

Automatic Esophageal Intubation Detection Using Giant Magneto Resistance
Sensors

Bradley J. Alson

Thesis submitted to the faculty of the Virginia Polytechnic Institute and State
University in partial fulfillment of the requirements for the degree of

Master of Science
In
Mechanical Engineering

Alfred L. Wicks
John P. Bird
Andre A. Muelenaer

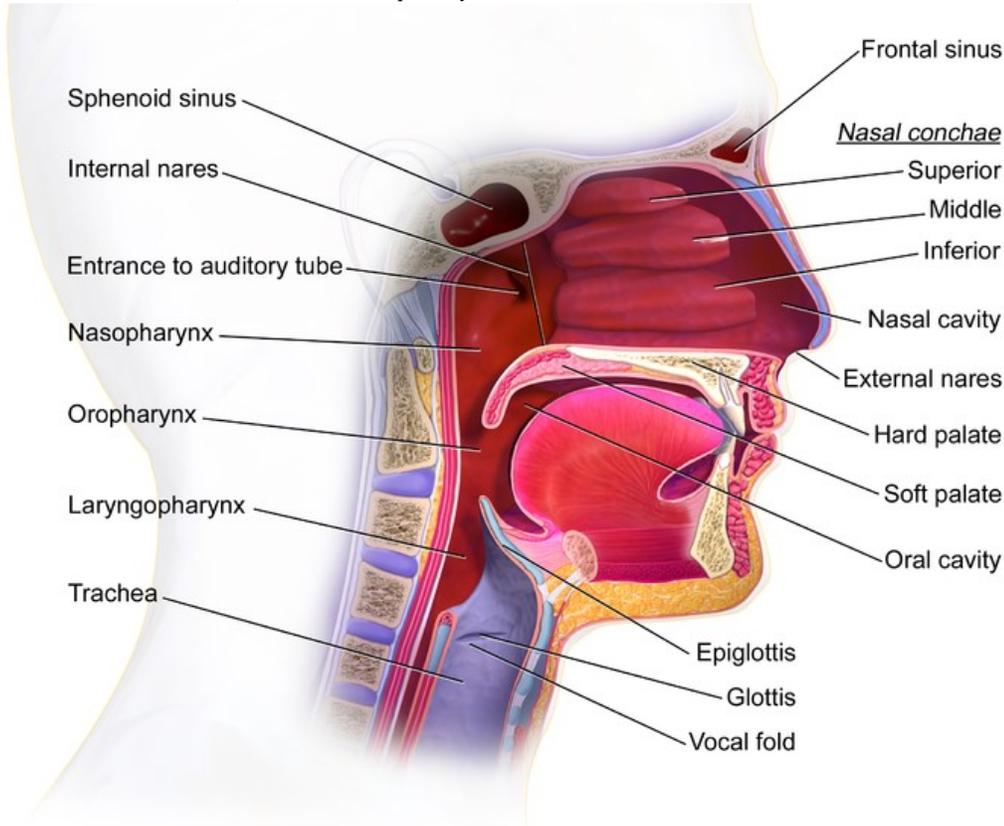
July 2, 2015
Blacksburg, VA

Keywords: Airway Management, Intubation

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File:Blausen 0872 UpperRespiratorySystem.png

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The Upper Respiratory System

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Summary

Description	English: Upper Respiratory System. See a related animation (http://blausen.com/?Topic=9331) on this medical topic
Date	28 August 2013, 11:56:36
Source	Own work
Author	BruceBlaus. When using this image in external sources it can be cited as: <ul style="list-style-type: none"> ▪ Blausen.com staff. "Blausen gallery 2014 (https://en.wikiversity.org/wiki/Blausen_gallery_2014)". <i>Wikiversity Journal of Medicine</i>. DOI:10.15347/wjm/2014.010 (http://dx.doi.org/10.15347/wjm/2014.010). ISSN 20018762 (http://www.worldcat.org/issn/20018762).
Permission (Reusing this file)	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 10px;">OTRS</div> <p>This work is free and may be used by anyone for any purpose. If you wish to use this content, you do not need to request permission as long as you follow any licensing requirements mentioned on this page.</p> </div>

