <Transform DEF="stomach_escophagus" translation="-5.64 55.93 -46.32">
    <Shape>
      <Appearance>
        <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
        <ImageTexture url="stomach.jpg"/>
      </Appearance>
      <IndexedFaceSet DEF="stomach_escophagus-FACES" coordIndex=" 0 1 2 -1 3 0 2 -1 2 4 3 -1 6 4 7 -1 7 5 6 -1 10 11 8 -1 8 9 10 -1 15 12 13 -1 13 14 15 -1 14 13 16 -1 20
        <TextureCoordinate DEF="stomach_escophagus-TEXCOORD" point="0.0706 0.0797, 0.0778 0.0572, 0.0908 0.0669, 0.1043 0.0888, 0.1095 0.0711, 0.1186 0.0455, 0.1363 0.
        <Coordinate DEF="stomach_escophagus-COORD" point="4.734 5.165 3.297, 10.79 -4.456 10.07, 11.42 -4.556 2.694, 5.113 3.601 -5.491, 10.04 -6.427 -3.254, 13.95 -21.5
      </IndexedFaceSet>
    </Shape>
  </Transform>
```

Digestive organs - Duodenum

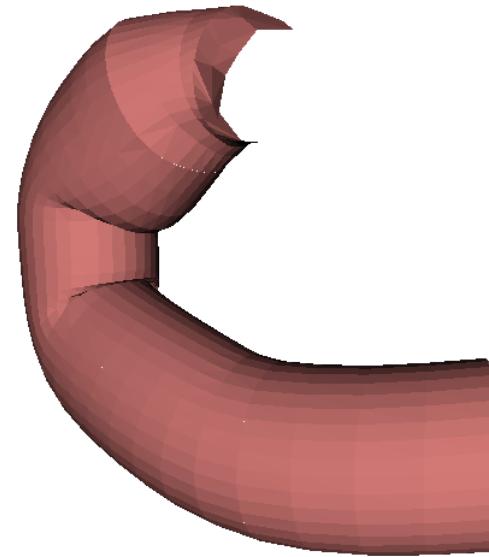


Duodenum Modeling

3ds Max Viewport Shot



Rendering Image

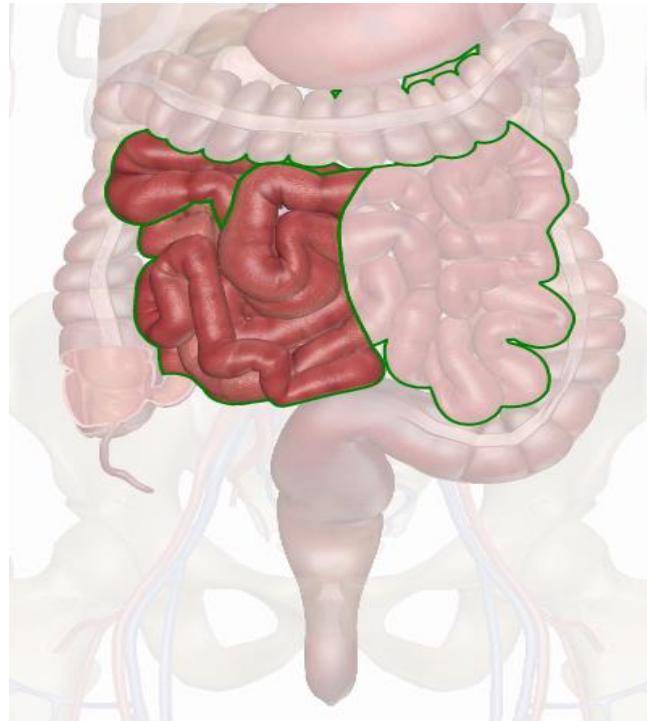


x3d Viewer Image

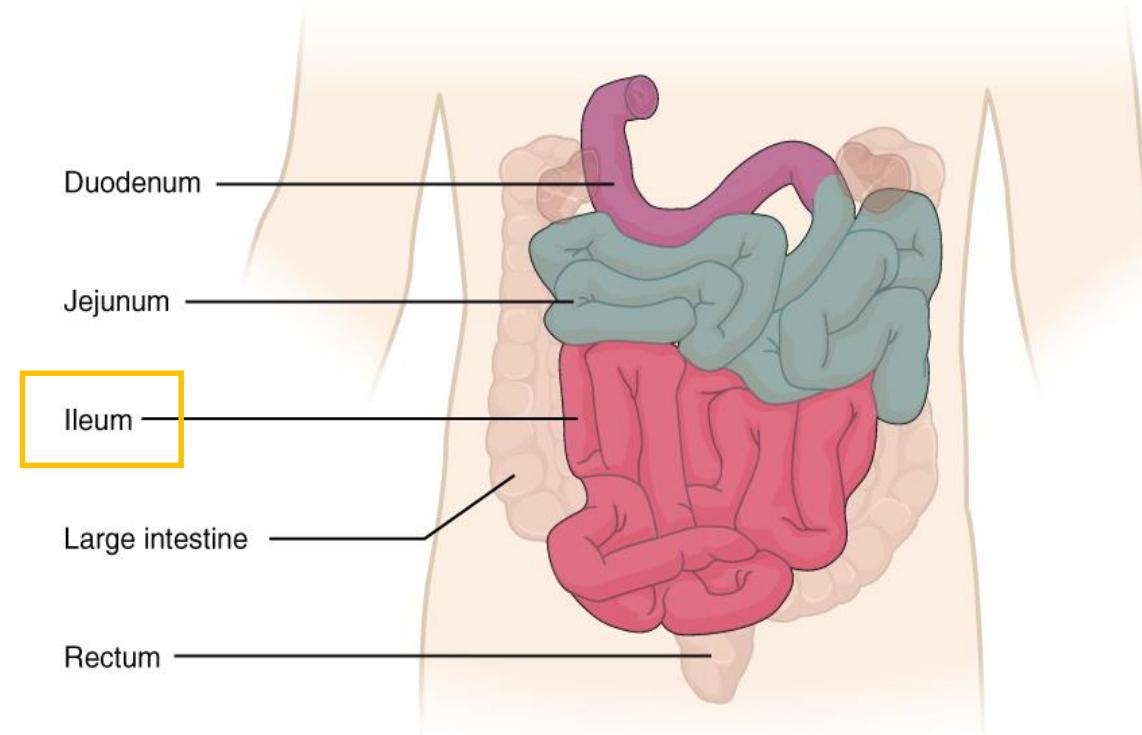
Duodenum X3D Structure

```
<?xml version='1.0' encoding='UTF-8'?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.2//EN" "http://www.web3d.org/specifications/x3d-3.2.dtd">
<X3D version='3.2' profile='Immersive' xmlns:xsd='http://www.w3.org/2001/XMLSchema-instance' xsd:noNamespaceSchemaLocation='http://www.web3d.org/specific
<head>
  <meta name='title' content='duodenum.x3d'/>
  <meta name='description' content='*enter description here, short-sentence summaries preferred' />
  <meta name='creator' content='*enter name of original author here' />
  <meta name='translator' content='*if manually translating VRML-to-X3D, enter name of person translating here' />
  <meta name='created' content='*enter date of initial version here' />
  <meta name='version' content='*enter version here' />
  <meta name='reference' content='*enter reference citation or relative/online url here' />
  <meta name='reference' content='*enter additional url/bibliographic reference information here' />
  <meta name='requires' content='*enter reference resource here if required to support function, delivery, or coherence of content' />
  <meta name='rights' content='*enter copyright information here* Example: Copyright (c) Web3D Consortium Inc. 2006' />
  <meta name='drawing' content='*enter drawing filename/url here' />
  <meta name='image' content='*enter image filename/url here' />
  <meta name='MovingImage' content='*enter movie filename/url here' />
  <meta name='photo' content='*enter photo filename/url here' />
  <meta name='subject' content='*enter subject keywords here' />
  <meta name='accessRights' content='*enter permission statements or url here' />
  <meta name='warning' content='*insert any known warnings, bugs or errors here' />
  <meta name='generator' content='Vrml97ToX3dNist, http://ovrt.nist.gov/v2_x3d.html' />
  <meta name='generator' content='X3D-Edit, https://savage.nps.edu/X3D-Edit' />
  <meta name='license' content='../license.html' />
</head>
<Scene>
  <Viewpoint position='0 0 200' />
  <Background groundColor='1 1 1' skyColor='1 1 1' />
  <Transform DEF="duodenum2" translation="-19.07 11.62 -11.71">
    <Shape>
      <Appearance>
        <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
        <ImageTexture url="small_intestine.jpg"/>
      </Appearance>
      <IndexedFaceSet DEF="duodenum2-FACES" coordIndex="0 1 2 -1 2 3 0 -1 1 4 5 -1 5 2 1 -1 6 7 8 -1 8 9 6 -1 9 8 3 -1 3 2 9 -1 1 0 9 2 -1 2 5 1 0 -1 1 1 6 9 -1 9 10 11 -1
        <TextureCoordinate DEF="duodenum2-TEXCOORD" point="0.6468 0.8972, 0.6333 0.9207, 0.6333 0.9207, 0.6468 0.8972, 0.6197 0.9442, 0.6197 0.9442, 0.6333 0.9207
        <Coordinate DEF="duodenum2-COORD" point="14.3 -31.27 -11.29, 13.18 -33.76 -11.28, 10.01 -31.05 -14.41, 11.1 -28.57 -14.35, 11.84 -36.06 -10.92, 8.673 -33.34
      </IndexedFaceSet>
    </Shape>
  </Transform>
  <Transform DEF="duodenum4" translation="26.47 -27.09 10.12">
    <Shape>
      <Appearance>
        <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
        <ImageTexture url="small_intestine.jpg"/>
      </Appearance>
      <IndexedFaceSet DEF="duodenum4-FACES" coordIndex="3 4 5 -1 5 6 3 -1 4 3 8 -1 8 7 4 -1 0 4 7 -1 7 2 0 -1 1 5 4 -1 4 0 1 -1 1 4 4 1 4 5 9 -1 9 10 1 4 4 -1 1 1 9 1 4 5 -1
        <TextureCoordinate DEF="duodenum4-TEXCOORD" point="0.6333 0.9207, 0.6197 0.9442, 0.6468 0.8972, 0.6333 0.9207, 0.6333 0.9207, 0.6197 0.9442, 0.6197 0.9442
        <Coordinate DEF="duodenum4-COORD" point="22.75 -7.362 -9.094, 22.69 -9.81 -7.661, 22.77 -4.67 -10.13, 5.503 -8.475 -12.15, 13.83 -8.039 -10.2, 13.62 -10.5 -1
      </IndexedFaceSet>
    </Shape>
  </Transform>
```

Digestive System – Small Intestine (Ileum)

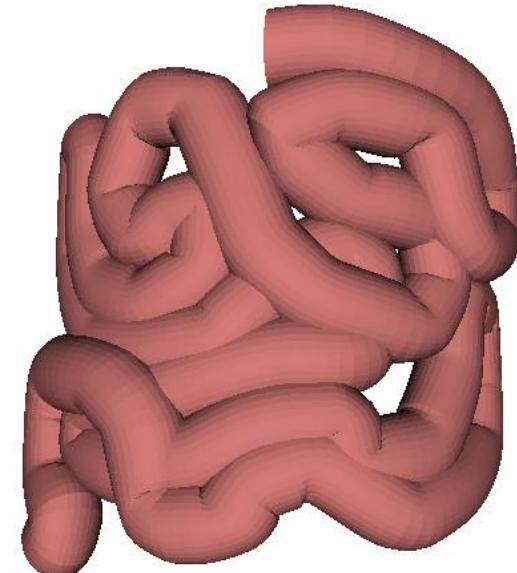
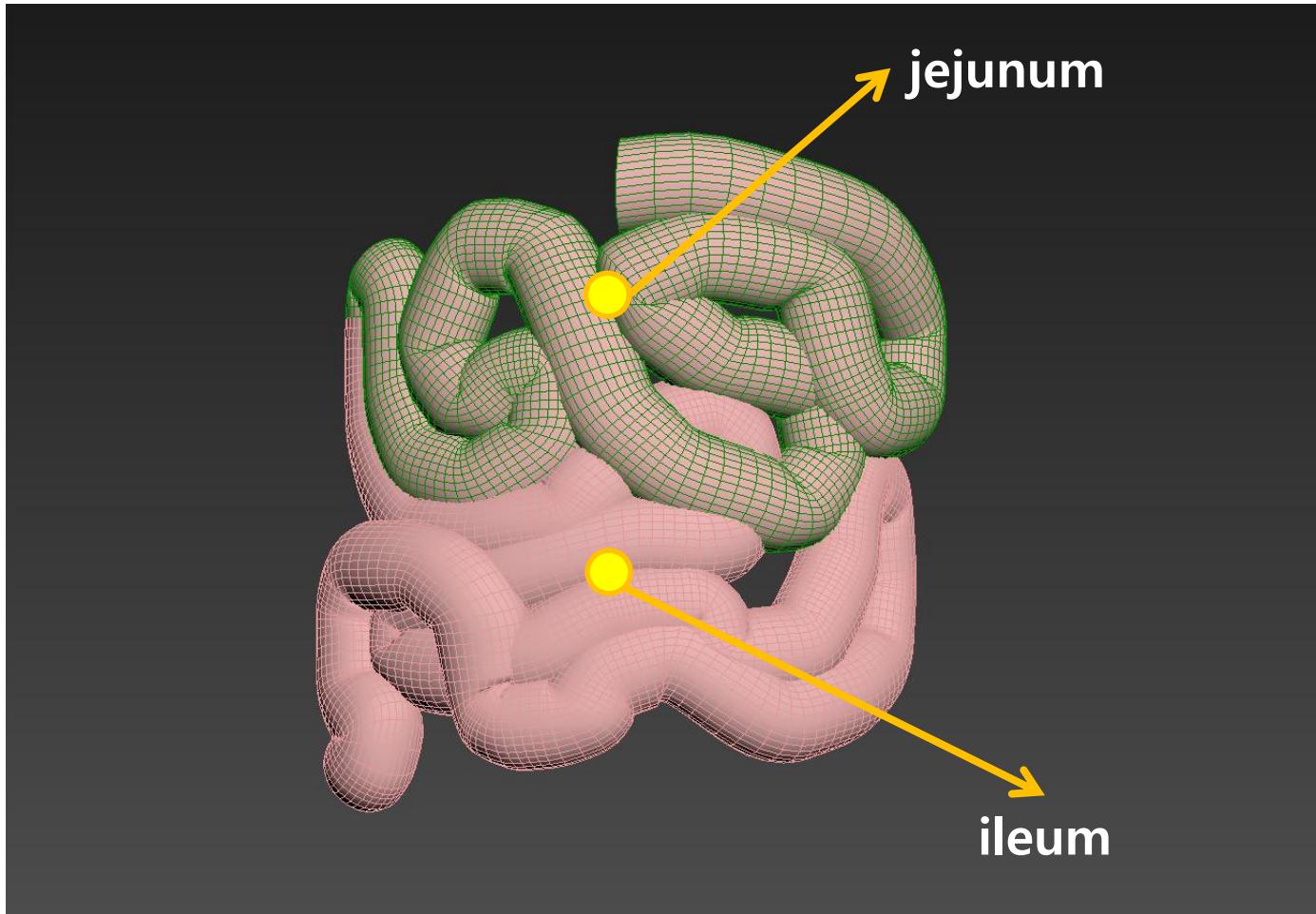


<http://www.innerbody.com/>



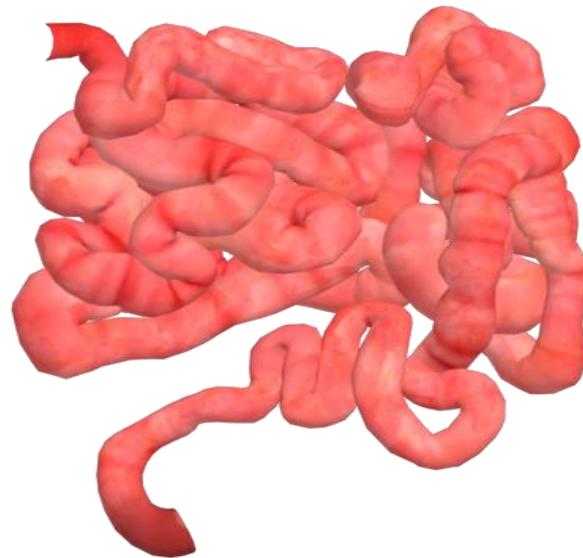
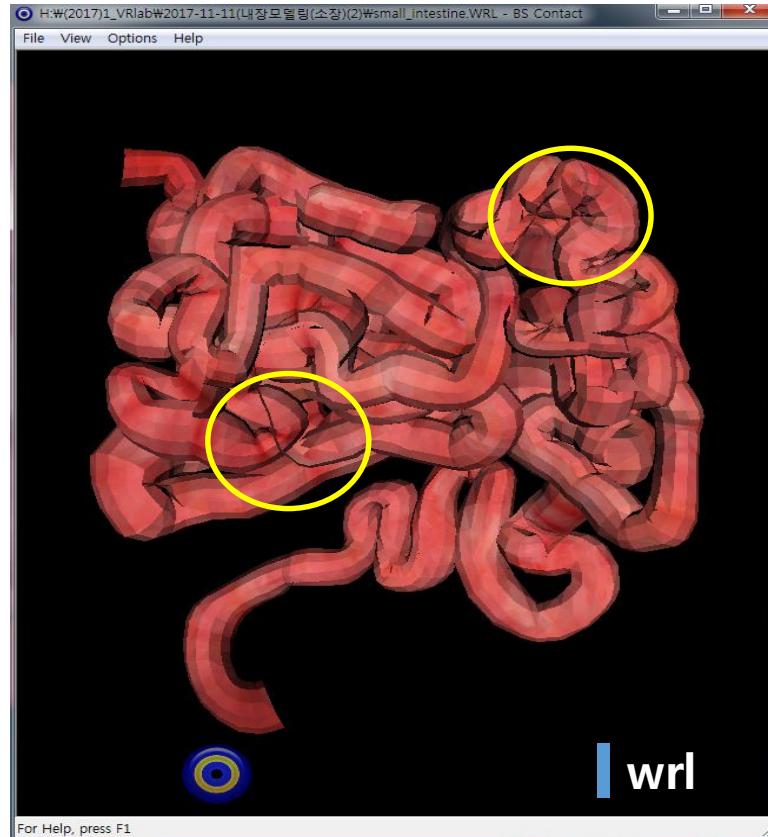
Small Intestine Modeling

3ds Max Viewport Shot

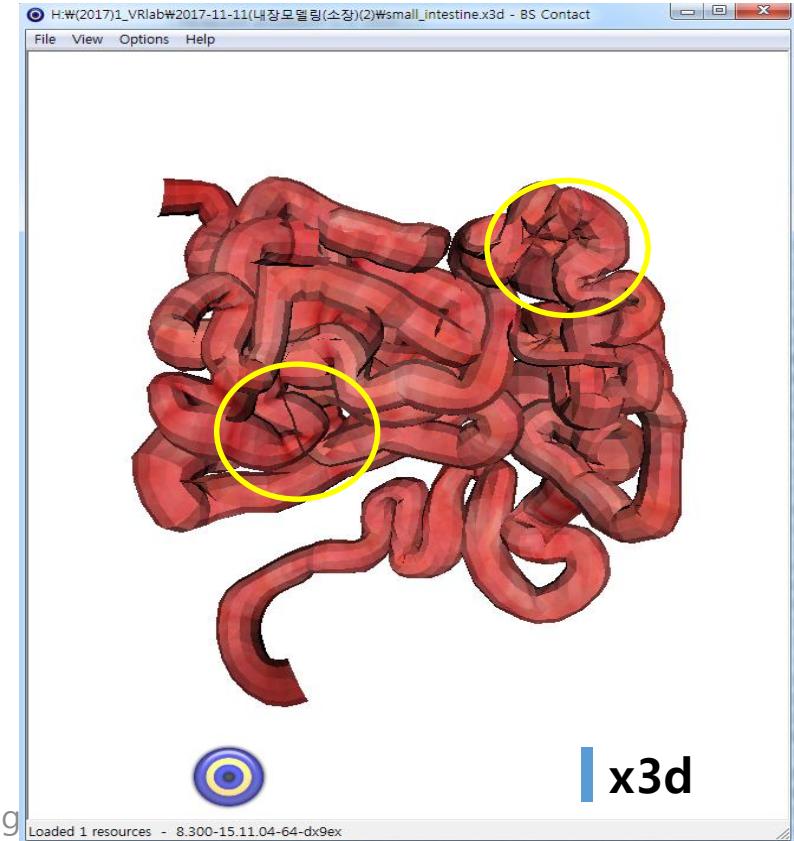


x3d Viewer Image

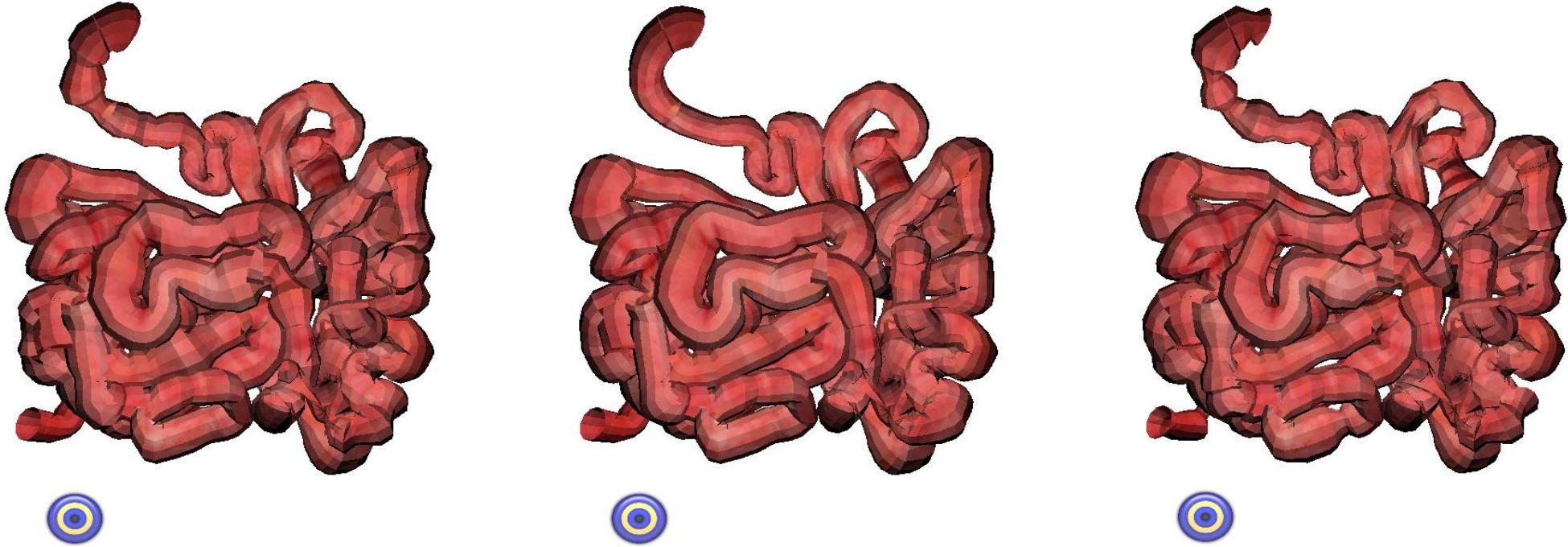
Digestive System – Problem of Small Intestine Modeling



Overlapping polygon



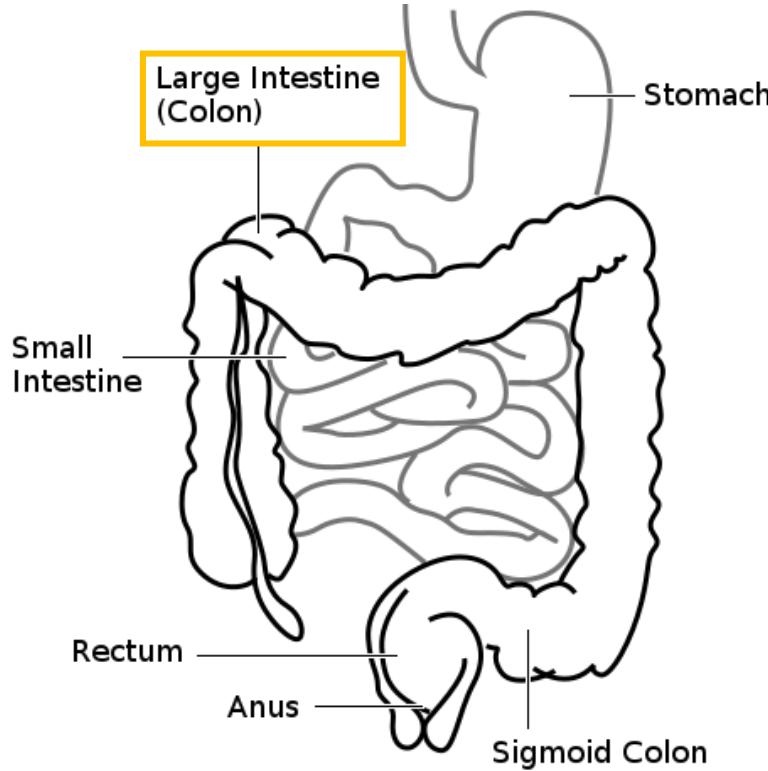
Small Intestine Animation using Interpolators



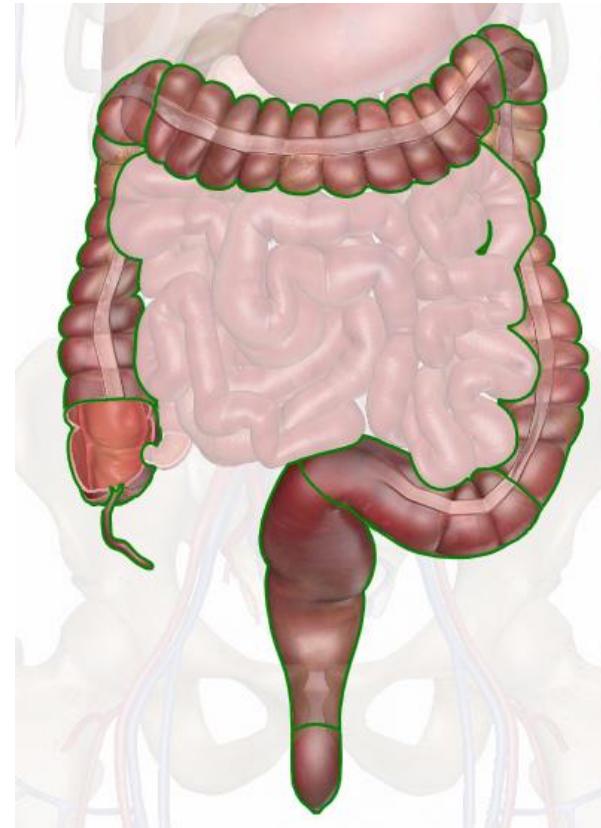
Small Intestine X3D Structure

```
<?xml version='1.0' encoding='UTF-8'?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.2//EN" "http://www.web3d.org/specifications/x3d-3.2.dtd">
<X3D version='3.2' profile='Immersive' xmlns:xsd='http://www.w3.org/2001/XMLSchema-instance' xsd:noNamespaceSchemaLocation='http://www.web3d.org/specification:X3D.xsd'>
  <head>
    <meta name='title' content='small_intestine.x3d'/>
    <meta name='description' content='*enter description here, short-sentence summaries preferred*'/>
    <meta name='creator' content='*enter name of original author here*'/>
    <meta name='translator' content='*if manually translating VRML-to-X3D, enter name of person translating here*'/>
    <meta name='created' content='*enter date of initial version here*'/>
    <meta name='version' content='*enter version here*'/>
    <meta name='reference' content='*enter reference citation or relative/online url here*'/>
    <meta name='reference' content='*enter additional url/bibliographic reference information here*'/>