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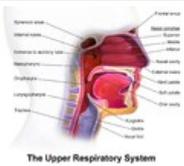
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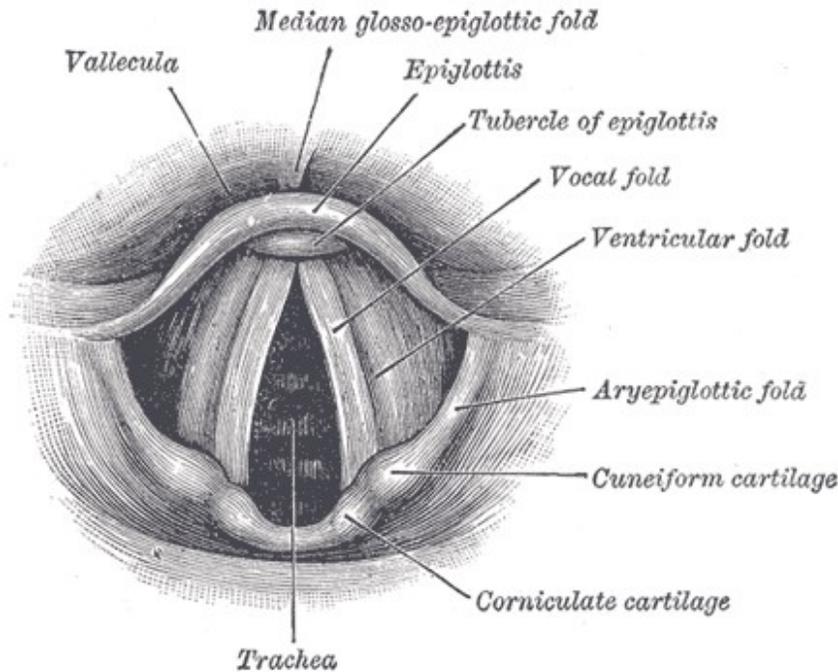
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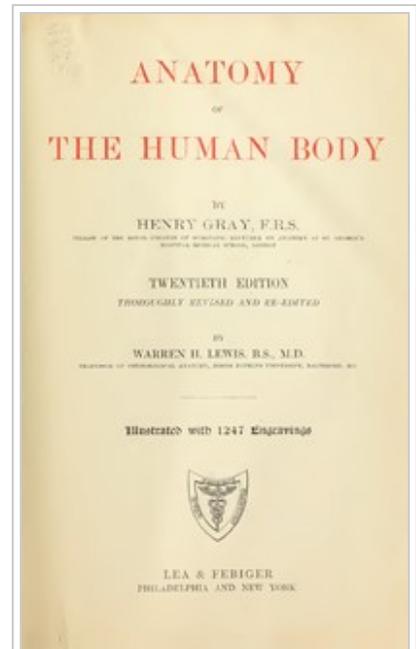


Description	Laryngoscopic view of interior of larynx.
Plate	956
Date	before 1858
Source	<ul style="list-style-type: none"> Henry Gray (1918) <i>Anatomy of the Human Body</i> (See "Book" section below) Bartleby.com: Gray's Anatomy (http://www.bartleby.com/107/), Plate 956 (http://www.bartleby.com/107/illus956.html)
Author	Henry Vandyke Carter (1831–1897)  

Book

Author	Henry Gray (1827–1861)  	
Editor	Revised by Warren H. Lewis	

Illustrator	Henry Vandyke Carter (1831–1897) 
Title	Anatomy of the Human Body
Edition	20
Publisher	Lea and Febiger
Year of publication	1918
Place of publication	Philadelphia and New York
Page overview	list of all the plates
Source	Bartleby (http://www.bartleby.com/107/)



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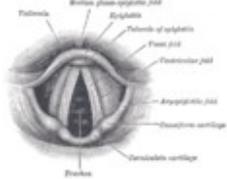


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current	04:59, 29 July 2005		450 × 354 (33 KB)	Keenan Pepper (talk contribs)	{{Gray's Anatomy plate Laryngoscopic view of interior of larynx.}}