    <meta name='requires' content='*enter reference resource here if required to support function, delivery, or coherence of content*'/>
    <meta name='rights' content='*enter copyright information here- Example: Copyright (c) Web3D Consortium Inc. 2006*'/>
    <meta name='drawing' content='*enter drawing filename/url here*'/>
    <meta name='image' content='*enter image filename/url here*'/>
    <meta name='MovingImage' content='*enter movie filename/url here*'/>
    <meta name='photo' content='*enter photo filename/url here*'/>
    <meta name='subject' content='*enter subject keywords here*'/>
    <meta name='accessRights' content='*enter permission statements or url here*'/>
    <meta name='warning' content='*insert any known warnings, bugs or errors here*'/><content='Vrml97ToX3dNist, http://ovrt.nist.gov/v2_x3d.html'/>
    <meta name='generator' content='X3D-Edit, https://savage.nps.edu/X3D-Edit/'/>
    <meta name='license' content='..../license.html'/>
  </head>
  <Scene>
    <Viewpoint position='0 0 500'/>
    <Background groundColor='1 1 1' skyColor='1 1 1'/>
    <Transform DEF="small_intestine_ileum" translation="-9.634 -37.75 3.528">
      <Shape>
        <Appearance>
          <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
          <ImageTexture url="small_intestine.jpg"/>
        </Appearance>
        <IndexedFaceSet DEF="small_intestine_ileum-FACES" coordIndex=" 12267 1 2 -1 2 0 12267 -1 12267 0 4 -1 4 3 12267 -1 5 6 7 -1 7 8 5 -1 6 5 10 -1 10 9 6 -1 0 6 9 -1 9 4 0
          <TextureCoordinate DEF="small_intestine_ileum-TEXCOORD" point="0.6333 0.9207, 0.6333 0.9207, 0.6197 0.9442, 0.6197 0.9442, 0.6468 0.8972, 0.6468 0.8972, 0.6333 0.
          <Coordinate DEF="small_intestine_ileum-COORD" point="-71.96 78.83 -31.29, -73.71 82.8 -29.92, -73.88 79.11 -29.5, -70.19 82.23 -33.8, -70.35 78.54 -33.37, -72.21 72
        </IndexedFaceSet>
      </Shape>
    </Transform>
    <Transform DEF="small_intestine_jejunem" translation="0.9395 40.66 -5.853">
      <Shape>
        <Appearance>
          <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
          <ImageTexture url="small_intestine.jpg"/>
        </Appearance>
        <IndexedFaceSet DEF="small_intestine_jejunem-FACES" coordIndex=" 7662 7663 1 -1 1 0 7662 -1 2 7662 0 -1 0 3 2 -1 4 5 6 -1 6 7 4 -1 8 6 5 -1 5 9 8 -1 6 8 3 -1 3 0 6 -1
          <TextureCoordinate DEF="small_intestine_jejunem-TEXCOORD" point="0.6333 0.9207, 0.6333 0.9207, 0.6197 0.9442, 0.6197 0.9442, 0.6468 0.8972, 0.6468 0.8972, 0.6197
          <Coordinate DEF="small_intestine_jejunem-COORD" point="52.79 51.84 -8.667, 53.97 54.39 -8.175, 45.22 51.57 -3.997, 51.86 49.11 -8.806, 65.26 48.74 -19.12, 63.89 46.
        </IndexedFaceSet>
      </Shape>
    </Transform>
  </Scene>
</X3D>
```

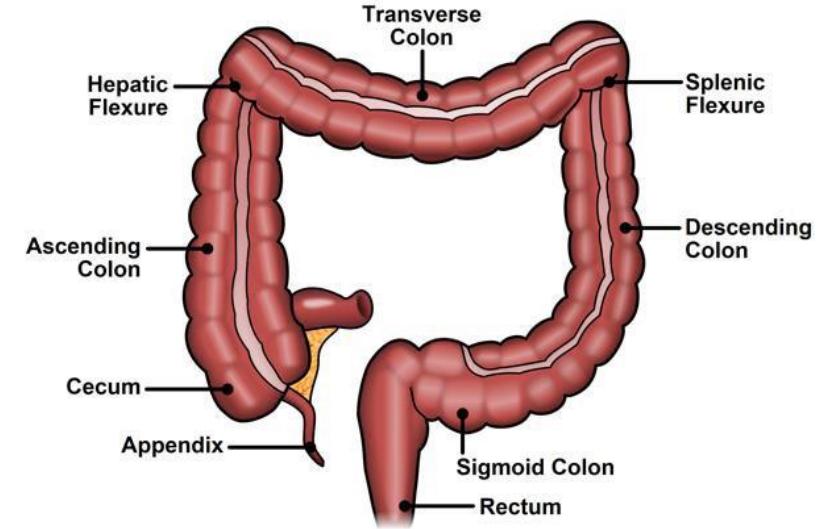
Digestive System – Large Intestine



Front of abdomen, showing the large intestine, with the stomach and small intestine in gray outline
https://en.wikipedia.org/wiki/Large_intestine



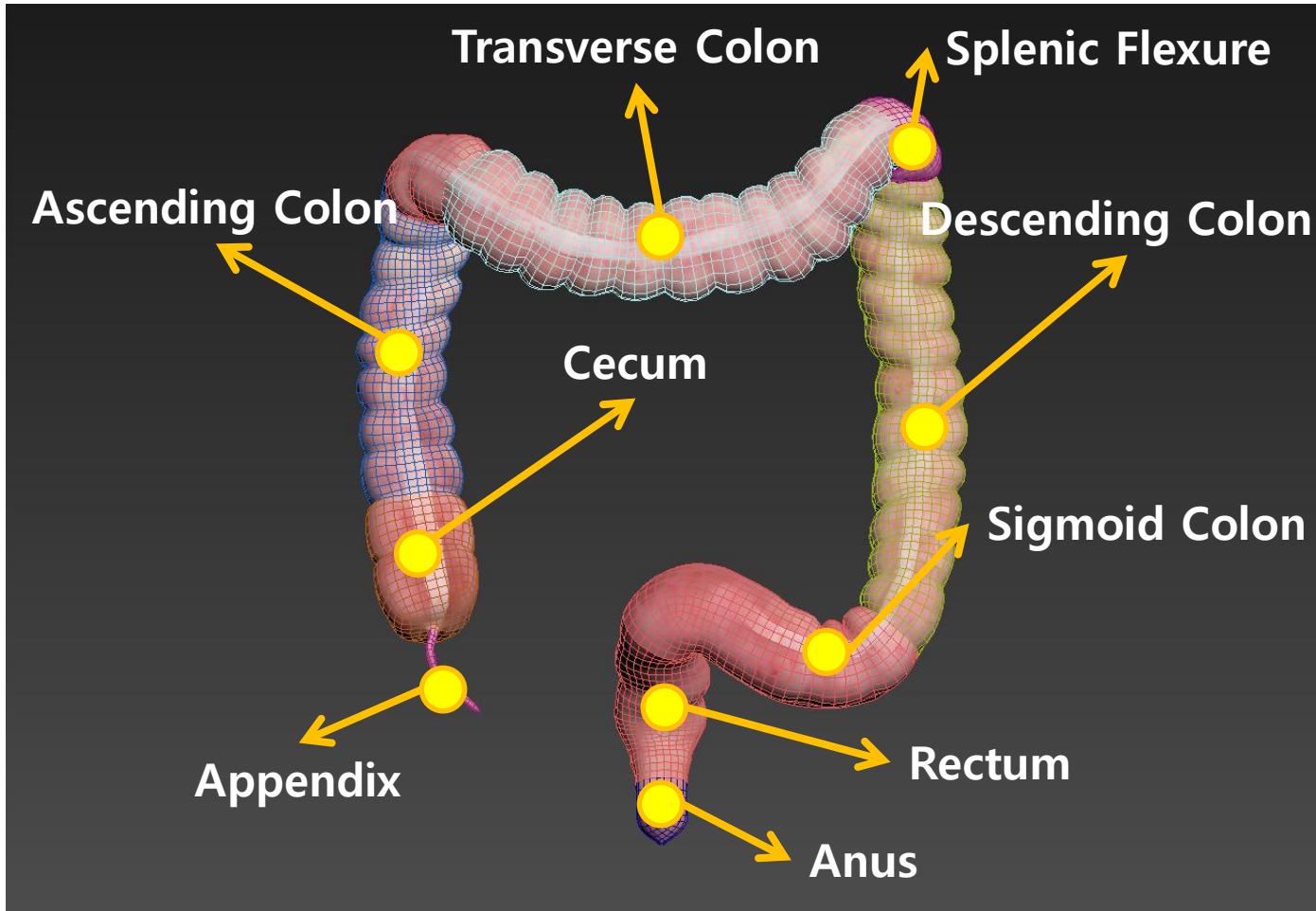
http://www.innerbody.com/image_digeov/dige10-new3.html



<https://medium.com/@vincentmarger/nutrition-and-digestion-large-intestine-71dab5c05aaaf>

Large Intestine Modeling

3ds Max Viewport Shot

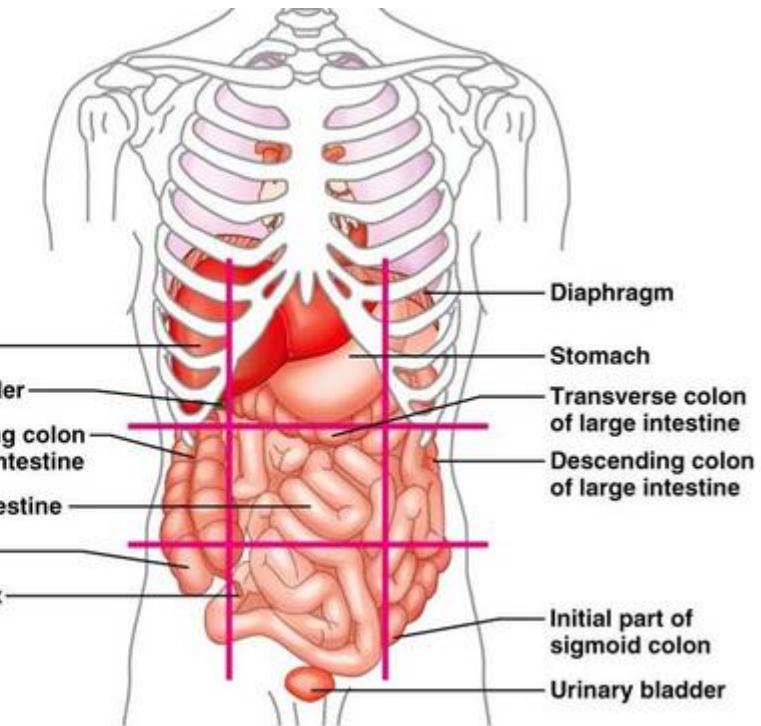
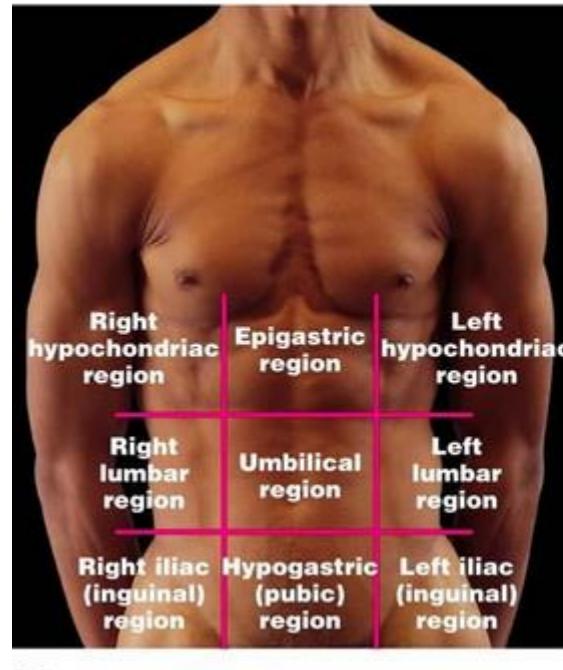
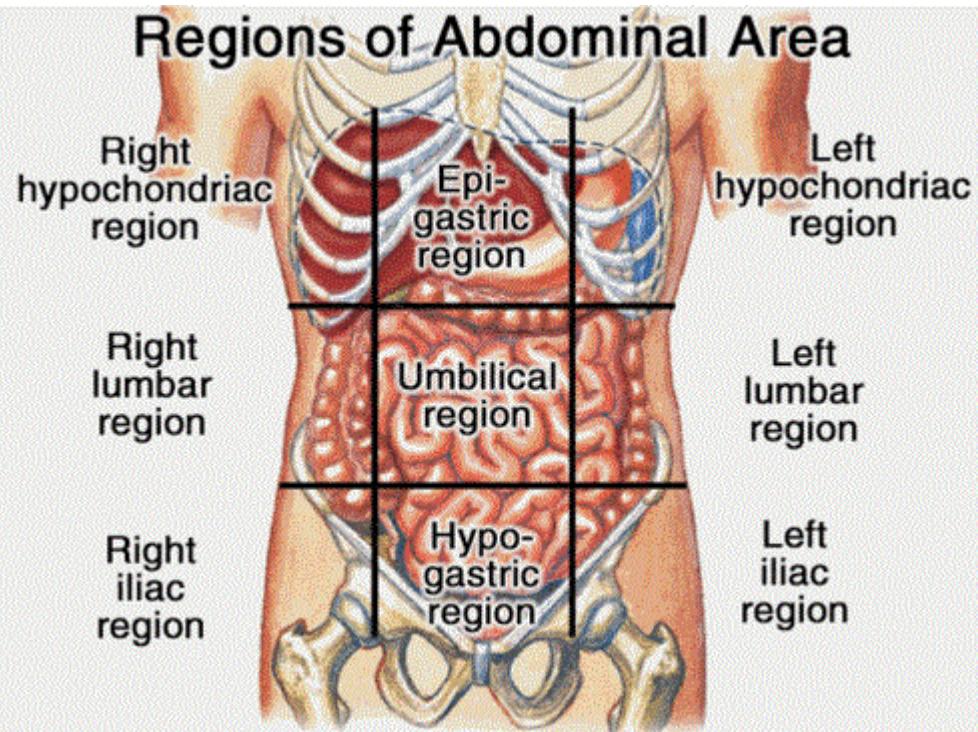


x3d Viewer Image

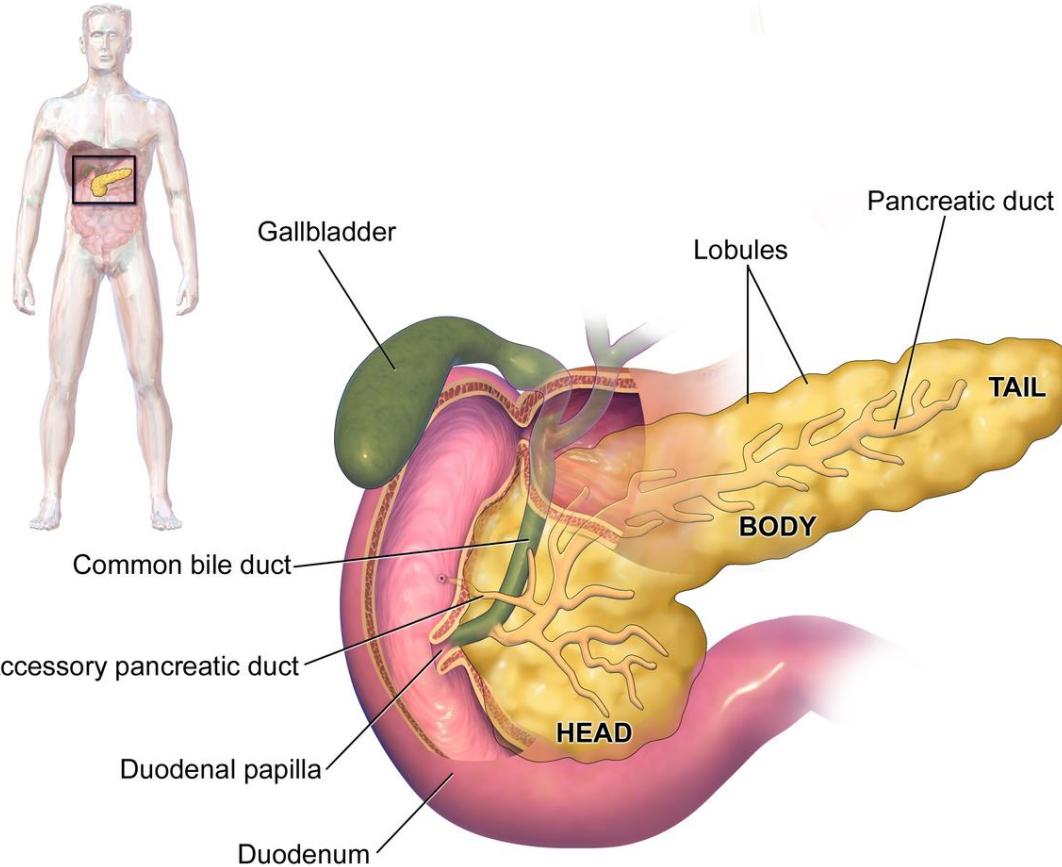
Large Intestine X3D Structure

```
<?xml version='1.0' encoding='UTF-8'?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.2//EN" "http://www.web3d.org/specifications/x3d-3.2.dtd">
<X3D version='3.2' profile='Immersive' xmlns:xsd='http://www.w3.org/2001/XMLSchema-instance' xsd:noNamespaceSchemaLocation='http://www.web3d.org/specifications
<head>
  <meta name='title' content='large_intestine.x3d'/>
  <meta name='description' content='*enter description here, short-sentence summaries preferred*'/>
  <meta name='creator' content='*enter name of original author here*'/>
  <meta name='translator' content='*if manually translating VRML-to-X3D, enter name of person translating here*'/>
  <meta name='created' content='*enter date of initial version here*'/>
  <meta name='version' content='*enter version here*'/>
  <meta name='reference' content='*enter reference citation or relative/online url here*'/>
  <meta name='reference' content='*enter additional url/bibliographic reference information here*'/>
  <meta name='requires' content='*enter reference resource here if required to support function, delivery, or coherence of content*'/>
  <meta name='rights' content='*enter copyright information here* Example: Copyright (c) Web3D Consortium Inc. 2006' />
  <meta name='drawing' content='*enter drawing filename/url here*'/>
  <meta name='image' content='*enter image filename/url here*'/>
  <meta name='MovingImage' content='*enter movie filename/url here*'/>
  <meta name='photo' content='*enter photo filename/url here*'/>
  <meta name='subject' content='*enter subject keywords here*'/>
  <meta name='accessRights' content='*enter permission statements or url here*'/>
  <meta name='warning' content='*insert any known warnings, bugs or errors here*'/>
  <meta name='generator' content='Vrml97ToX3dNist, http://ovrt.nist.gov/v2_x3d.html' />
  <meta name='generator' content='X3D-Edit, https://savage.nps.edu/X3D-Edit' />
  <meta name='license' content='../license.html' />
</head>
<Scene>
  <Viewpoint position='0 0 500' />
  <Background groundColor='1 1 1' skyColor='1 1 1' />
  <Transform DEF="large_intestine_splenic_Flexure" translation="132.0 164.3 7.361">
    <Shape>
      <Appearance>
        <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
        <ImageTexture url="colon.jpg"/>
      </Appearance>
      <IndexedFaceSet DEF="large_intestine_splenic_Flexure-FACES" coordIndex=" 3 0 1 -1 1 2 3 -1 2 4 5 -1 5 3 2 -1 8 9 6 -1 6 7 8 -1 10 11 5 -1 5 12 10 -1 13 21 7 14 -1 16 17
        <TextureCoordinate DEF="large_intestine_splenic_Flexure-TEXCOORD" point="0.2804 0.448, 0.2793 0.4532, 0.2674 0.4515, 0.274 0.448, 0.2624 0.445, 0.2715 0.4437, 0.2
        <Coordinate DEF="large_intestine_splenic_Flexure-COORD" point="21.0 -3.69 -24.81, 19.28 -0.8395 -26.07, 19.77 3.174 -19.44, 21.16 -1.043 -21.55, 21.74 1.657 -14.56,
      </IndexedFaceSet>
    </Shape>
  </Transform>
  <Transform DEF="large_intestine_anus" translation="15.34 -176.2 -43.93">