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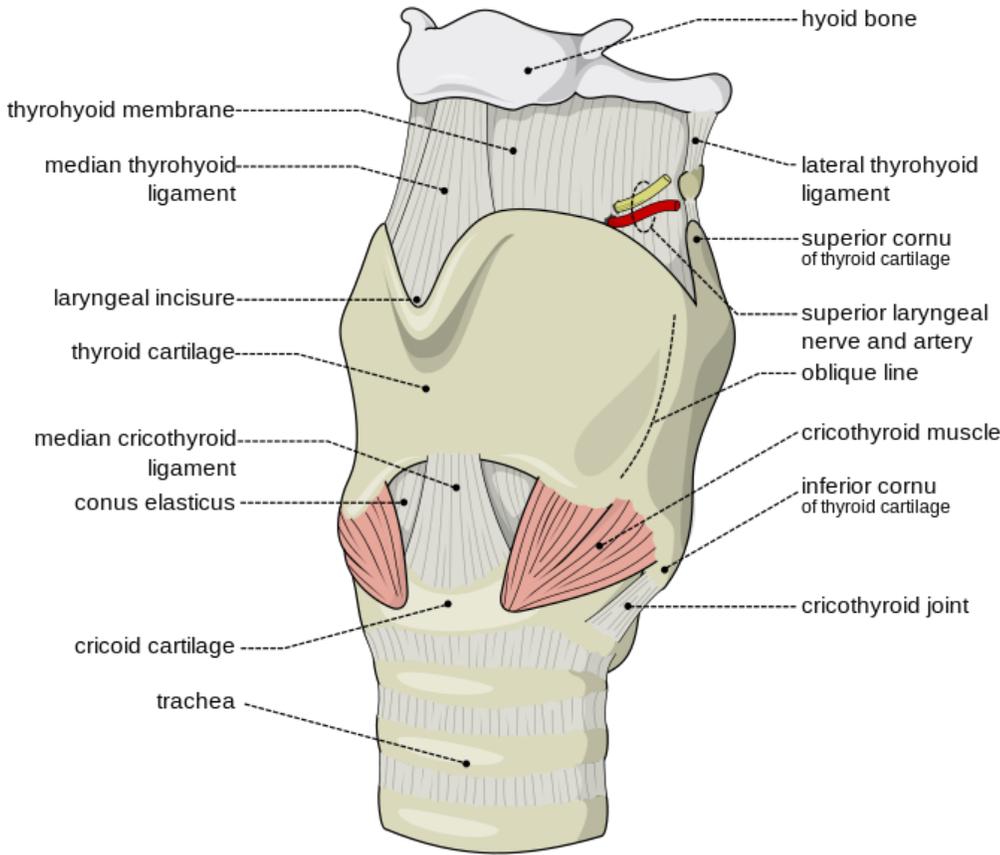
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Categories: Gray's Anatomy plates | Human voice

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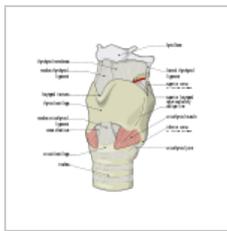
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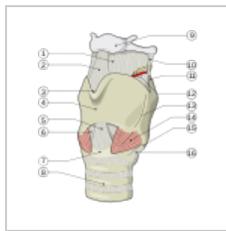
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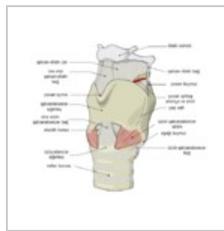
Description	<p>English: Larynx - antero-lateral view, with external muscles of larynx visible. Version with english descriptions on the picture.</p> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">  This vector image was created with Inkscape. </div>
Date	02:44, 3 February 2008 (UTC) (upload on commons)
Source	Own work, modified SVG version of PD picture from Gray's Anatomy.
Author	Olek Remesz (wiki-pl: Orem, commons: Orem)
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Other versions	<div style="border: 1px solid black; height: 20px; width: 15px; display: inline-block;"></div>



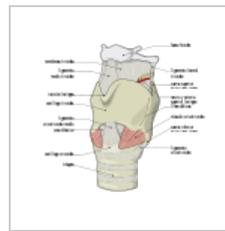
English (original)