    <Shape>
      <Appearance>
        <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
        <ImageTexture url="colon.jpg"/>
      </Appearance>
      <IndexedFaceSet DEF="large_intestine_anus-FACES" coordIndex=" 0 1 2 -1 2 3 0 -1 4 5 2 -1 2 1 4 -1 7 8 9 -1 9 6 7 -1 6 12 10 -1 10 11 6 -1 14 15 1 -1 1 13 14 -1 231 40 4
        <TextureCoordinate DEF="large_intestine_anus-TEXCOORD" point="0.285 0.8862, 0.2816 0.8931, 0.2793 0.8873, 0.2806 0.8831, 0.2751 0.8925, 0.2755 0.8862, 0.258 0.916
        <Coordinate DEF="large_intestine_anus-COORD" point="-12.89 0.1512 1.821, -12.75 -3.438 3.537, -12.23 -1.181 5.531, -12.53 0.9597 4.8, -11.19 -4.357 7.79, -11.03 -1.
      </IndexedFaceSet>
    </Shape>
  </Transform>
```

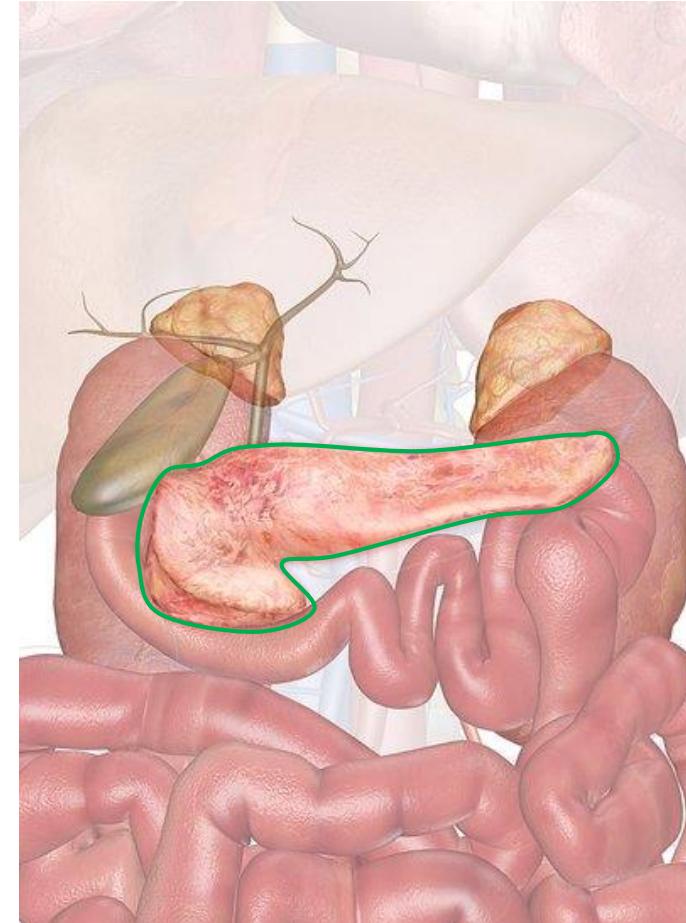
Abdominal Regions



Digestive System - Pancreas



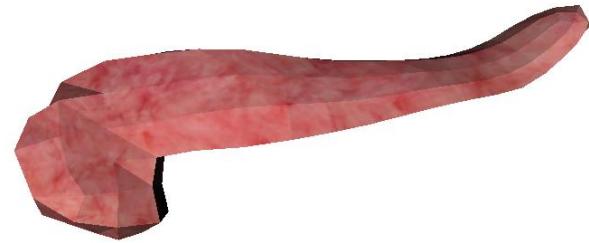
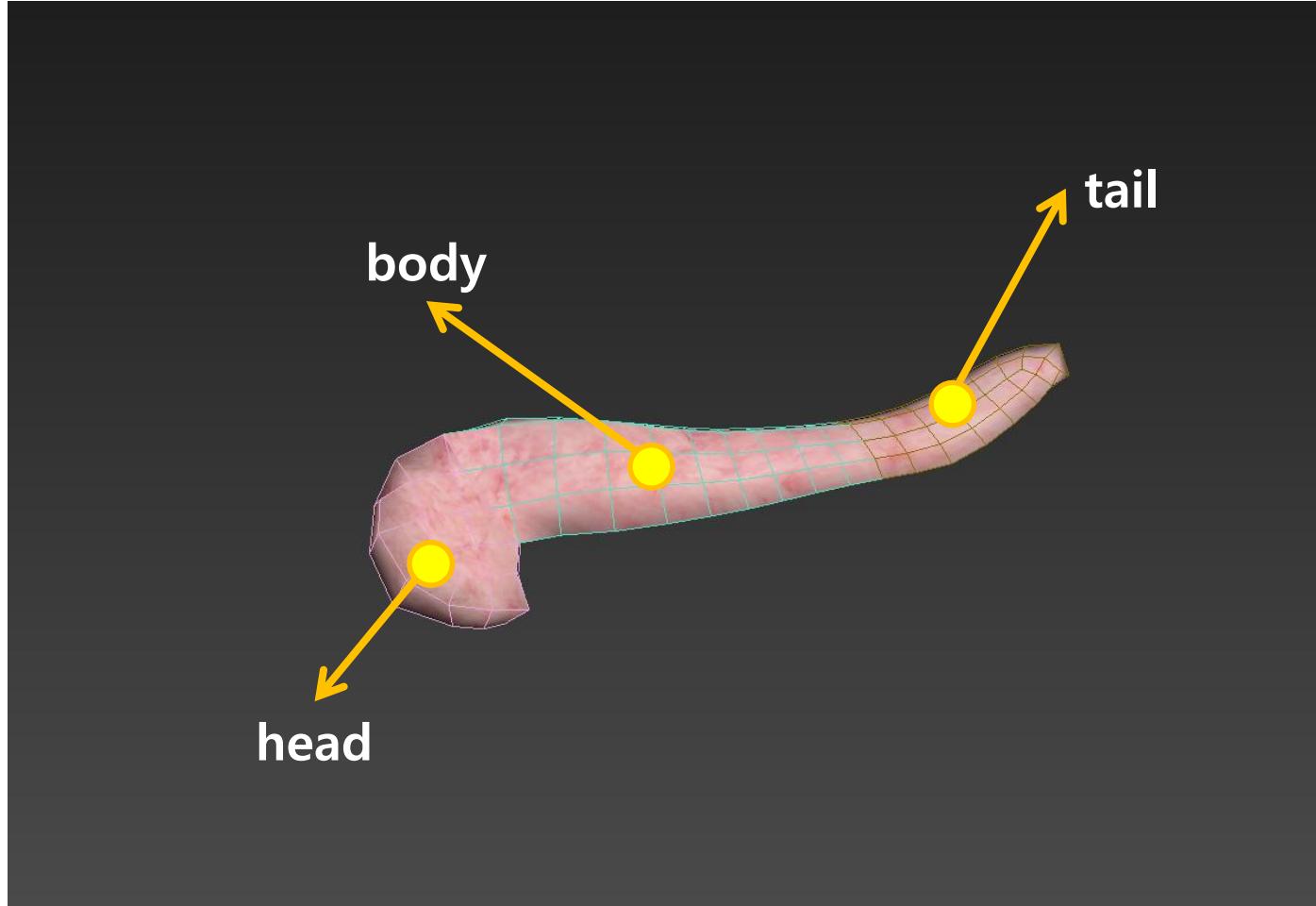
Anatomy of the pancreas
<https://en.wikipedia.org/wiki/Pancreas>



<https://www.innerbody.com/image/endo03.html>

Pancreas Modeling

3ds Max Viewport Shot

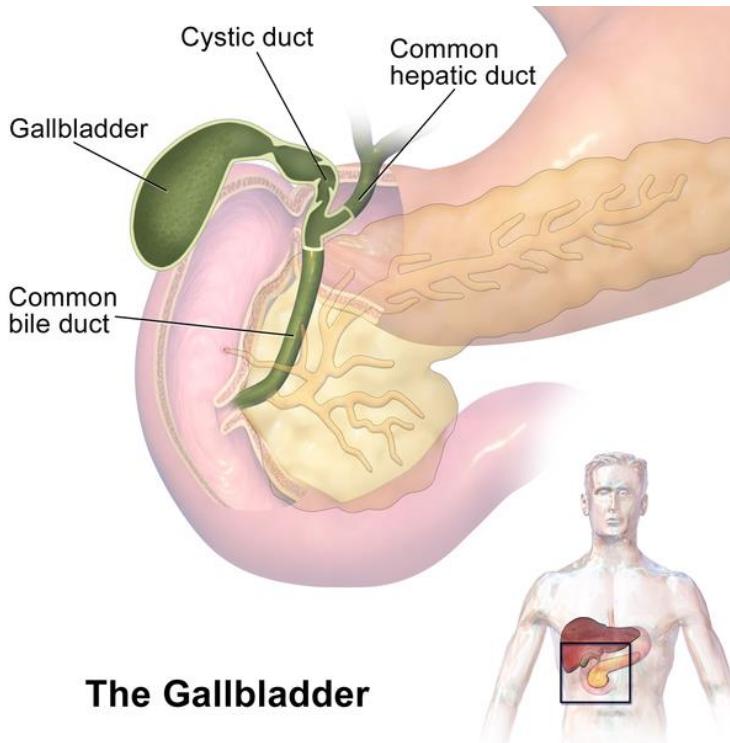


x3d Viewer Image

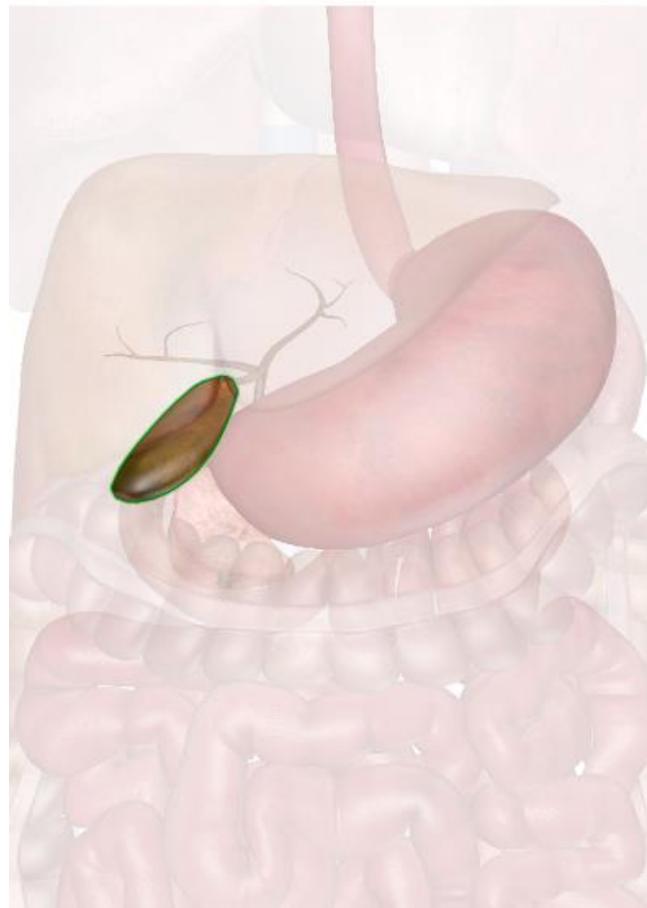
Pancreas X3D Structure

```
<?xml version='1.0' encoding='UTF-8'?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.2//EN" "http://www.web3d.org/specifications/x3d-3.2.dtd">
<X3D version='3.2' profile='Immersive' xmlns:xsd='http://www.w3.org/2001/XMLSchema-instance' xsd:noNamespaceSchemaLocation='http://www.web3d.org/specifications/x3d-3.2.xsd'>
  <head>
    <meta name='title' content='Pancreas.x3d'/>
    <meta name='description' content='*enter description here, short-sentence summaries preferred' />
    <meta name='creator' content='*enter name of original author here' />
    <meta name='translator' content='*if manually translating VRML-to-X3D, enter name of person translating here' />
    <meta name='created' content='*enter date of initial version here' />
    <meta name='version' content='*enter version here' />
    <meta name='reference' content='*enter reference citation or relative/online url here' />
    <meta name='reference' content='*enter additional url/bibliographic reference information here' />
    <meta name='requires' content='*enter reference resource here if required to support function, delivery, or coherence of content' />
    <meta name='rights' content='*enter copyright information here* Example: Copyright (c) Web3D Consortium Inc. 2006' />
    <meta name='drawing' content='*enter drawing filename/url here' />
    <meta name='image' content='*enter image filename/url here' />
    <meta name='MovingImage' content='*enter movie filename/url here' />
    <meta name='photo' content='*enter photo filename/url here' />
    <meta name='subject' content='*enter subject keywords here' />
    <meta name='accessRights' content='*enter permission statements or url here' />
    <meta name='warning' content='*insert any known warnings, bugs or errors here' />
    <meta name='generator' content='Vrml97ToX3dNist, http://ovrt.nist.gov/v2_x3d.html' />
    <meta name='generator' content='X3D-Edit, https://savage.nps.edu/X3D-Edit' />
    <meta name='license' content='..../license.html' />
  </head>
  <Scene>
    <Viewpoint position='0 0 500' />
    <Background groundColor='1 1 1' skyColor='1 1 1' />
    <Transform DEF="pancreas_body" translation="4.627 -2.169 -4.993">
      <Shape>
        <Appearance>
          <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
          <ImageTexture url="pancreas.jpg" />
        </Appearance>
        <IndexedFaceSet DEF="pancreas_body-FACES" coordIndex="3 0 1 -1 1 2 3 -1 7 4 5 -1 5 6 7 -1 10 11 8 -1 8 9 10 -1 15 12 13 -1 13 14 15 -1 19 16 17 -1 17 18 19 -1 20 21 22 -1 24 25 26 -1 28 29 30 -1 32 33 34 -1 36 37 38 -1 40 41 42 -1 44 45 46 -1 48 49 50 -1 52 53 54 -1 56 57 58 -1 60 61 62 -1 64 65 66 -1 68 69 70 -1 72 73 74 -1 76 77 78 -1 80 81 82 -1 84 85 86 -1 88 89 90 -1 92 93 94 -1 96 97 98 -1 100 101 102 -1 104 105 106 -1 108 109 110 -1 112 113 114 -1 116 117 118 -1 120 121 122 -1 124 125 126 -1 128 129 130 -1 132 133 134 -1 136 137 138 -1 140 141 142 -1 144 145 146 -1 148 149 150 -1 152 153 154 -1 156 157 158 -1 160 161 162 -1 164 165 166 -1 168 169 170 -1 172 173 174 -1 176 177 178 -1 180 181 182 -1 184 185 186 -1 188 189 190 -1 192 193 194 -1 196 197 198 -1 199 200 201 -1 202 203 204 -1 205 206 207 -1 208 209 210 -1 211 212 213 -1 214 215 216 -1 217 218 219 -1 220 221 222 -1 223 224 225 -1 226 227 228 -1 229 230 231 -1 232 233 234 -1 235 236 237 -1 238 239 240 -1 241 242 243 -1 244 245 246 -1 247 248 249 -1 250 251 252 -1 253 254 255 -1 256 257 258 -1 259 260 261 -1 262 263 264 -1 265 266 267 -1 268 269 270 -1 271 272 273 -1 274 275 276 -1 277 278 279 -1 280 281 282 -1 283 284 285 -1 286 287 288 -1 289 290 291 -1 292 293 294 -1 295 296 297 -1 298 299 299 -1 300 301 302 -1 303 304 305 -1 306 307 308 -1 309 310 311 -1 312 313 314 -1 315 316 317 -1 318 319 320 -1 321 322 323 -1 324 325 326 -1 327 328 329 -1 329 330 331 -1 331 332 333 -1 333 334 335 -1 334 335 336 -1 335 336 337 -1 336 337 338 -1 337 338 339 -1 338 339 340 -1 339 340 341 -1 340 341 342 -1 341 342 343 -1 342 343 344 -1 343 344 345 -1 344 345 346 -1 345 346 347 -1 346 347 348 -1 347 348 349 -1 348 349 350 -1 349 350 351 -1 350 351 352 -1 351 352 353 -1 352 353 354 -1 353 354 355 -1 354 355 356 -1 355 356 357 -1 356 357 358 -1 357 358 359 -1 358 359 360 -1 359 360 361 -1 360 361 362 -1 361 362 363 -1 362 363 364 -1 363 364 365 -1 364 365 366 -1 365 366 367 -1 366 367 368 -1 367 368 369 -1 368 369 370 -1 369 370 371 -1 370 371 372 -1 371 372 373 -1 372 373 374 -1 373 374 375 -1 374 375 376 -1 375 376 377 -1 376 377 378 -1 377 378 379 -1 378 379 380 -1 379 380 381 -1 380 381 382 -1 381 382 383 -1 382 383 384 -1 383 384 385 -1 384 385 386 -1 385 386 387 -1 386 387 388 -1 387 388 389 -1 388 389 390 -1 389 390 391 -1 390 391 392 -1 391 392 393 -1 392 393 394 -1 393 394 395 -1 394 395 396 -1 395 396 397 -1 396 397 398 -1 397 398 399 -1 398 399 399 -1 399 400 400 -1 400 401 401 -1 401 402 402 -1 402 403 403 -1 403 404 404 -1 404 405 405 -1 405 406 406 -1 406 407 407 -1 407 408 408 -1 408 409 409 -1 409 410 410 -1 410 411 411 -1 411 412 412 -1 412 413 413 -1 413 414 414 -1 414 415 415 -1 415 416 416 -1 416 417 417 -1 417 418 418 -1 418 419 419 -1 419 420 420 -1 420 421 421 -1 421 422 422 -1 422 