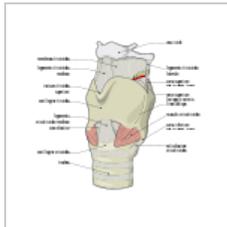
multilingual (original)



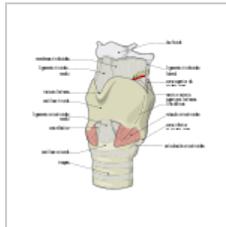
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current	05:15, 1 May 2009		1,125 × 975 (113 KB)	Quuxplusone (talk contribs)	Fixed typo "ligament" -> "ligament"; cleaned up Inkscape cruft in the XML
	02:44, 3 February 2008		1,125 × 975 (175 KB)	Orem (talk contribs)	{{Information Description= {{en Larynx - antero-lateral view, with external muscles of larynx visible. Version with english descriptions on the picture. }} <center>{{inkscape}} </center> Source= Own work, modified SVG version of PD [[Image:Gray951.jpg

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 - Tracheal intubation
 - Origin of language

- Airway management
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- Thyroid cartilage
- Cricothyroid ligament
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- Conus elasticus
- Lateral thyrohyoid ligament
- Thyrohyoid membrane
- Cricothyrotomy
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- Cricothyroid articulation
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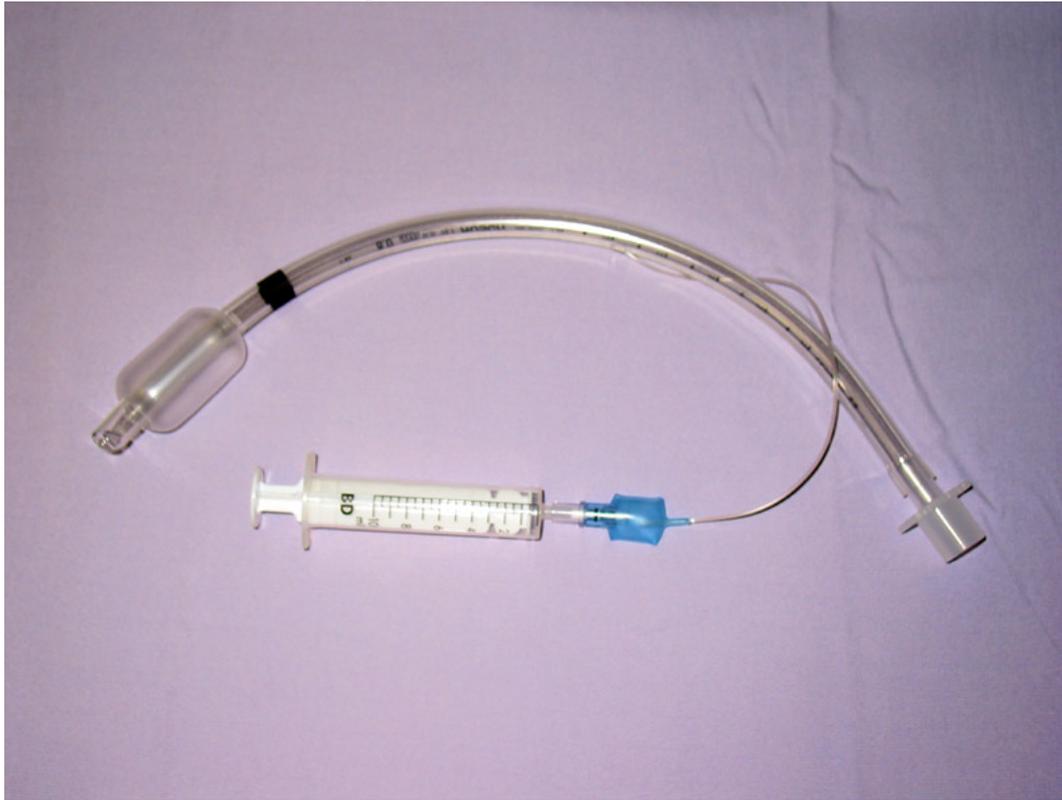
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Categories: Human anatomy plates and drawings | Respiratory system | Larynx | Hyoid bones | Ligaments | SVG Gray's Anatomy plates

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Source	Self-photographed
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current	14:04, 23 May 2007		800 × 600 (74 KB)	Bigomar2 (talk contribs)	{{Information Description=sonde d'intubation tracheale Source=photographie personnelle Date=23 mai 2007 Author=bigomar2 Permission= other_versions= }} Category:medicine

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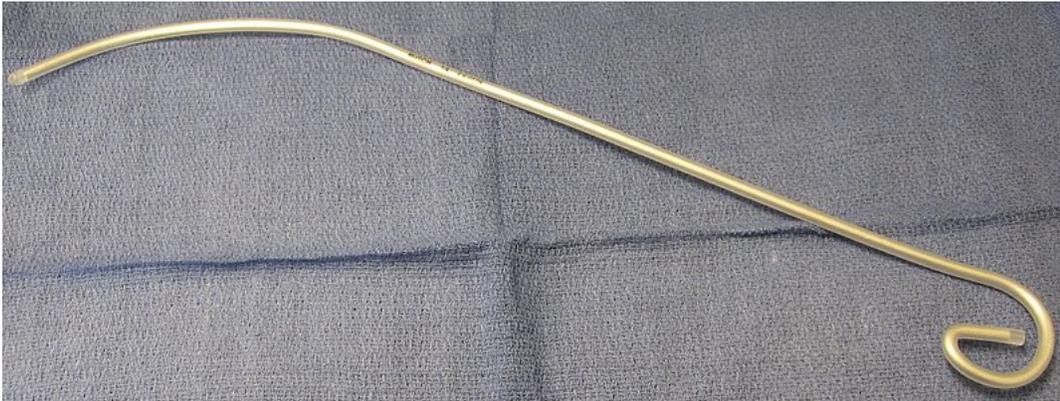
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Description	English: An endotracheal tube stylet, useful in facilitating orotracheal intubation. Italiano: Un mandrino, utilizzato per facilitare l'indubazione orotracheale
Date	25 July 2010 (originally posted on 04:11, 22 July 2010 (UTC))
Source	Transferred from en.Wikipedia
Author	DiverDave (talk) (on en.wiki)

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current	16:14, 25 July 2010		3,942 × 1,487 (2.25 MB)	DoppioM (talk contribs)	{{Information Description = {{en An endotracheal tube stylet, useful in facilitating orotracheal intubation.}} {{it Un mandrino, utilizzato per facilitare l'indubazione orotracheale}} Source = Transferred from [http://en.wikipedia.org/wiki/Fi

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Camera manufacturer	Canon
Camera model	Canon PowerShot SD780 IS
Exposure time	1/20 sec (0.05)
F-number	f/3.2
ISO speed rating	250
Date and time of data generation	10:40, 21 July 2010
Lens focal length	5.9 mm

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Category: Intubation

-
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File:Macintosh Blades.jpg

From Wikipedia, the free encyclopedia



Size of this preview: 450 × 600 pixels.

Original file (600 × 800 pixels, file size: 175 KB, MIME type: image/jpeg)

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Summary

Description

Laryngoscope with Macintosh type curved blades. The complete range of sizes is shown: sizes 0 (neonate) through 4 (large adult)

Source

I (Sasata (talk)) created this work entirely by myself.

Date

03:10, 13 August 2010 (UTC)

Author

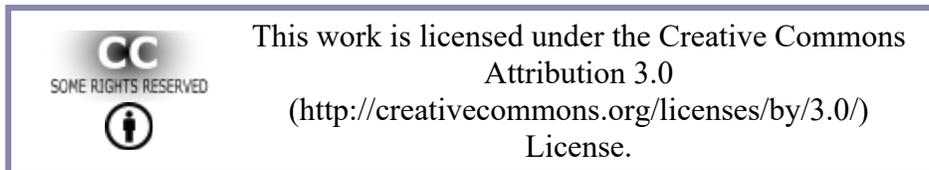
Sasata (talk)

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File history

Click on a date/time to view the file as it appeared at that time.