423 423 -1 423 424 424 -1 424 425 425 -1 425 426 426 -1 426 427 427 -1 427 428 428 -1 428 429 429 -1 429 430 430 -1 430 431 431 -1 431 432 432 -1 432 433 433 -1 433 434 434 -1 434 435 435 -1 435 436 436 -1 436 437 437 -1 437 438 438 -1 438 439 439 -1 439 440 440 -1 440 441 441 -1 441 442 442 -1 442 443 443 -1 443 444 444 -1 444 445 445 -1 445 446 446 -1 446 447 447 -1 447 448 448 -1 448 449 449 -1 449 450 450 -1 450 451 451 -1 451 452 452 -1 452 453 453 -1 453 454 454 -1 454 455 455 -1 455 456 456 -1 456 457 457 -1 457 458 458 -1 458 459 459 -1 459 460 460 -1 460 461 461 -1 461 462 462 -1 462 463 463 -1 463 464 464 -1 464 465 465 -1 465 466 466 -1 466 467 467 -1 467 468 468 -1 468 469 469 -1 469 470 470 -1 470 471 471 -1 471 472 472 -1 472 473 473 -1 473 474 474 -1 474 475 475 -1 475 476 476 -1 476 477 477 -1 477 478 478 -1 478 479 479 -1 479 480 480 -1 480 481 481 -1 481 482 482 -1 482 483 483 -1 483 484 484 -1 484 485 485 -1 485 486 486 -1 486 487 487 -1 487 488 488 -1 488 489 489 -1 489 490 490 -1 490 491 491 -1 491 492 492 -1 492 493 493 -1 493 494 494 -1 494 495 495 -1 495 496 496 -1 496 497 497 -1 497 498 498 -1 498 499 499 -1 499 500 500 -1 500 501 501 -1 501 502 502 -1 502 503 503 -1 503 504 504 -1 504 505 505 -1 505 506 506 -1 506 507 507 -1 507 508 508 -1 508 509 509 -1 509 510 510 -1 510 511 511 -1 511 512 512 -1 512 513 513 -1 513 514 514 -1 514 515 515 -1 515 516 516 -1 516 517 517 -1 517 518 518 -1 518 519 519 -1 519 520 520 -1 520 521 521 -1 521 522 522 -1 522 523 523 -1 523 524 524 -1 524 525 525 -1 525 526 526 -1 526 527 527 -1 527 528 528 -1 528 529 529 -1 529 530 530 -1 530 531 531 -1 531 532 532 -1 532 533 533 -1 533 534 534 -1 534 535 535 -1 535 536 536 -1 536 537 537 -1 537 538 538 -1 538 539 539 -1 539 540 540 -1 540 541 541 -1 541 542 542 -1 542 543 543 -1 543 544 544 -1 544 545 545 -1 545 546 546 -1 546 547 547 -1 547 548 548 -1 548 549 549 -1 549 550 550 -1 550 551 551 -1 551 552 552 -1 552 553 553 -1 553 554 554 -1 554 555 555 -1 555 556 556 -1 556 557 557 -1 557 558 558 -1 558 559 559 -1 559 560 560 -1 560 561 561 -1 561 562 562 -1 562 563 563 -1 563 564 564 -1 564 565 565 -1 565 566 566 -1 566 567 567 -1 567 568 568 -1 568 569 569 -1 569 570 570 -1 570 571 571 -1 571 572 572 -1 572 573 573 -1 573 574 574 -1 574 575 575 -1 575 576 576 -1 576 577 577 -1 577 578 578 -1 578 579 579 -1 579 580 580 -1 580 581 581 -1 581 582 582 -1 582 583 583 -1 583 584 584 -1 584 585 585 -1 585 586 586 -1 586 587 587 -1 587 588 588 -1 588 589 589 -1 589 590 590 -1 590 591 591 -1 591 592 592 -1 592 593 593 -1 593 594 594 -1 594 595 595 -1 595 596 596 -1 596 597 597 -1 597 598 598 -1 598 599 599 -1 599 600 600 -1 600 601 601 -1 601 602 602 -1 602 603 603 -1 603 604 604 -1 604 605 605 -1 605 606 606 -1 606 607 607 -1 607 608 608 -1 608 609 609 -1 609 610 610 -1 610 611 611 -1 611 612 612 -1 612 613 613 -1 613 614 614 -1 614 615 615 -1 615 616 616 -1 616 617 617 -1 617 618 618 -1 618 619 619 -1 619 620 620 -1 620 621 621 -1 621 622 622 -1 622 623 623 -1 623 624 624 -1 624 625 625 -1 625 626 626 -1 626 627 627 -1 627 628 628 -1 628 629 629 -1 629 630 630 -1 630 631 631 -1 631 632 632 -1 632 633 633 -1 633 634 634 -1 634 635 635 -1 635 636 636 -1 636 637 637 -1 637 638 638 -1 638 639 639 -1 639 640 640 -1 640 641 641 -1 641 642 642 -1 642 643 643 -1 643 644 644 -1 644 645 645 -1 645 646 646 -1 646 647 647 -1 647 648 648 -1 648 649 649 -1 649 650 650 -1 650 651 651 -1 651 652 652 -1 652 653 653 -1 653 654 654 -1 654 655 655 -1 655 656 656 -1 656 657 657 -1 657 658 658 -1 658 659 659 -1 659 660 660 -1 660 661 661 -1 661 662 662 -1 662 663 663 -1 663 664 664 -1 664 665 665 -1 665 666 666 -1 666 667 667 -1 667 668 668 -1 668 669 669 -1 669 670 670 -1 670 671 671 -1 671 672 672 -1 672 673 673 -1 673 674 674 -1 674 675 675 -1 675 676 676 -1 676 677 677 -1 677 678 678 -1 678 679 679 -1 679 680 680 -1 680 681 681 -1 681 682 682 -1 682 683 683 -1 683 684 684 -1 684 685 685 -1 685 686 686 -1 686 687 687 -1 687 688 688 -1 688 689 689 -1 689 690 690 -1 690 691 691 -1 691 692 692 -1 692 693 693 -1 693 694 694 -1 694 695 695 -1 695 696 696 -1 696 697 697 -1 697 698 698 -1 698 699 699 -1 699 700 700 -1 700 701 701 -1 701 702 702 -1 702 703 703 -1 703 704 704 -1 704 705 705 -1 705 706 706 -1 706 707 707 -1 707 708 708 -1 708 709 709 -1 709 710 710 -1 710 711 711 -1 711 712 712 -1 712 713 713 -1 713 714 714 -1 714 715 715 -1 715 716 716 -1 716 717 717 -1 717 718 718 -1 718 719 719 -1 719 720 720 -1 720 721 721 -1 721 722 722 -1 722 723 723 -1 723 724 724 -1 724 725 725 -1 725 726 726 -1 726 727 727 -1 727 728 728 -1 728 729 729 -1 729 730 730 -1 730 731 731 -1 731 732 732 -1 732 733 733 -1 733 734 734 -1 734 735 735 -1 735 736 736 -1 736 737 737 -1 737 738 738 -1 738 739 739 -1 739 740 740 -1 740 741 741 -1 741 742 742 -1 742 743 743 -1 743 744 744 -1 744 745 745 -1 745 746 746 -1 746 747 747 -1 747 748 748 -1 748 749 749 -1 749 750 750 -1 750 751 751 -1 751 752 752 -1 752 753 753 -1 753 754 754 -1 754 755 755 -1 755 756 756 -1 756 757 757 -1 757 758 758 -1 758 759 759 -1 759 760 760 -1 760 761 761 -1 761 762 762 -1 762 763 763 -1 763 764 764 -1 764 765 765 -1 765 766 766 -1 766 767 767 -1 767 768 768 -1 768 769 769 -1 769 770 770 -1 770 771 771 -1 771 772 772 -1 772 773 773 -1 773 774 774 -1 774 775 775 -1 775 776 776 -1 776 777 777 -1 777 778 778 -1 778 779 779 -1 779 780 780 -1 780 781 781 -1 781 782 782 -1 782 783 783 -1 783 784 784 -1 784 785 785 -1 785 786 786 -1 786 787 787 -1 787 788 788 -1 788 789 789 -1 789 790 790 -1 790 791 791 -1 791 792 792 -1 792 793 793 -1 793 794 794 -1 794 795 795 -1 795 796 796 -1 796 797 797 -1 797 798 798 -1 798 799 799 -1 799 800 800 -1 800 801 801 -1 801 802 802 -1 802 803 803 -1 803 804 804 -1 804 805 805 -1 805 806 806 -1 806 807 807 -1 807 808 808 -1 808 809 809 -1 809 810 810 -1 810 811 811 -1 811 812 812 -1 812 813 813 -1 813 814 814 -1 814 815 815 -1 815 816 816 -1 816 817 817 -1 817 818 818 -1 818 819 819 -1 819 820 820 -1 820 821 821 -1 821 822 822 -1 822 823 823 -1 823 824 824 -1 824 825 825 -1 825 826 826 -1 826 827 827 -1 827 828 828 -1 828 829 829 -1 829 830 830 -1 830 831 831 -1 831 832 832 -1 832 833 833 -1 833 834 834 -1 834 835 835 -1 835 836 836 -1 836 837 837 -1 837 838 838 -1 838 839 839 -1 839 840 840 -1 840 841 841 -1 841 842 842 -1 842 843 843 -1 843 844 844 -1 844 845 845 -1 845 846 846 -1 846 847 847 -1 847 848 848 -1 848 849 849 -1 849 850 850 -1 850 851 851 -1 851 852 852 -1 852 853 853 -1 853 854 854 -1 854 855 855 -1 855 856 856 -1 856 857 857 -1 857 858 858 -1 858 859 859 -1 859 860 860 -1 860 861 861 -1 861 862 862 -1 862 863 863 -1 863 864 864 -1 864 865 865 -1 865 866 866 -1 866 867 867 -1 867 868 868 -1 868 869 869 -1 869 870 870 -1 870 871 871 -1 871 872 872 -1 872 873 873 -1 873 874 874 -1 874 875 875 -1 875 876 876 -1 876 877 877 -1 877 878 878 -1 878 879 879 -1 879 880 880 -1 880 881 881 -1 881 882 882 -1 882 883 883 -1 883 884 884 -1 884 885 885 -1 885 886 886 -1 886 887 887 -1 887 888 888 -1 888 889 889 -1 889 890 890 -1 890 891 891 -1 891 892 892 -1 892 893 893 -1 893 894 894 -1 894 895 895 -1 895 896 896 -1 896 897 897 -1 897 898 898 -1 898 899 899 -1 899 900 900 -1 900 901 901 -1 901 902 902 -1 902 903 903 -1 903 904 904 -1 904 905 905 -1 905 906 906 -1 906 907 907 -1 907 908 908 -1 908 909 909 -1 909 910 910 -1 910 911 911 -1 911 912 912 -1 912 913 913 -1 913 914 914 -1 914 915 915 -1 915 916 916 -1 916 917 917 -1 917 918 918 -1 918 919 919 -1 919 920 920 -1 920 921 921 -1 921 922 922 -1 922 923 923 -1 923 924 924 -1 924 925 925 -1 925 926 926 -1 926 927 927 -1 927 928 928 -1 928 929 929 -1 929 930 930 -1 930 931 931 -1 931 932 932 -1 932 933 933 -1 933 934 934 -1 934 935 935 -1 935 936 936 -1 936 937 937 -1 937 938 938 -1 938 939 939 -1 939 940 940 -1 940 941 941 -1 941 942 942 -1 942 943 943 -1 943 944 944 -1 944 945 945 -1 945 946 946 -1 946 947 947 -1 947 948 948 -1 948 949 949 -1 949 950 950 -1 950 951 951 -1 951 952 952 -1 952 953 953 -1 953 954 954 -1 954 955 955 -1 955 956 956 -1 956 957 957 -1 957 958 958 -1 958 959 959 -1 959 960 960 -1 960 961 961 -1 961 962 962 -1 962 963 963 -1 963 964 964 -1 964 965 96
```

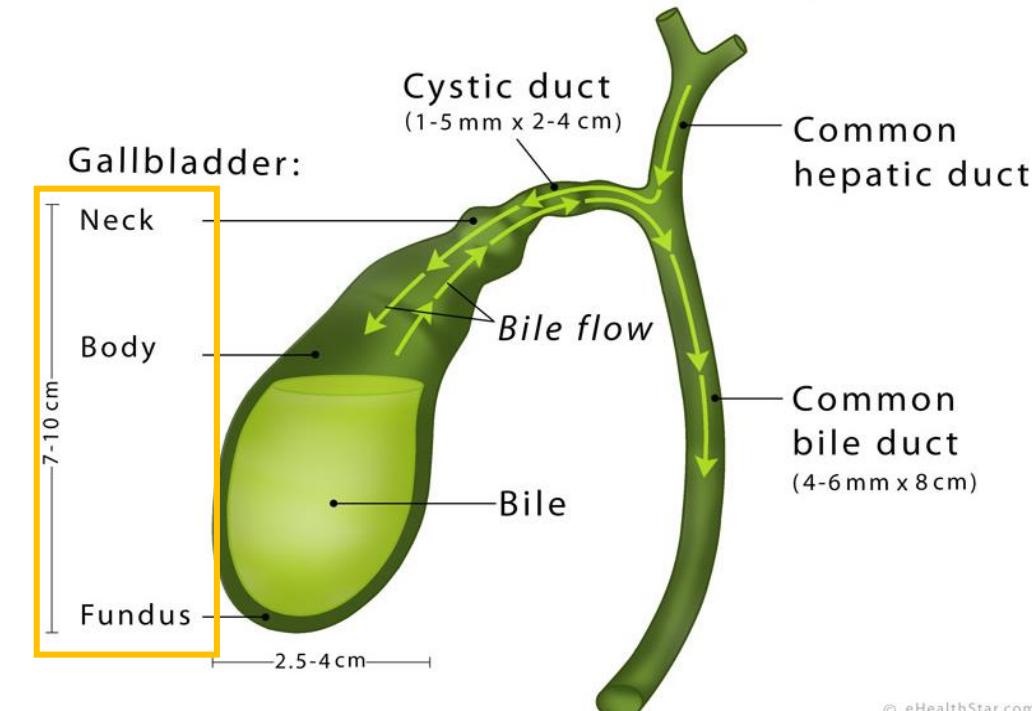
Digestive System - Gallbladder



The gallbladder sits beneath the liver
<https://en.wikipedia.org/wiki/Gallbladder>

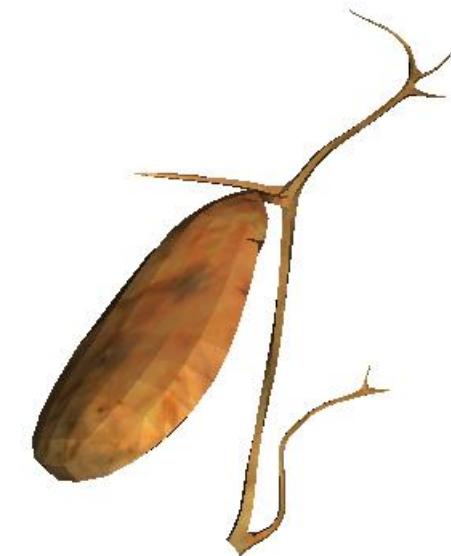
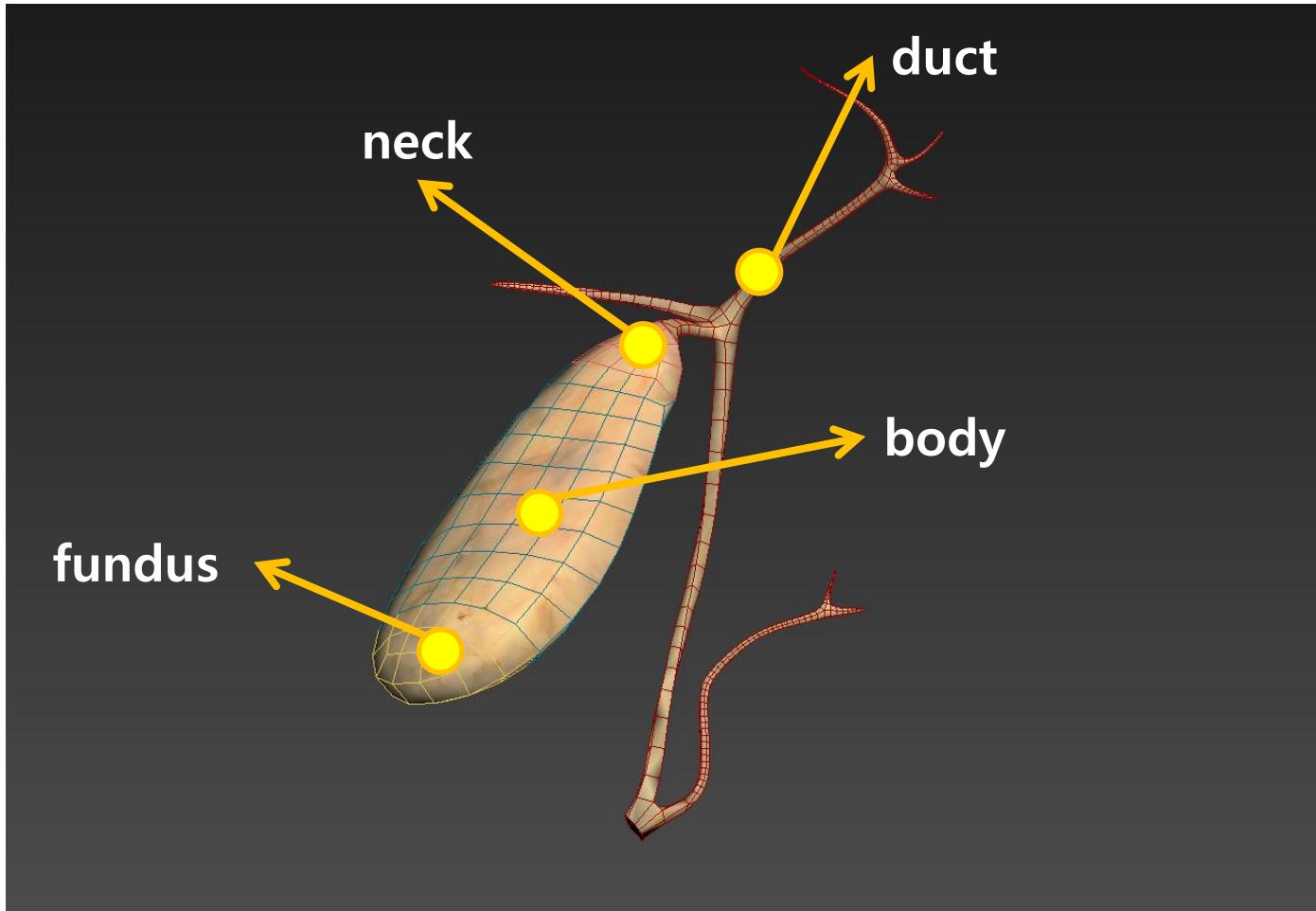


http://www.innerbody.com/image_digeov/dige04-new.html



Gallbladder Modeling

| 3ds Max Viewport Shot



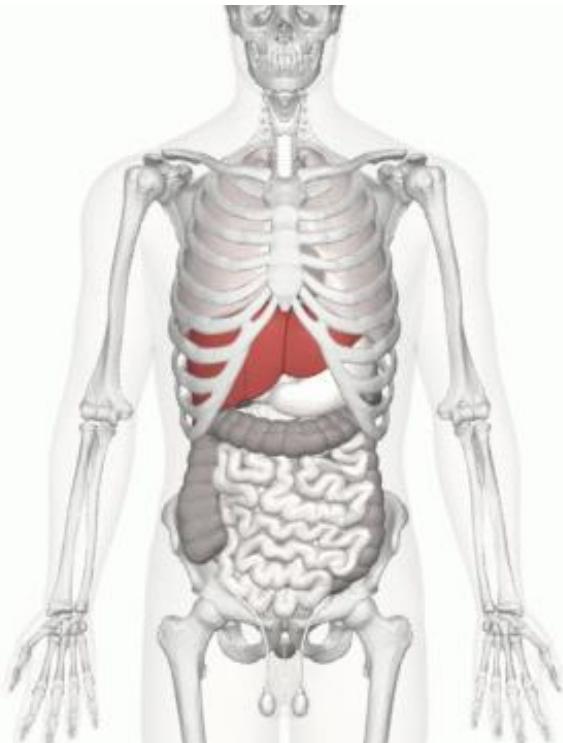
| x3d Viewer Image

Gallbladder X3D Structure

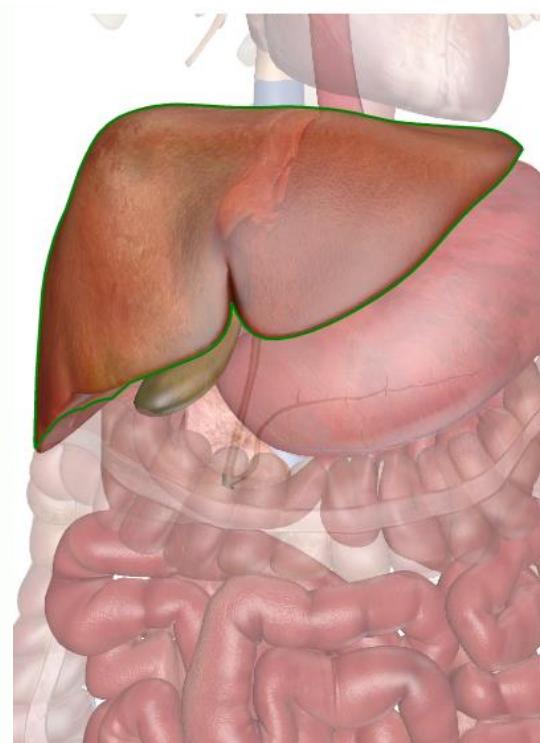
```
<?xml version='1.0' encoding='UTF-8'?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.2//EN" "http://www.web3d.org/specifications/x3d-3.2.dtd">
<X3D version='3.2' profile='Immersive' xmlns:xsd='http://www.w3.org/2001/XMLSchema-instance' xsd:noNamespaceSchemaLocation='http://www.web3d.org/specifications/x3d-3.2.xsd'>
<head>
  <meta name='title' content='gallbladder.x3d'/>
  <meta name='description' content='*enter description here, short-sentence summaries preferred' />
  <meta name='creator' content='*enter name of original author here' />
  <meta name='translator' content='*if manually translating VRML-to-X3D, enter name of person translating here' />
  <meta name='created' content='*enter date of initial version here' />

  <meta name='version' content='*enter version here' />
  <meta name='reference' content='*enter reference citation or relative/online url here' />
  <meta name='reference' content='*enter additional url/bibliographic reference information here' />
  <meta name='requires' content='*enter reference resource here if required to support function, delivery, or coherence of content' />
  <meta name='rights' content='*enter copyright information here. Example: Copyright (c) Web3D Consortium Inc. 2006' />
  <meta name='drawing' content='*enter drawing filename/url here' />
  <meta name='image' content='*enter image filename/url here' />
  <meta name='MovingImage' content='*enter movie filename/url here' />
  <meta name='photo' content='*enter photo filename/url here' />
  <meta name='subject' content='*enter subject keywords here' />
  <meta name='accessRights' content='*enter permission statements or url here' />
  <meta name='warning' content='*insert any known warnings, bugs or errors here' />
  <meta name='generator' content='Vrml97ToX3dNist, http://ovrt.nist.gov/v2_x3d.html' />
  <meta name='generator' content='X3D-Edit, https://savage.nps.edu/X3D-Edit' />
  <meta name='license' content='../license.html' />
</head>
<Scene>
  <Viewpoint position='0 0 300' />
  <Background groundColor='1 1 1' skyColor='1 1 1' />
  <Transform DEF="gallbladder_fundus" translation="-13.99 -24.14 24.74">
    <Shape>
      <Appearance>
        <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
        <ImageTexture url="gallbladder.jpg"/>
      </Appearance>
      <IndexedFaceSet DEF="gallbladder_fundus-FACES" coordIndex=" 3 0 1 -1 1 2 3 -1 3 2 5 4 -1 4 3 1 3 2 -1 8 9 6 -1 6 7 8 -1 1 0 0 8 -1 8 5 10 -1 1 1 2 1 3 11 -1 1 1 2 1 2 -1 1 15
        <TextureCoordinate DEF="gallbladder_fundus-TEXCOORD" point="0.6347 0.5604, 0.6065 0.5497, 0.6187 0.5135, 0.6484 0.528, 0.0744 0.253, 0.0547 0.278, 0.0325 0.1
        <Coordinate DEF="gallbladder_fundus-COORD" point="-5.734 -6.289 -2.613, -1.761 -4.985 -3.741, 0.2867 -5.992 -0.158, -3.632 -7.292 1.279, -13.13 -0.3377 -4.31
      </IndexedFaceSet>
    </Shape>
  </Transform>
  <Transform DEF="gallbladder_body" translation="-2.824 -2.156 10.22">
    <Shape>
      <Appearance>
        <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
        <ImageTexture url="gallbladder.jpg"/>
      </Appearance>
      <IndexedFaceSet DEF="gallbladder_body-FACES" coordIndex=" 3 0 1 -1 1 2 3 -1 4 5 6 -1 7 8 2 -1 2 1 7 -1 1 2 9 10 -1 1 0 11 12 -1 1 14 13 6 -1 6 5 14 -1 1 18 19 17 -1 1 17
        <TextureCoordinate DEF="gallbladder_body-TEXCOORD" point="0.2323 0.6535, 0.1988 0.6464, 0.1748 0.6163, 0.2306 0.6169, 0.2789 0.3066, 0.3423 0.3155, 0.2910 0.2910
        <Coordinate DEF="gallbladder_body-COORD" point="-4.08 12.09 -17.3, -1.552 15.51 -18.32, 3.181 16.33 -19.72, 0.4239 10.51 -16.83, -16.5 -4.704 -7.051, -11.58 2
      </IndexedFaceSet>
    </Shape>
  </Transform>
```

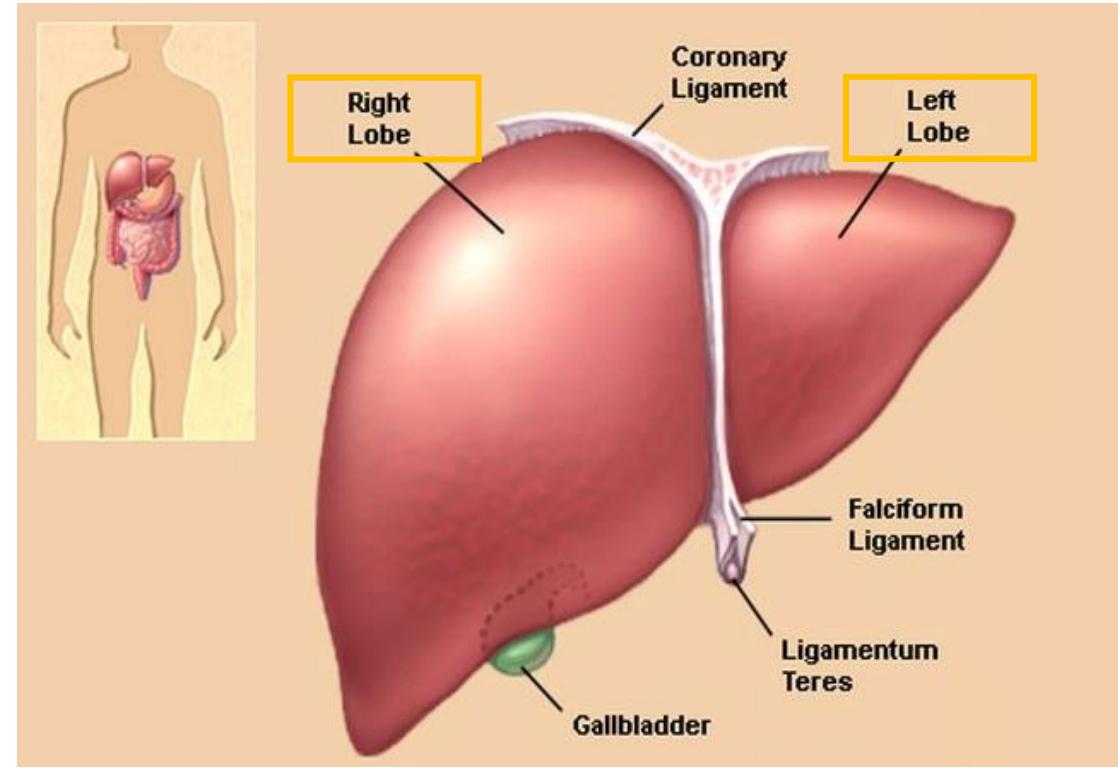
Digestive System - Liver



Location of human liver (in red)
<https://en.wikipedia.org/wiki/Liver>



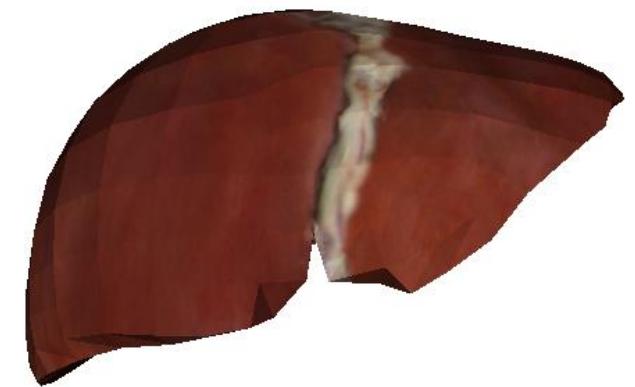
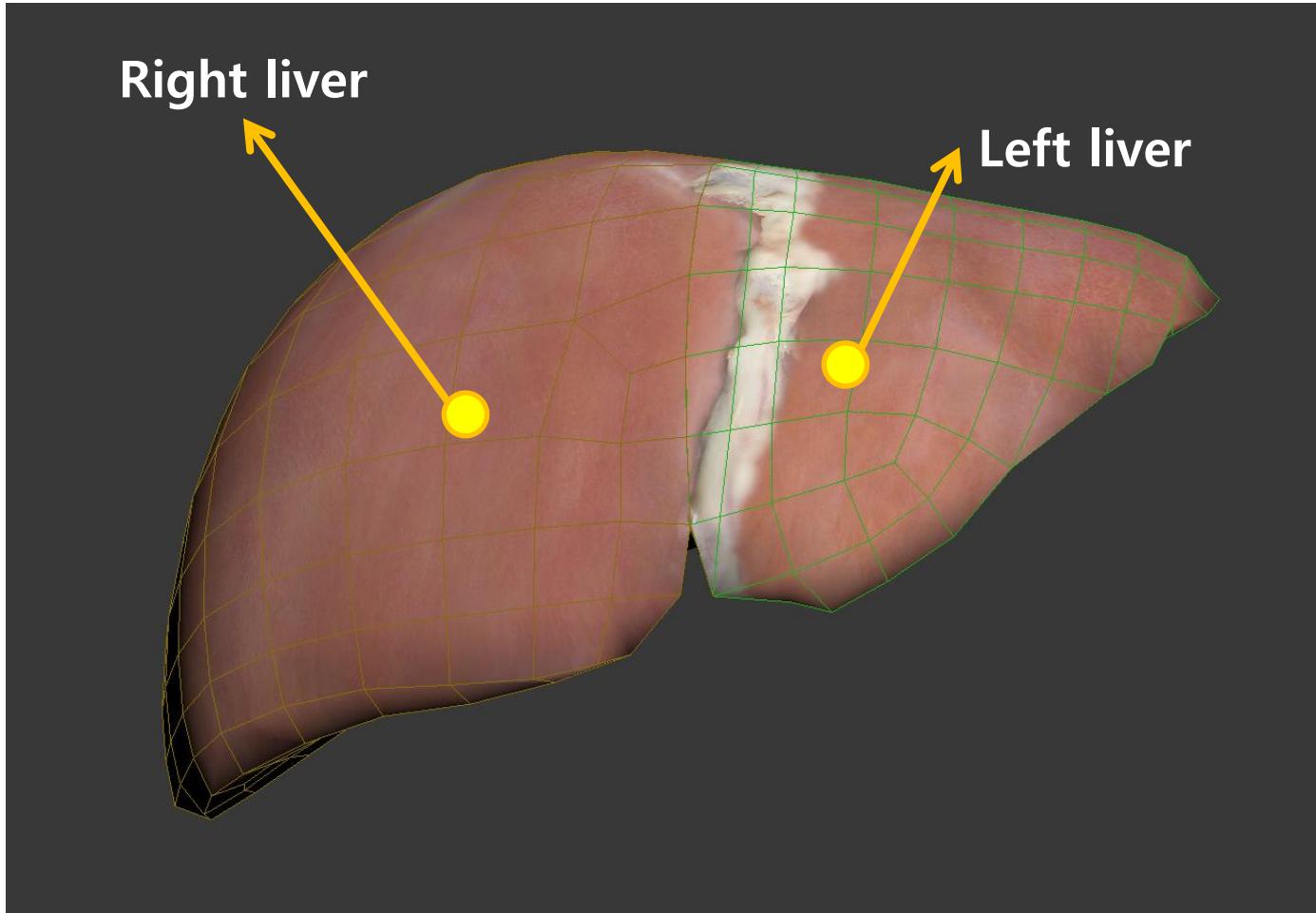
<http://www.innerbody.com/image/digeov/card10-new2.html>



Sections of the human Liver
<https://www.webmd.com/digestive-disorders/picture-of-the-liver#1> / © 2014 WebMD, LLC. All rights reserved.