	Date/Time	Thumbnail	Dimensions	User	Comment
current	03:10, 13 August 2010		600 × 800 (175 KB)	Sasata (talk contribs)	{{Information Description = Laryngoscope with Macintosh type curved blades. The complete range of sizes is shown: sizes 0 (neonate) through 4 (large adult) Source = I (~~~~) created this work entirely by myself. Date = ~~~~~ Au

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File usage

The following pages on the English Wikipedia link to this file (pages on other projects are not listed):

- Laryngoscopy
- Robert Reynolds Macintosh
- Tracheal intubation

Metadata

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Camera manufacturer	Apple
Camera model	iPhone 3G
F-number	f/2.8
Date and time of data generation	16:08, 12 August 2010

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File:Laryngoscopes-Miller blades.JPG

From Wikimedia Commons, the free media repository



Size of this preview: 680 × 599 pixels.

Original file (3,269 × 2,881 pixels, file size: 3.24 MB, MIME type: image/jpeg); ZoomViewer: flash/no flash

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Information
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Summary

Description	English: Laryngoscope handles with an assortment of Miller blades
Date	21 July 2010
Source	Own work
Author	DiverDave (talk)

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Original upload log

Transferred from en.wikipedia (<http://en.wikipedia.org>) to Commons using For the Common Good. The original description page was here (https://en.wikipedia.org/w/index.php?title=File:Laryngoscopes-Miller_blades.JPG). All following user names refer to en.wikipedia.

Date/Time	Dimensions	User	Comment
03:30, 22 July 2010	3,269 × 2,881 (3,395,265 bytes)	w:en:DiverDave (talk contribs)	<i>({{Information Description = [[Laryngoscope]] handles with an assortment of Miller blades Source = I (~~~) created this work entirely by myself. Date = 21 July 2010 Author = ~~~ other_versions = }} {{subst:chc}})</i>

File history

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	Date/Time	Thumbnail	Dimensions	User	Comment
current	18:14, 17 January 2013		3,269 × 2,881 (3.24 MB)	Fredlyfish4 (talk contribs)	Transferred from en.wikipedia: see original upload log above

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File usage on other wikis

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- Usage on en.wikipedia.org
 - Tracheal intubation
 - Laryngoscopy
 - User:DiverDave/Images

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Camera manufacturer	Canon
Camera model	Canon PowerShot SD780 IS
Exposure time	1/25 sec (0.04)

F-number	f/3.2
ISO speed rating	250
Date and time of data generation	10:30, 21 July 2010
Lens focal length	5.9 mm

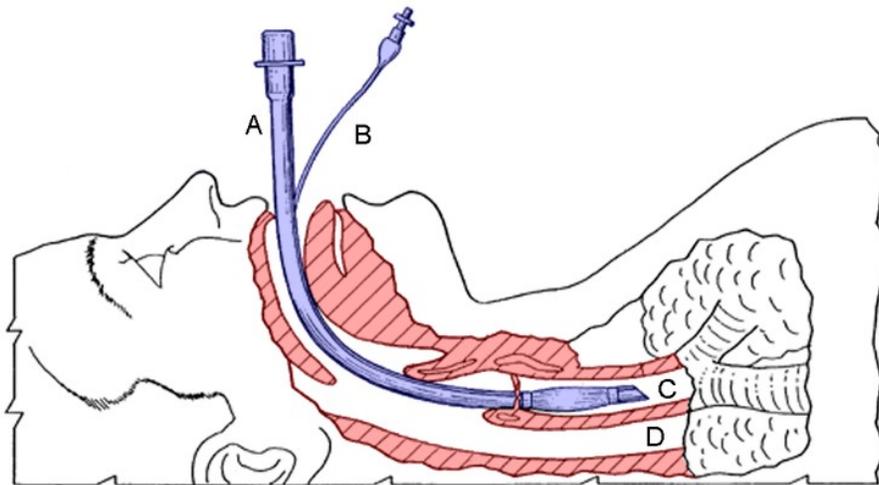
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Categories: Intubation | Laryngoscope

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File:Endotracheal tube colored.png

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Size of this preview: 800 × 482 pixels.
Original file (1,100 × 663 pixels, file size: 208 KB, MIME type: image/png)

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Description	English: Diagram of an inserted endotracheal tube Deutsch: Schema eines Endotrachealtubus (blau, A; Cuffleitung B), der in der Luftröhre (C) liegt. D: Speiseröhre
Date	May 2008
Source	Modification of http://commons.wikimedia.org/wiki/Image:Endotracheal_tube_inserted.png
Author	PhilippN
Permission (Reusing this file)	United States Patent illustration