Liver Modeling

| 3ds Max Viewport Shot

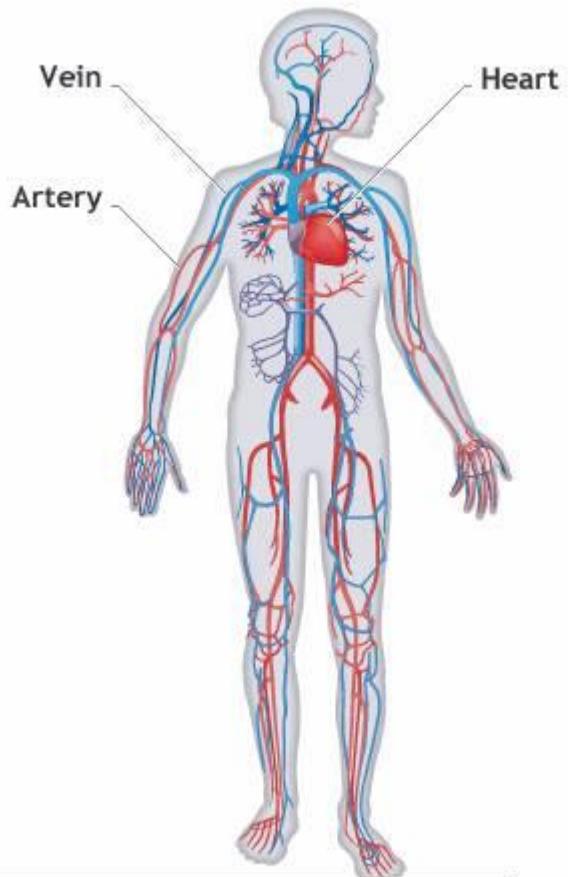


| x3d Viewer Image

Liver X3D Structure

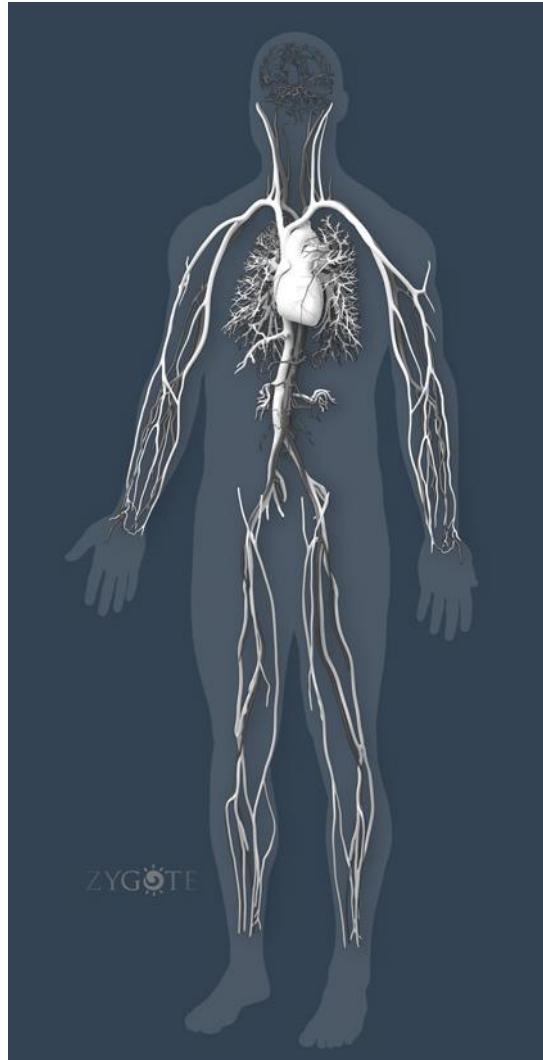
```
<?xml version='1.0' encoding='UTF-8'?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.2//EN" "http://www.web3d.org/specifications/x3d-3.2.dtd">
<X3D version='3.2' profile='Immersive' xmlns:xsd='http://www.w3.org/2001/XMLSchema-Instance' xsd:noNamespaceSchemaLocation='http://www.web3d.org/specification
<head>
  <meta name='title' content='Liver.x3d'/>
  <meta name='description' content='*enter description here, short-sentence summaries preferred*'/>
  <meta name='creator' content='*enter name of original author here*'/>
  <meta name='translator' content='*if manually translating VRML-to-X3D, enter name of person translating here*'/>
  <meta name='created' content='*enter date of initial version here*'/>
  <meta name='version' content='*enter version here*'/>
  <meta name='reference' content='*enter reference citation or relative/online url here*'/>
  <meta name='reference' content='*enter additional url/bibliographic reference information here*'/>
  <meta name='requires' content='*enter reference resource here if required to support function, delivery, or coherence of content*'/>
  <meta name='rights' content='*enter copyright information here* Example: Copyright (c) Web3D Consortium Inc. 2006' />
  <meta name='drawing' content='*enter drawing filename/url here*'/>
  <meta name='image' content='*enter image filename/url here*'/>
  <meta name='MovingImage' content='*enter movie filename/url here*'/>
  <meta name='photo' content='*enter photo filename/url here*'/>
  <meta name='subject' content='*enter subject keywords here*'/>
  <meta name='accessRights' content='*enter permission statements or url here*'/>
  <meta name='warning' content='*insert any known warnings, bugs or errors here*'/>
  <meta name='generator' content='Vrml97ToX3dNist, http://ovrt.nist.gov/v2_x3d.html' />
  <meta name='generator' content='X3D-Edit, https://savage.nps.edu/X3D-Edit' />
  <meta name='license' content='../license.html' />
</head>
<Scene>
  <Viewpoint position='0 0 500' />
  <Background groundColor='1 1 1' skyColor='1 1 1' />
  <Transform DEF="liver_right_lobe" translation="-59.16 -11.23 -14.76">
    <Shape>
      <Appearance>
        <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
        <ImageTexture url="liver.jpg"/>
      </Appearance>
      <IndexedFaceSet DEF="liver_right_lobe-FACES" coordIndex=" 3 0 1 -1 1 2 3 -1 6 7 4 -1 4 5 6 -1 11 8 9 -1 9 10 11 -1 2 1 12 -1 12 13 2 -1 9 15 13 -1 13 14 9 -1 11 16 17 -1
        <TextureCoordinate DEF="liver_right_lobe-TEXCOORD" point="0.5106 0.9681, 0.4723 0.956, 0.4714 0.9262, 0.5197 0.9253, 0.4119 0.7147, 0.3625 0.7207, 0.3585 0.6745, 0
        <Coordinate DEF="liver_right_lobe-COORD" point="4.141 15.81 -77.97, 13.63 22.51 -67.86, 12.11 18.21 -57.48, -1.551 6.703 -64.19, 33.23 -10.37 10.18, 50.18 -3.288 10.<
      </IndexedFaceSet>
    </Shape>
  </Transform>
  <Transform DEF="liver_left_lobe" translation="59.42 12.42 14.6">
    <Shape>
      <Appearance>
        <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
        <ImageTexture url="liver.jpg"/>
      </Appearance>
      <IndexedFaceSet DEF="liver_left_lobe-FACES" coordIndex=" 2 3 0 -1 0 1 2 -1 5 6 3 -1 3 4 5 -1 4 7 8 -1 8 9 4 -1 1 2 1 3 10 -1 1 0 1 1 12 -1 1 6 1 7 14 -1 1 4 1 5 16 -1 1 8 1 9 20 -1
        <TextureCoordinate DEF="liver_left_lobe-TEXCOORD" point="0.2177 0.8386, 0.1918 0.8522, 0.1799 0.8252, 0.2131 0.8118, 0.2114 0.789, 0.2505 0.7841, 0.2482 0.8117, 0.1
        <Coordinate DEF="liver_left_lobe-COORD" point="-29.74 17.71 -42.5, -24.93 28.84 -48.82, -15.2 19.73 -48.82, -25.69 9.106 -46.54, -19.62 0.253 -43.89, -32.52 -5.944 -1
      </IndexedFaceSet>
    </Shape>
  </Transform>
</Scene>
</X3D>
```

Circulatory System



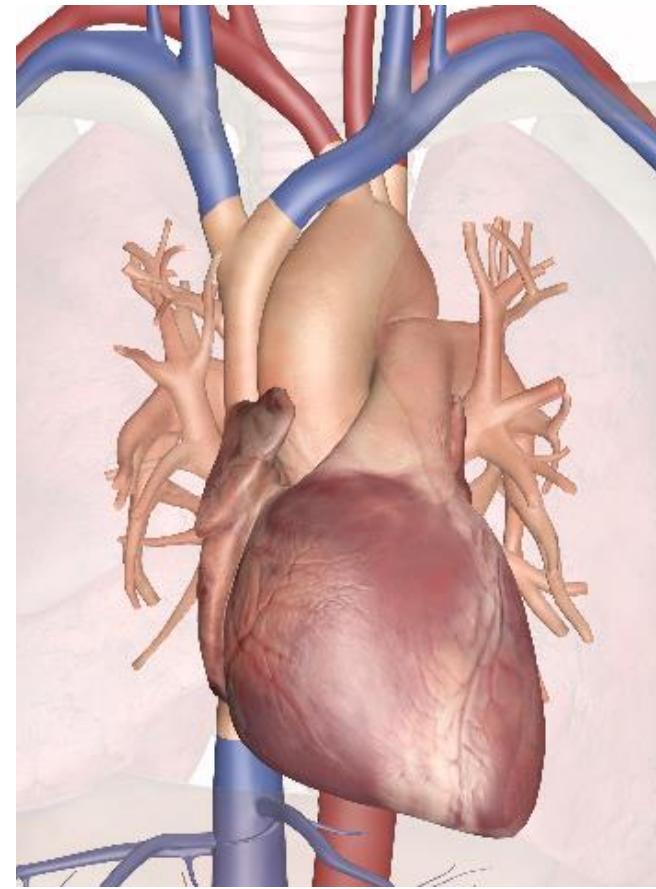
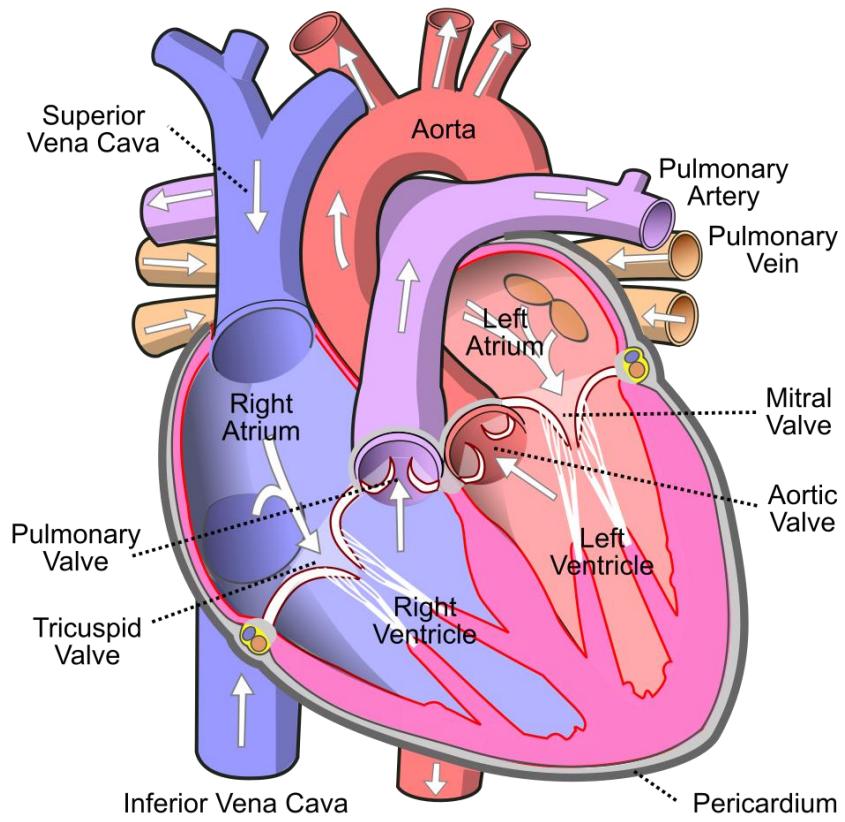
© Microsoft Corporation. All Rights Reserved.

<http://www.fit-ed.org/>



[http://www.3dscience.com/3D_Models/Human_Anatomy/Solid_Models/
solid-3d-human-anatomy-model-collection](http://www.3dscience.com/3D_Models/Human_Anatomy/Solid_Models/solid-3d-human-anatomy-model-collection)

Circulatory System - Heart

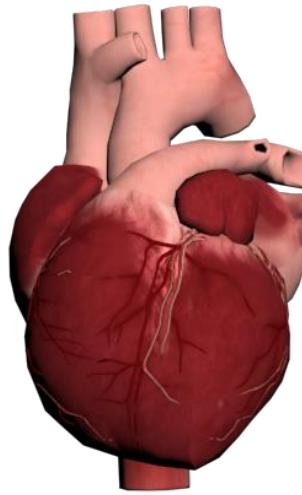
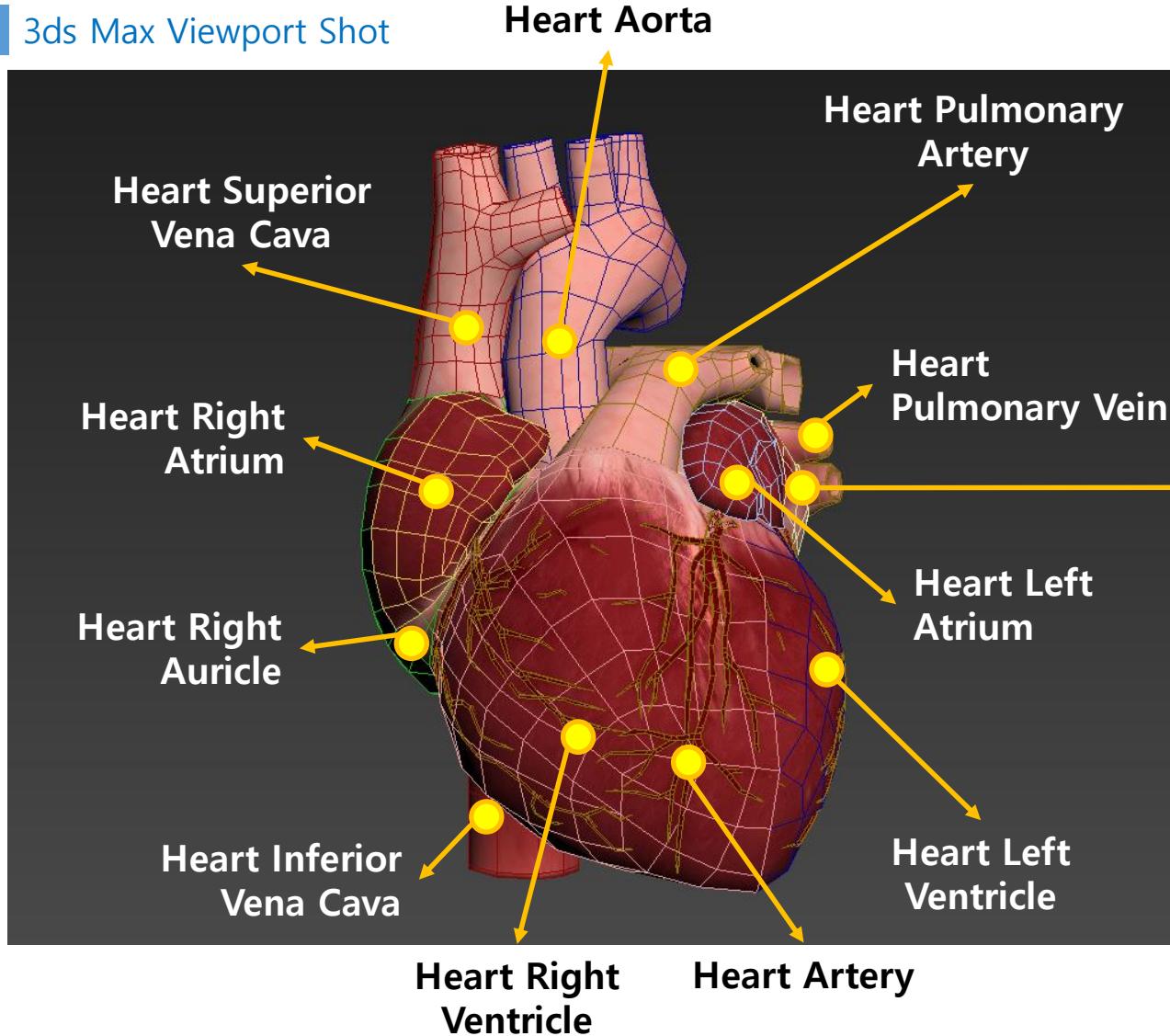


The heart, showing valves, arteries and veins. The white arrows show the normal direction of blood flow
<https://en.wikipedia.org/wiki/Heart>

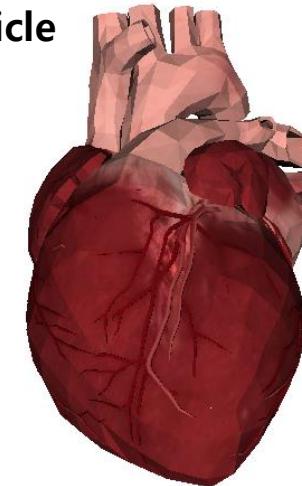
<https://www.innerbody.com/image/card01.html>

Heart Modeling

3ds Max Viewport Shot



Rendering Image

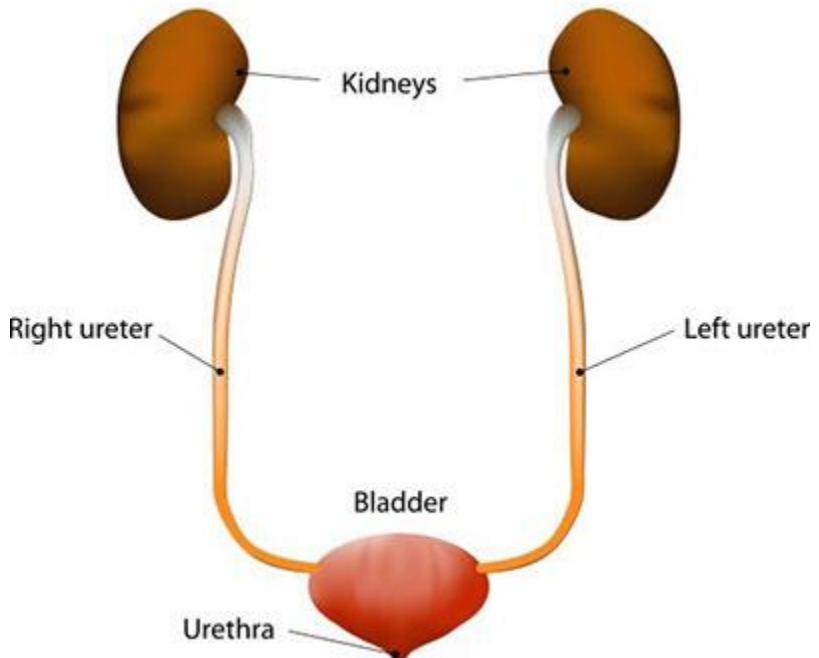


x3d Viewer Image

Heart X3D Structure

```
<?xml version='1.0' encoding='UTF-8'?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.3//EN" "http://www.web3d.org/specifications/x3d-3.3.dtd">
<X3D version='3.3' profile='Immersive' xmlns:xsd='http://www.w3.org/2001/XMLSchema-instance' xsd:noNamespaceSchemaLocation='http://www.web3d.org/specifications/x3d-3.3.xsd'>
  <head>
    <meta name='title' content='Heart.x3d'/>
    <meta name='description' content='*enter description here, short-sentence summaries preferred*'/>
    <meta name='creator' content='*enter name of original author here*'/>
    <meta name='translator' content='*if manually translating VRML-to-X3D, enter name of person translating here*'/>
    <meta name='created' content='*enter date of initial version here*'/>
    <meta name='version' content='*enter version here*'/>
    <meta name='reference' content='*enter reference citation or relative/online url here*'/>
    <meta name='reference' content='*enter additional url/bibliographic reference information here*'/>
    <meta name='requires' content='*enter reference resource here if required to support function, delivery, or coherence of content*'/>
    <meta name='rights' content='*enter copyright information here* Example: Copyright (c) Web3D Consortium Inc. 2006' />
    <meta name='drawing' content='*enter drawing filename/url here*'/>
    <meta name='image' content='*enter image filename/url here*'/>
    <meta name='MovingImage' content='*enter movie filename/url here*'/>
    <meta name='photo' content='*enter photo filename/url here*'/>
    <meta name='subject' content='*enter subject keywords here*'/>
    <meta name='accessRights' content='*enter permission statements or url here*'/>
    <meta name='warning' content='*insert any known warnings, bugs or errors here*'/>
    <meta name='generator' content='Vrml97ToX3DNIst, http://ovrt.nist.gov/v2_x3d.html' />
    <meta name='generator' content='X3D-Edit, https://savage.nps.edu/X3D-Edit' />
    <meta name='license' content='..../license.html' />
  </head>
  <Scene>
    <Viewpoint position='0 3 30' />
    <Background groundColor='1 1 1' skyColor='1 1 1' />
    <Transform DEF="Heart_Artery" translation="-0.1058 0.0167 -0.1214">
      <Shape>
        <Appearance>
          <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
          <ImageTexture url="Heart.jpg"/>
        </Appearance>
        <IndexedFaceSet DEF="Heart_Artery-FACES" coordIndex=" 2 3 0 -1 0 1 2 -1 2 4 5 -1 5 3 2 -1 6 7 8 -1 8 9 6 -1 10 11 7 -1 7 6 10 -1 15 12 13 -1 13 14 15 -1 16 17 13 -1
          <TextureCoordinate DEF="Heart_Artery-TEXCOORD" point="0.865 0.0, 0.865 1.0, 0.0 1.0, 0.0 0.0, 0.0 0.9102, 1.0 0.9102, 1.0 1.0, 1.0 0.0, 0.0 0.865, 1.0 0.865, 0.1 0.0, 1
            <Coordinate DEF="Heart_Artery-COORD" point="4.231 0.1496 -3.796, 4.344 0.3423 -3.867, 4.828 0.3262 -3.078, 4.797 0.0916 -3.038, 5.091 0.3505 -2.635, 5.089 0.153
          </IndexedFaceSet>
        </Shape>
      </Transform>
      <Transform DEF="Heart_Aorta" translation="0.8961 9.616 -5.32">
        <Shape>
          <Appearance>
            <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
            <ImageTexture url="Heart.jpg"/>
          </Appearance>
          <IndexedFaceSet DEF="Heart_Aorta-FACES" coordIndex=" 452 8 7 -1 7 453 452 -1 452 0 9 -1 9 8 452 -1 9 0 1 -1 1 17 9 -1 17 1 2 -1 2 19 17 -1 2 454 10 -1 10 19 2 -1 1
            <TextureCoordinate DEF="Heart_Aorta-TEXCOORD" point="0.4947 0.9077, 0.5034 0.9129, 0.4864 0.9037, 0.4762 0.8964, 0.4671 0.885, 0.4582 0.8713, 0.4469 0.8639, 0
              <Coordinate DEF="Heart_Aorta-COORD" point="-1.635 -4.145 2.974, -0.8707 -4.237 2.796, -0.4332 -4.19 2.031, -2.839 -3.992 0.693, -1.401 -4.069 0.2697, -2.04 -3.9
            </IndexedFaceSet>
          </Shape>
        </Transform>
```

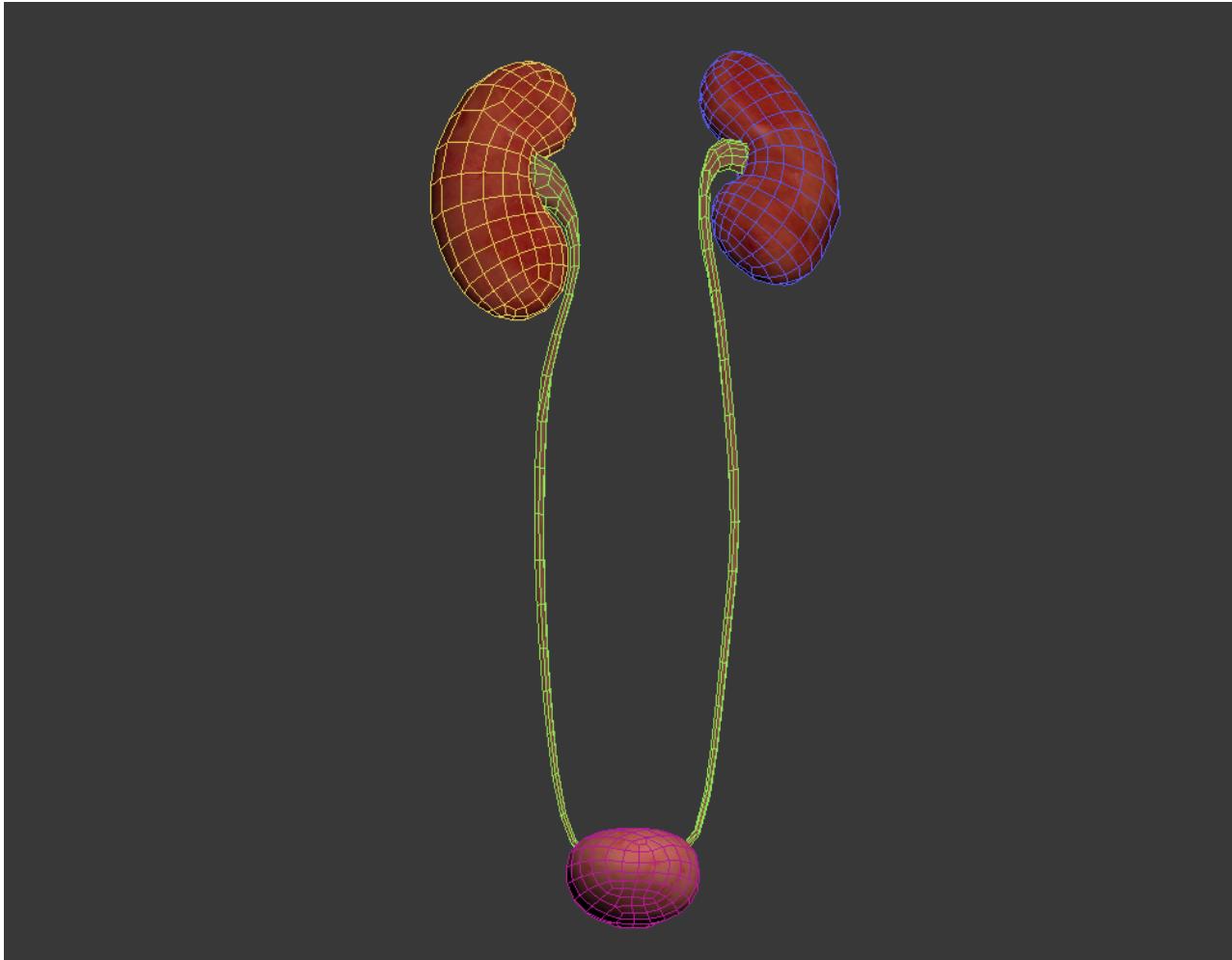
Urinary System



<https://www.cincinnatichildrens.org/health/u/urinary-system>

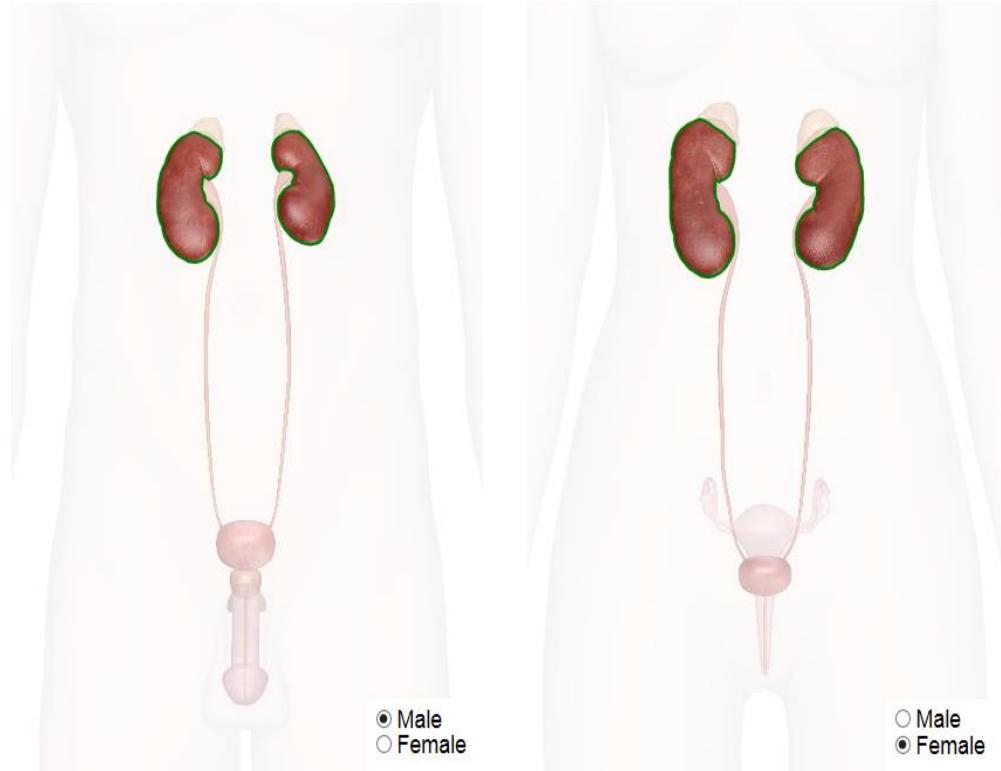
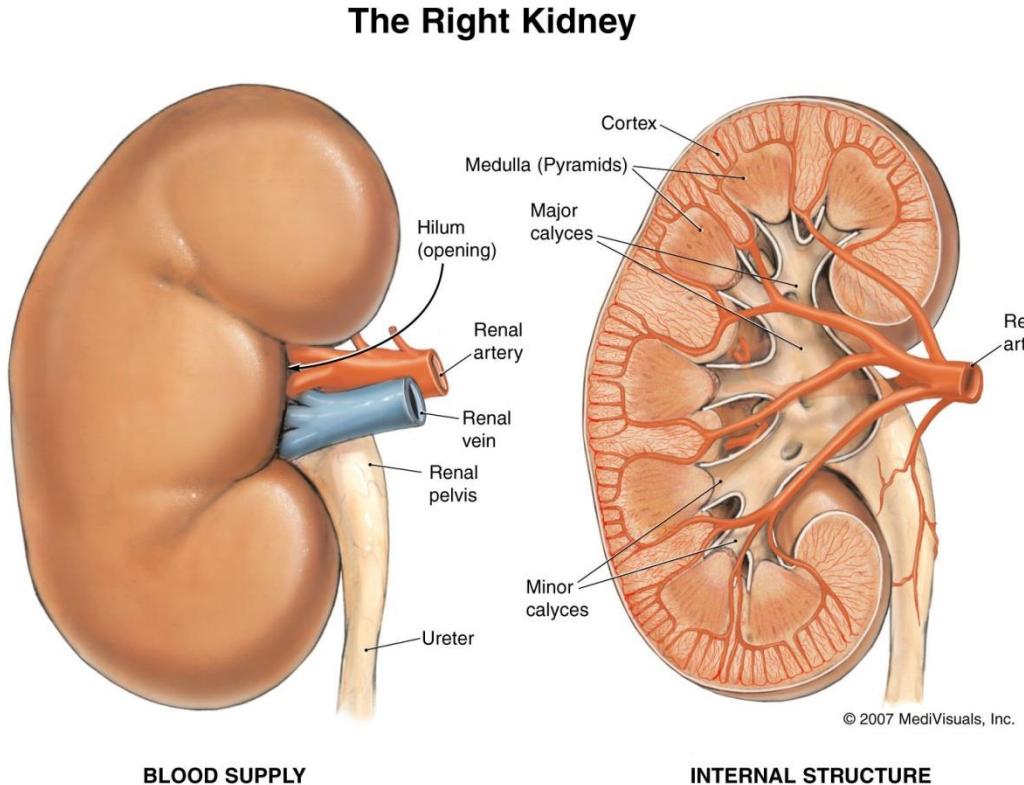
Urinary System Modeling

| 3ds Max Viewport Shot



x3d Viewer Image |

Urinary System - Kidney

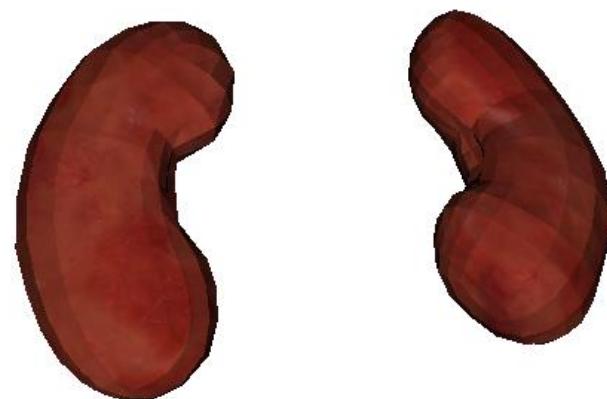
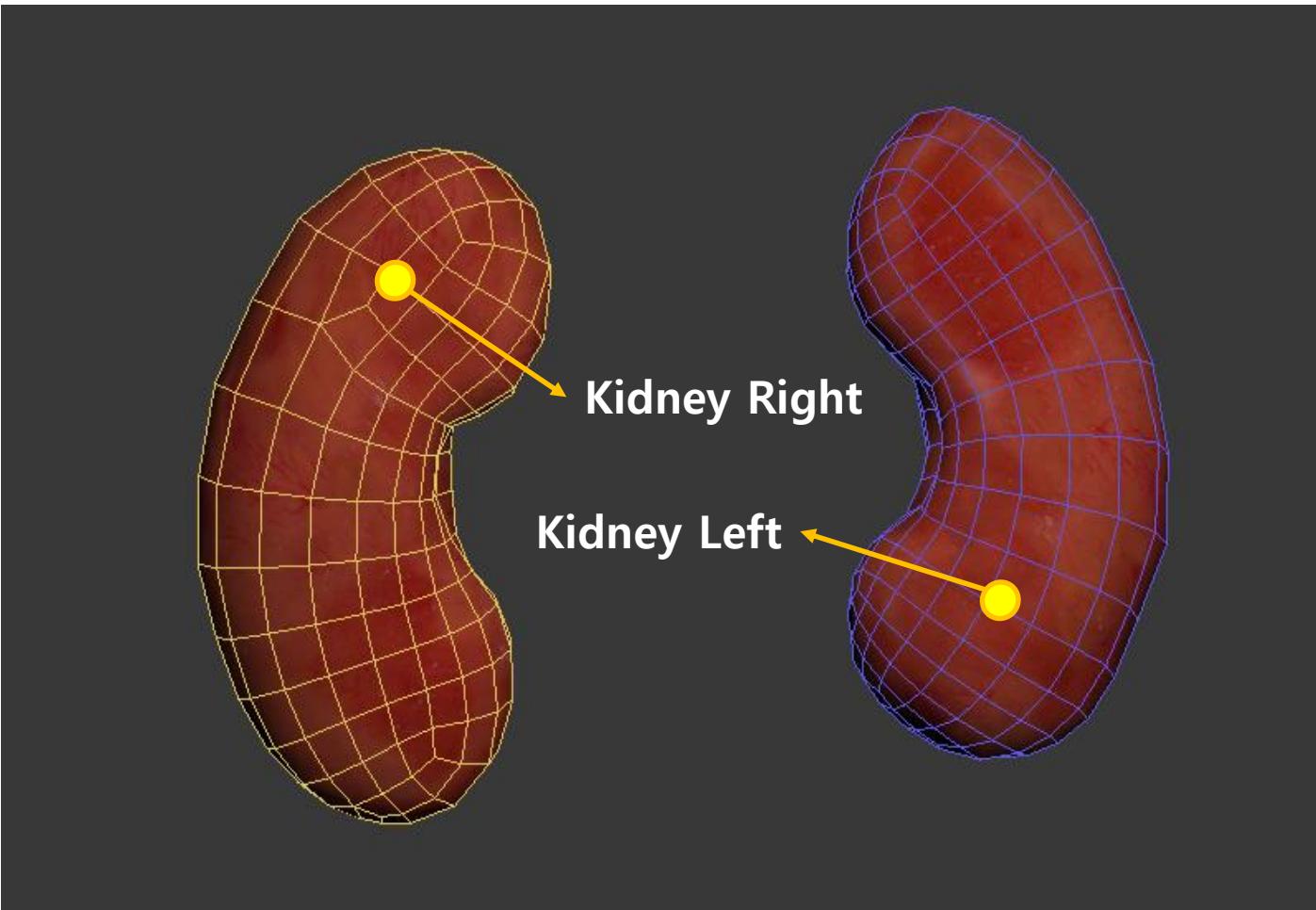


<https://therevealer.org/the-patient-body-whats-a-kidney-worth/>

https://www.innerbody.com/image_repo01/dige24-new.html

Kidney Modeling

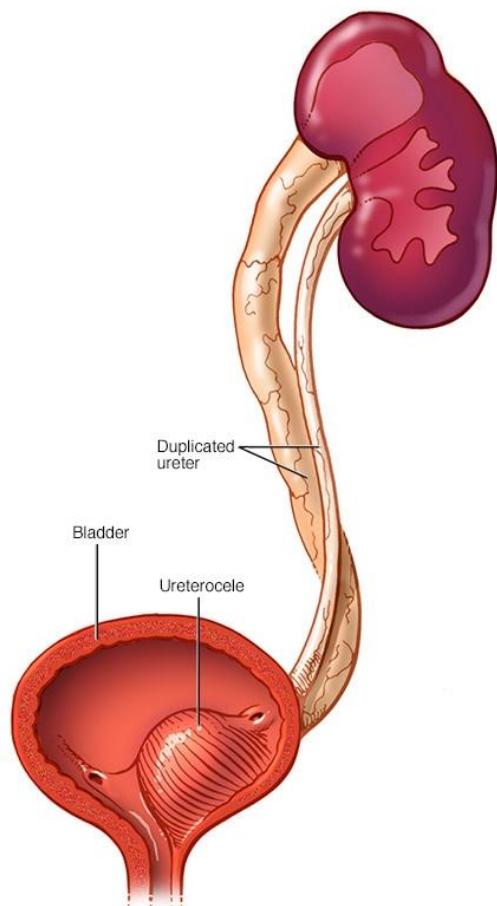
3ds Max Viewport Shot



Kidney X3D Structure

```
<?xml version='1.0' encoding='UTF-8'?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.3//EN" "http://www.web3d.org/specifications/x3d-3.3.dtd">
<X3D version='3.3' profile='Immersive' xmlns:xsd='http://www.w3.org/2001/XMLSchema-instance' xsd:noNamespaceSchemaLocation='http://www.web3d.org/specifications/x3d-3.3.xsd'>
  <head>
    <meta name='title' content='Kidney.x3d'/>
    <meta name='description' content='*enter description here, short-sentence summaries preferred*'/>
    <meta name='creator' content='*enter name of original author here*'/>
    <meta name='translator' content='*if manually translating VRML-to-X3D, enter name of person translating here*'/>
    <meta name='created' content='*enter date of initial version here*'/>
    <meta name='version' content='*enter version here*'/>
    <meta name='reference' content='*enter reference citation or relative/online url here*'/>
    <meta name='reference' content='*enter additional url/bibliographic reference information here*'/>
    <meta name='requires' content='*enter reference resource here if required to support function, delivery, or coherence of content*'/>
    <meta name='rights' content='*enter copyright information here* Example: Copyright (c) Web3D Consortium Inc. 2006' />
    <meta name='drawing' content='*enter drawing filename/url here*'/>
    <meta name='image' content='*enter image filename/url here*'/>
    <meta name='MovingImage' content='*enter movie filename/url here*'/>
    <meta name='photo' content='*enter photo filename/url here*'/>
    <meta name='subject' content='*enter subject keywords here*'/>
    <meta name='accessRights' content='*enter permission statements or url here*'/>
    <meta name='warning' content='*insert any known warnings, bugs or errors here*'/>
    <meta name='generator' content='Vrml97ToX3dNist http://vrt.nist.gov/v2_x3d.html' />
    <meta name='generator' content='X3D-Edit, https://savage.nps.edu/X3D-Edit' />
    <meta name='license' content='../license.html' />
  </head>
  <Scene>
    <Viewpoint position='0 0 0.5' />
    <Background groundColor='1 1 1' skyColor='1 1 1' />
    <Transform DEF="Kidney_Right" translation="-0.05388 -0.004601 0.005788">
      <Shape>
        <Appearance>
          <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
          <ImageTexture url="kidneys.jpg"/>
        </Appearance>
        <IndexedFaceSet DEF="Kidney_Right-FACES" coordIndex="0 1 2 -1 2 3 0 -1 4 5 6 -1 6 7 4 -1 8 9 10 -1 10 11 8 -1 8 11 12 -1 12 13 8 -1 14 15 16 -1 16 17 14 -1 18 19 20
          <TextureCoordinate DEF="Kidney_Right-TEXCOORD" point="0.492 0.6083, 0.4697 0.6066, 0.4698 0.6228, 0.4868 0.6298, 0.5659 0.5082, 0.5371 0.5184, 0.5458 0.5453, 0.5
            <Coordinate DEF="Kidney_Right-COORD" point="0.005598 0.05194 -0.01834, 0.011 0.05224 -0.02144, 0.008298 0.05094 -0.02444, 0.003699 0.05044 -0.02364, 0.003599 ">
        </IndexedFaceSet>
      </Shape>
    </Transform>
    <Transform DEF="Kidney_left" translation="0.05389 0.004598 -0.005808">
      <Shape>
        <Appearance>
          <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
          <ImageTexture url="kidneys.jpg"/>
        </Appearance>
        <IndexedFaceSet DEF="Kidney_left-FACES" coordIndex="0 1 2 -1 2 3 0 -1 4 0 3 -1 3 5 4 -1 6 7 8 -1 8 4 6 -1 6 4 5 -1 5 9 6 -1 10 11 12 -1 12 13 10 -1 14 15 16 -1 16 17 1
          <TextureCoordinate DEF="Kidney_left-TEXCOORD" point="0.3194 0.6935, 0.3097 0.6868, 0.3249 0.6592, 0.3302 0.682, 0.3195 0.7134, 0.3317 0.6987, 0.3353 0.7246, 0.328
            <Coordinate DEF="Kidney_left-COORD" point="-0.006898 -4.517E-4 0.01015, -0.009997 -0.001851 0.009647, -0.0119 -0.004251 0.01605, -0.009097 -1.523E-4 0.01355, ->
        </IndexedFaceSet>
      </Shape>
    </Transform>
  </Scene>
</X3D>
```

Urinary System - Ureter



© MAYO FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH. ALL RIGHTS RESERVED.