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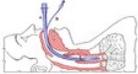
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current	10:53, 3 February 2012		1,100 × 663 (208 KB)	PhilippN (talk contribs)	improvement of former sloppy work by myself
	11:31, 12 May 2008		1,100 × 663 (266 KB)	PhilippN (talk contribs)	{{Information Description={{en Diagram of an inserted endotracheal tube}} {{de}} Source=Modification of http://commons.wikimedia.org/wiki/Image:Endotracheal_tube_inserted.png Date= 05/2008 Author= PhilippN Permission= United States P

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- File:Endotracheal tube inserted.png

File usage on other wikis

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- Usage on de.wikipedia.org
 - Endotracheale Intubation
 - Endotrachealtubus
 - Hypoventilation
 - Atemwegsmanagement
- Usage on de.wiktionary.org
 - Tubus
- Usage on en.wikipedia.org
 - Tracheal intubation
 - Mechanical ventilation
 - Tracheal tube
 - User:RepordRider
- Usage on es.wikipedia.org
 - Tubo traqueal
- Usage on ja.wikipedia.org
 - 人工呼吸器
 - 気管内チューブ
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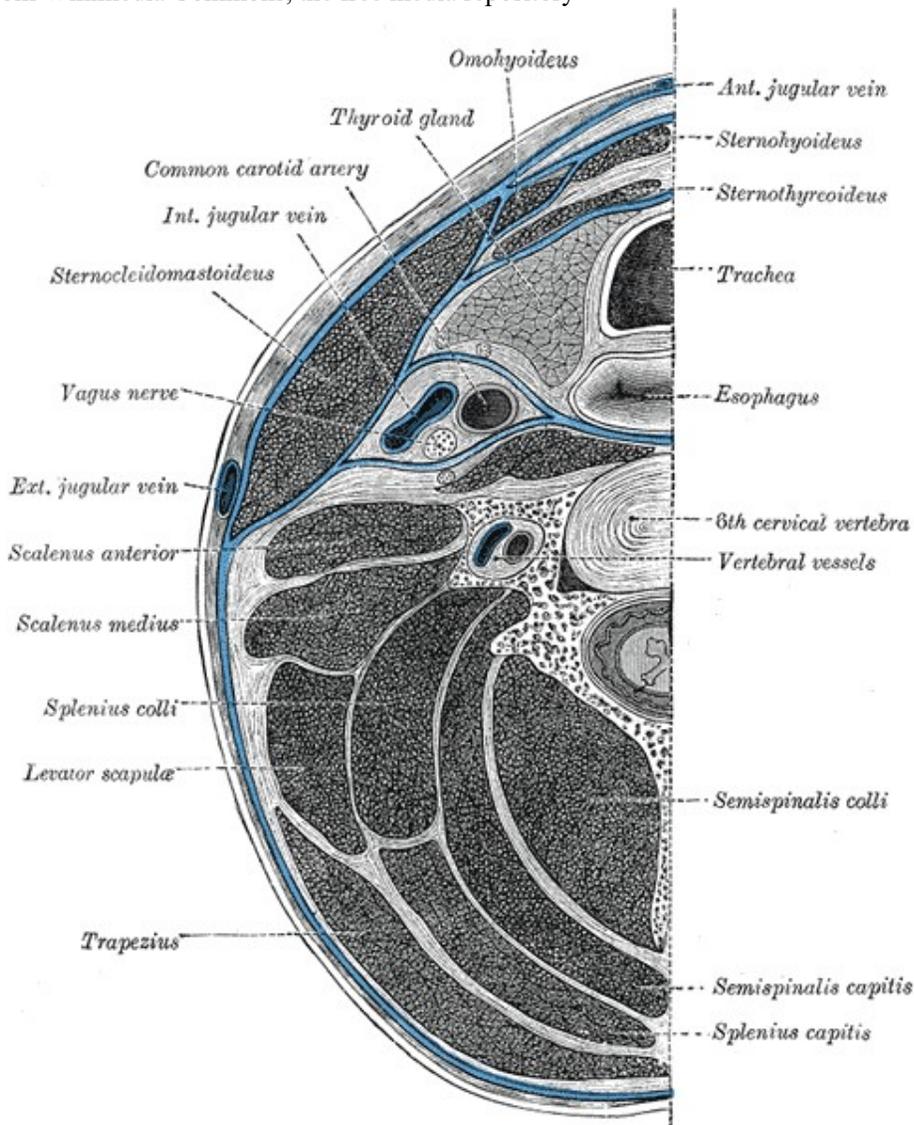
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Categories: Medical instruments | Intubation

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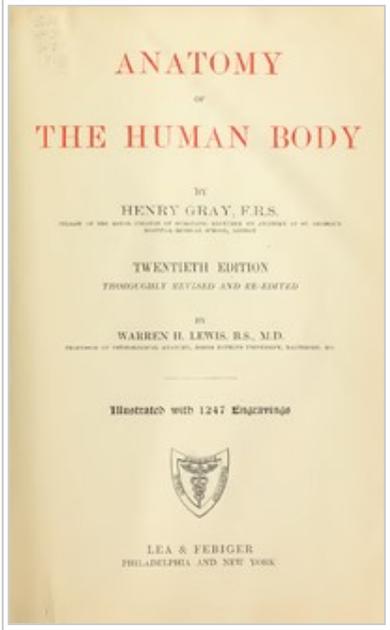


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Plate	384
Date	before 1858
Source	<ul style="list-style-type: none"> Henry Gray (1918) <i>Anatomy of the Human Body</i> (See "Book" section below) Bartleby.com: Gray's Anatomy (http://www.bartleby.com/107/), Plate 384 (http://www.bartleby.com/107/illus384.html)
Author	Henry Vandyke Carter (1831–1897)  

Book

Author	Henry Gray (1827–1861)  	 
Editor	Revised by Warren H. Lewis	
Illustrator	Henry Vandyke Carter (1831–1897)  	
Title	Anatomy of the Human Body	
Edition	20	
Publisher	Lea and Febiger	
Year of publication	1918	
Place of publication	Philadelphia and New York	
Page overview	list of all the plates	
Source	Bartleby (http://www.bartleby.com/107/)	

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current	20:43, 23 January 2007		512 × 600 (57 KB)	Pngbot (talk contribs)	optimized with optipng
	13:39, 8 February 2006	 Thumbnail for version as of 13:39, 8 February 2006	512 × 600 (96 KB)	Arcadian (talk contribs)	{{Gray's Anatomy plate}}

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 - Esòfag
 - Múscul esternocleidomastoïdal
 - Llista dels músculs del cos humà
 - Músculs escalens
 - Múscul esternohioïdal
 - Múscul esternotiroïdal
 - Múscul omohioïdal
 - Múscul espleni del cap
 - Múscul espleni cervical
 - Músculs transversospinals
 - Múscul semispinós del cap
 - Múscul semispinós cervical
 - Múscul elevador de l'escàpula
- Usage on de.wikipedia.org
 - Benutzer:Echinacin35/Anatomie
- Usage on de.wikibooks.org
 - Topographische Anatomie: Vordere Rumpfwand
 - Topographische Anatomie: Hals: Allgemeines
- Usage on dv.wikipedia.org
 - *ᲛᲟᲠᲗ᲏ ᲛᲟᲠᲗ᲏*
- Usage on en.wikipedia.org
 - Vagus nerve
 - Trachea
 - Internal carotid artery
 - Levator scapulae muscle
 - Cervical vertebrae
 - Internal jugular vein
 - External jugular vein
 - Vertebral artery
 - Scalene muscles
 - Sternohyoid muscle
 - Sternothyroid muscle

- Splenius capitis muscle
- Splenius cervicis muscle
- Semispinalis capitis
- Vertebral vein
- Anterior jugular vein
- Retropharyngeal space
- Deep cervical fascia
- Semispinalis cervicis
- Transversospinales muscles
- Investing layer of deep cervical fascia
- Pretracheal fascia
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- Alar fascia
- Danger space
- Prevertebral space
- Wikipedia:Reference desk/Archives/Science/2008 June 26

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