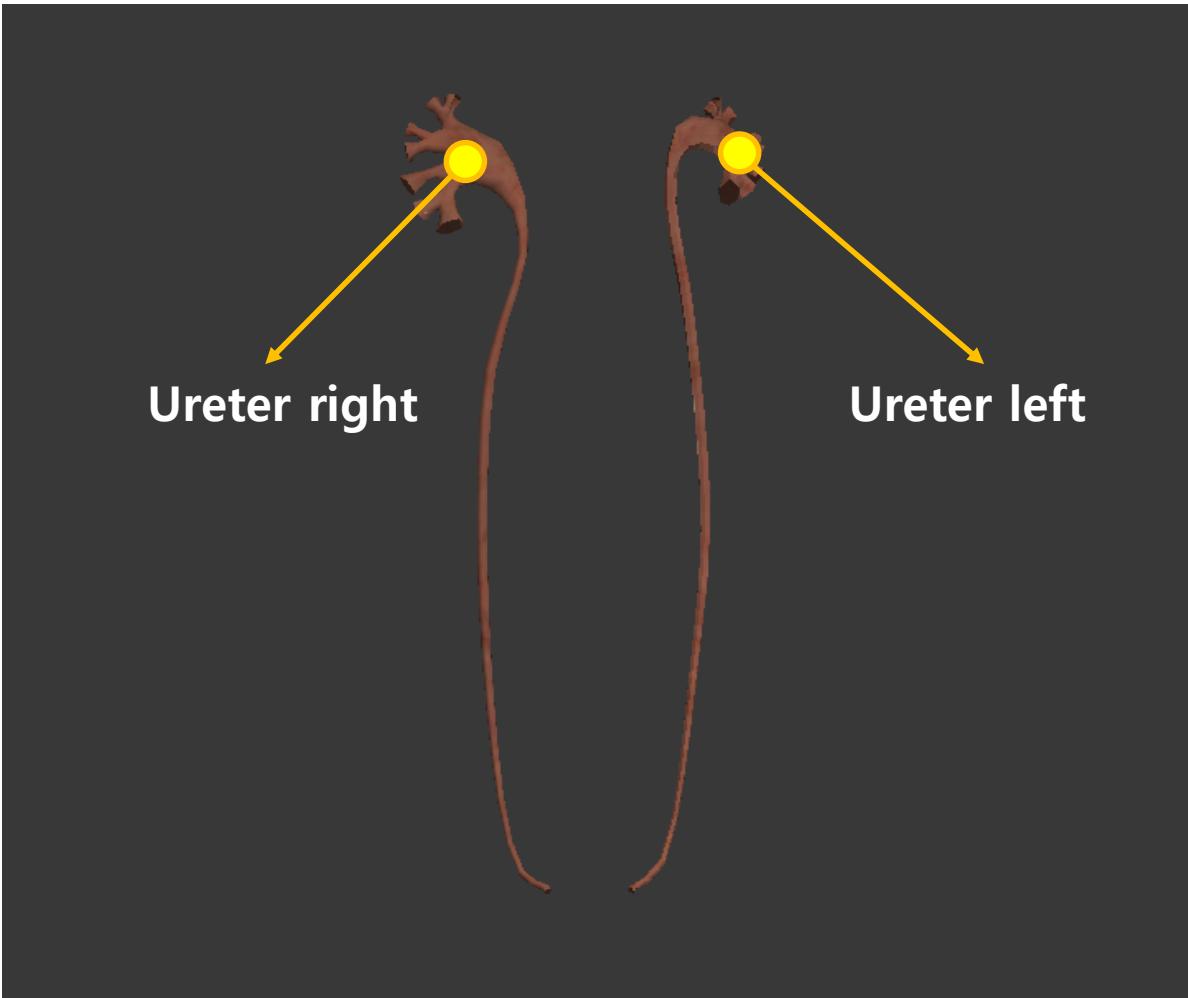
<https://www.mayoclinic.org/>



https://www.innerbody.com/image_urinov/repo15-new2.html

Ureter Modeling

| 3ds Max Viewport Shot

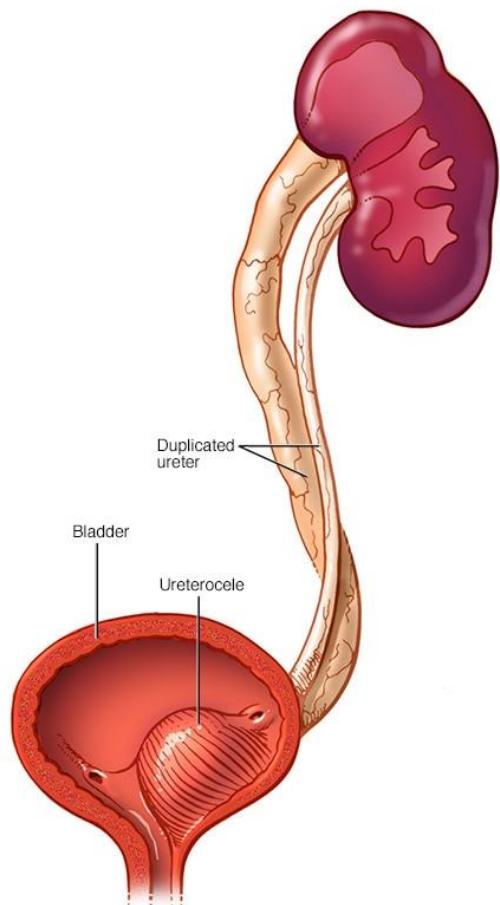


| x3d Viewer Image

Ureter X3D Structure

```
<?xml version='1.0' encoding='UTF-8'?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.3//EN" "http://www.web3d.org/specifications/x3d-3.3.dtd">
<X3D version='3.3' profile='Immersive' xmlns:xsd='http://www.w3.org/2001/XMLSchema-instance' xsd:noNamespaceSchemaLocation='http://www.web3d.org/specifications/x3d-3.3.xsd'>
  <head>
    <meta name='title' content='Ureter.x3d'/>
    <meta name='description' content='*enter description here, short-sentence summaries preferred*'/>
    <meta name='creator' content='*enter name of original author here*'/>
    <meta name='translator' content='*if manually translating VRML-to-X3D, enter name of person translating here*'/>
    <meta name='created' content='*enter date of initial version here*'/>
    <meta name='version' content='*enter version here*'/>
    <meta name='reference' content='*enter reference citation or relative/online url here*'/>
    <meta name='reference' content='*enter additional url/bibliographic reference information here*'/>
    <meta name='requires' content='*enter reference resource here if required to support function, delivery, or coherence of content*'/>
    <meta name='rights' content='*enter copyright information here* Example: Copyright (c) Web3D Consortium Inc. 2006' />
    <meta name='drawing' content='*enter drawing filename/url here*'/>
    <meta name='image' content='*enter image filename/url here*'/>
    <meta name='MovingImage' content='*enter movie filename/url here*'/>
    <meta name='photo' content='*enter photo filename/url here*'/>
    <meta name='subject' content='*enter subject keywords here*'/>
    <meta name='accessRights' content='*enter permission statements or url here*'/>
    <meta name='warning' content='*insert any known warnings, bugs or errors here*'/>
    <meta name='generator' content='Vrml97ToX3dNist, http://ovrt.nist.gov/v2_x3d.html' />
    <meta name='generator' content='X3D-Edit, https://savage.nps.edu/X3D-Edit' />
    <meta name='license' content='../license.html' />
  </head>
  <Scene>
    <Viewpoint position='0 0 0.5' />
    <Background groundColor='1 1 1' skyColor='1 1 1' />
    <Transform DEF="Ureter_right" translation="-0.03902 2.613E-4 8.431E-4">
      <Shape>
        <Appearance>
          <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
          <ImageTexture url="kidneys.jpg"/>
        </Appearance>
        <IndexedFaceSet DEF="Ureter_right-FACES" coordIndex="0 1 2 -1 2 3 0 -1 4 5 1 -1 1 0 4 -1 6 2 1 -1 7 8 5 -1 5 4 7 -1 6 1 9 -1 9 10 6 -1 1 5 9 -1 7 11 12 -1 12 8 7 -1 1:>
          <TextureCoordinate DEF="Ureter_right-TEXCOORD" point="0.1048 0.07738, 0.1041 0.07801, 0.07709 0.08209, 0.07778 0.0814, 0.1394 0.07261, 0.1394 0.07399, 0.07847">
            <Coordinate DEF="Ureter_right-COORD" point="0.007581 -0.1154 -0.01881, 0.007934 -0.1159 -0.02022, 0.01122 -0.1325 -0.01892, 0.01099 -0.1319 -0.01763, 0.00546">
          </TextureCoordinate>
        </IndexedFaceSet>
      </Shape>
    </Transform>
    <Transform DEF="Ureter_left" translation="0.03902 -2.678E-4 -8.612E-4">
      <Shape>
        <Appearance>
          <Material ambientIntensity="1.0" transparency="0.0" shininess="0.145" diffuseColor="0.588 0.588 0.588" specularColor="0.0 0.0 0.0"/>
          <ImageTexture url="kidneys.jpg"/>
        </Appearance>
        <IndexedFaceSet DEF="Ureter_left-FACES" coordIndex="0 1 2 -1 2 3 0 -1 4 5 1 -1 1 0 4 -1 1 6 7 -1 7 2 1 -1 9 5 4 -1 4 8 9 -1 10 6 1 -1 1 5 10 -1 7 6 11 -1 11 12 7 -1 9">
          <TextureCoordinate DEF="Ureter_left-TEXCOORD" point="0.629 0.08579, 0.6025 0.0824, 0.6019 0.08379, 0.6283 0.08718, 0.6303 0.08309, 0.6032 0.0797, 0.5674 0.0790">
            <Coordinate DEF="Ureter_left-COORD" point="-0.008051 -0.1206 -0.01616, -0.005465 -0.1037 -0.01346, -0.006406 -0.1037 -0.01475, -0.008756 -0.1208 -0.01734, -0">
          </TextureCoordinate>
        </IndexedFaceSet>
      </Shape>
    </Transform>
  </Scene>
</X3D>
```

Urinary System - Bladder



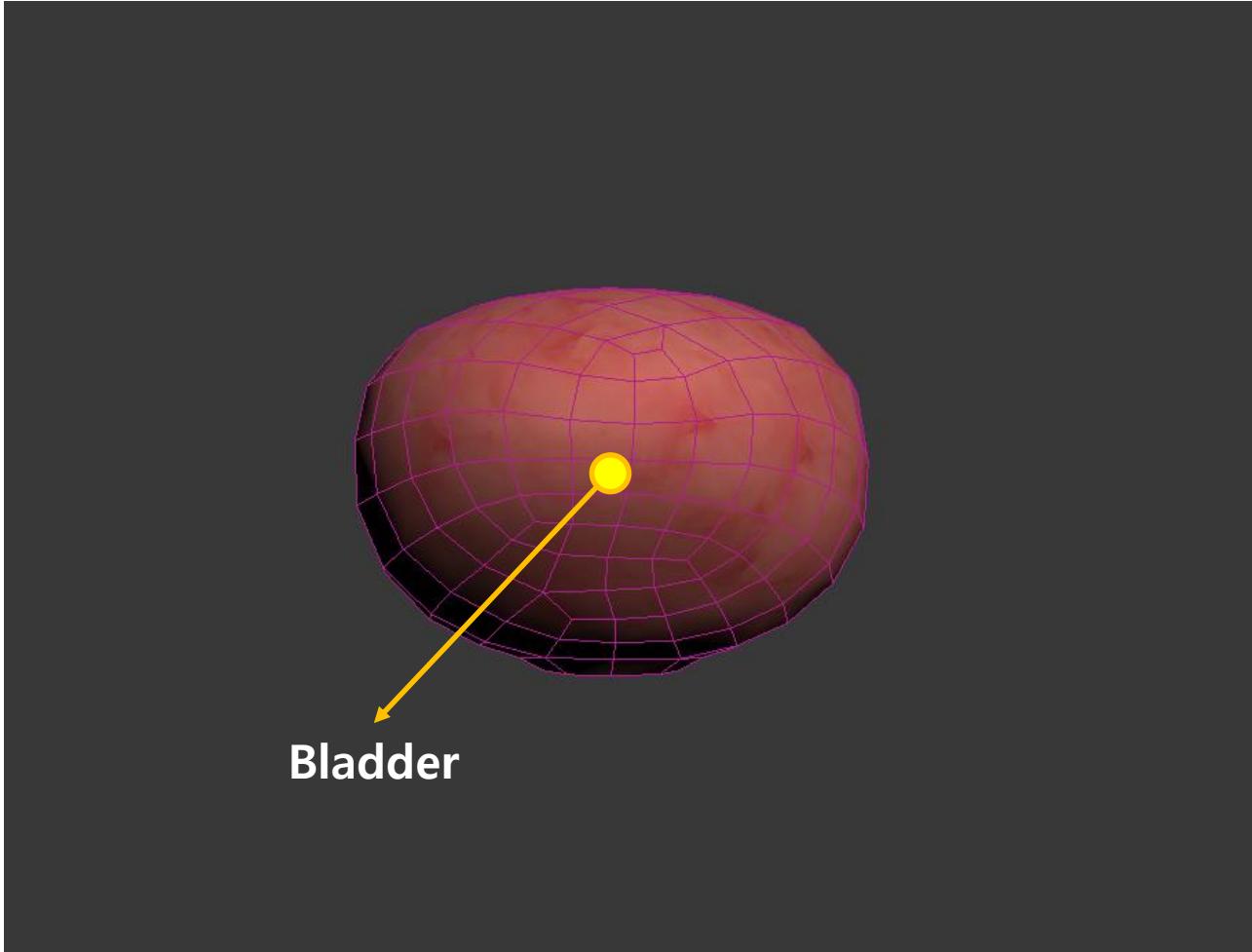
<https://www.mayoclinic.org/>



https://www.innerbody.com/image_urinov/repo15-new2.html

Bladder Modeling

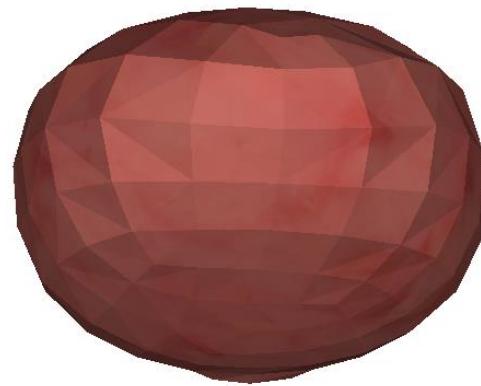
| 3ds Max Viewport Shot



2019-7-29

SIGGRAPH Web3D Standardization Meeting

59



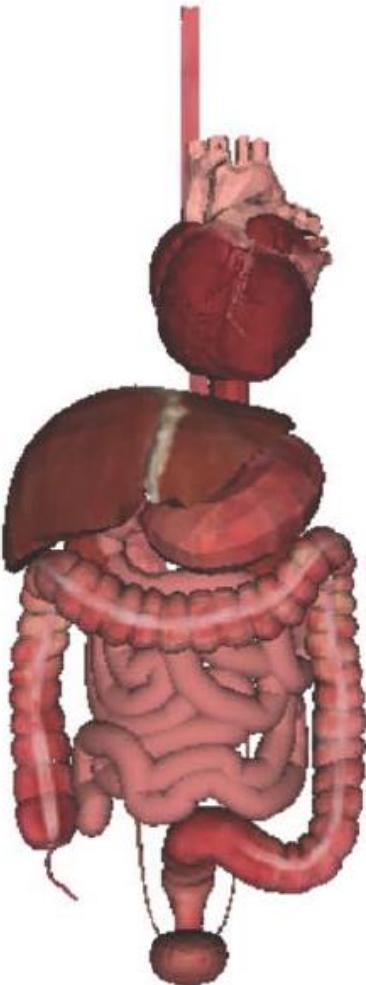
| x3d Viewer Image

Bladder X3D Structure

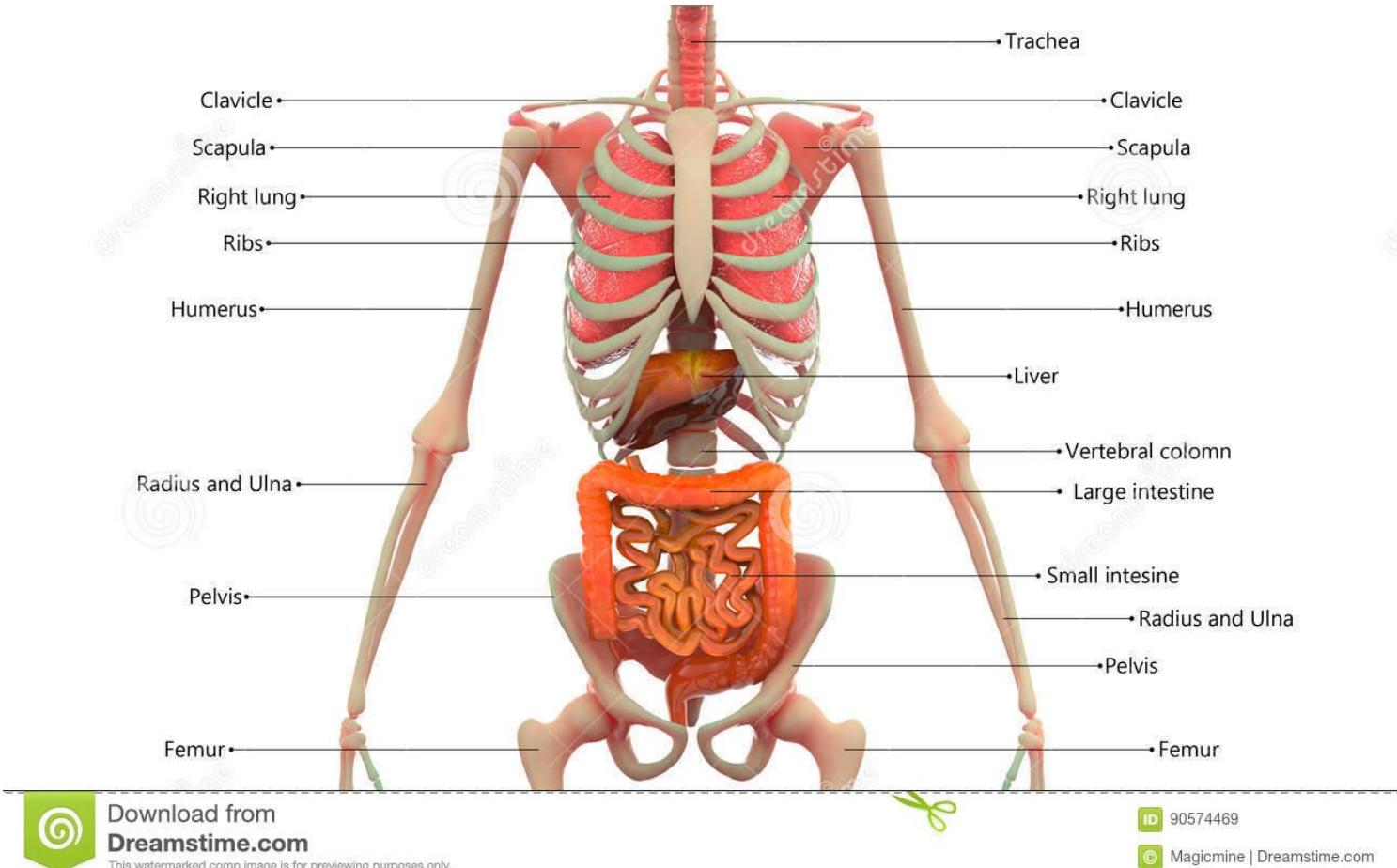
X3D Structure

```
<internal organ>
<digestive>
<Transform DEF="Esophagus">
  <Shape>
    <IndexedFaceSet DEF="Esophagus-FACES" coordindex="...">
      <TextureCoordinate EDF="Esophagus-TEXCOORD" point="...">
      <Coordinate DEF="Esophagus-COORD" point="...">
    </IndexedFaceSet>
  </Shape>
</Transform>
<Transform DEF="Stomach">
  <Shape>
    <IndexedFaceSet DEF="Stomach-FACES" coordindex="...">
      <TextureCoordinate EDF="Stomach-TEXCOORD" point="...">
      <Coordinate DEF="Stomach-COORD" point="...">
    </IndexedFaceSet>
  </Shape>
</Transform>
<Transform DEF="Duodenum">
  <Shape>
    <IndexedFaceSet DEF="Duodenum-FACES" coordindex="...">
      <TextureCoordinate EDF="Duodenum-TEXCOORD" point="...">
      <Coordinate DEF="Duodenum-COORD" point="...">
    </IndexedFaceSet>
  </Shape>
</Transform>
<Transform DEF="Small Intestine">
  <Shape>
    <IndexedFaceSet DEF="Small Intestine-FACES" coordindex="...">
      <TextureCoordinate EDF="Small Intestine-TEXCOORD" point="...">
      <Coordinate DEF="Small Intestine-COORD" point="...">
    </IndexedFaceSet>
  </Shape>
</Transform>
```

Integration of Internal Organs



Internal_Organs.x3d



Download from
Dreamstime.com

This watermarked comp image is for previewing purposes only.

ID 90574469

© Magicmine | Dreamstime.com

<https://www.dreamstime.com/stock-illustration-human-skeleton-organs-anatomy-d-illustration-image90574469>

Internal organs data model

- Modeling
 - Organ
 - Regions
 - Region name
 - Region meta interface
 - Geometry
 - Appearance
 - Layers
 - Layer name
 - Layer meta interface
 - Geometry
 - Appearance
 - Animation
 - Region based keyframe animation
 - Region based motion data animation

Level of details for representation

- Based on eye investigation (microscopy?)
- LOD 1
 - Organ level representation (stomach, lever, ..)
- LOD 2
 - Region level representation for each organ
- LOD 3
 - Layer representation

Conclusions (1)

- Representation data model for human internal organs
 - Modeling data model
 - Animation data model
 - Interface data model with medical and health devices
- Modeling: region and layer based modeling
 - Level of details (LOD1, LOD2, and LOD3)
 - Region partitioning and landmarks
 - Layer definition
- Animation: region and layer based deformation
 - Definition of deformation parameters
- Interface with medical and health devices
 - Definition of information from devices
 - Meta information related to specific parts of an organ

Conclusions (2)

- Standards development (ISO/IEC JTC 1/SC 24/WG 6)
 - Human internal organ representation and data model (Part 1)
 - Human respiratory system representation (Part 2)
 - Human digestive system representation (Part 3)
 - Human circulatory system representation (Part 4)
 - Human urinary system representation (Part 5)