

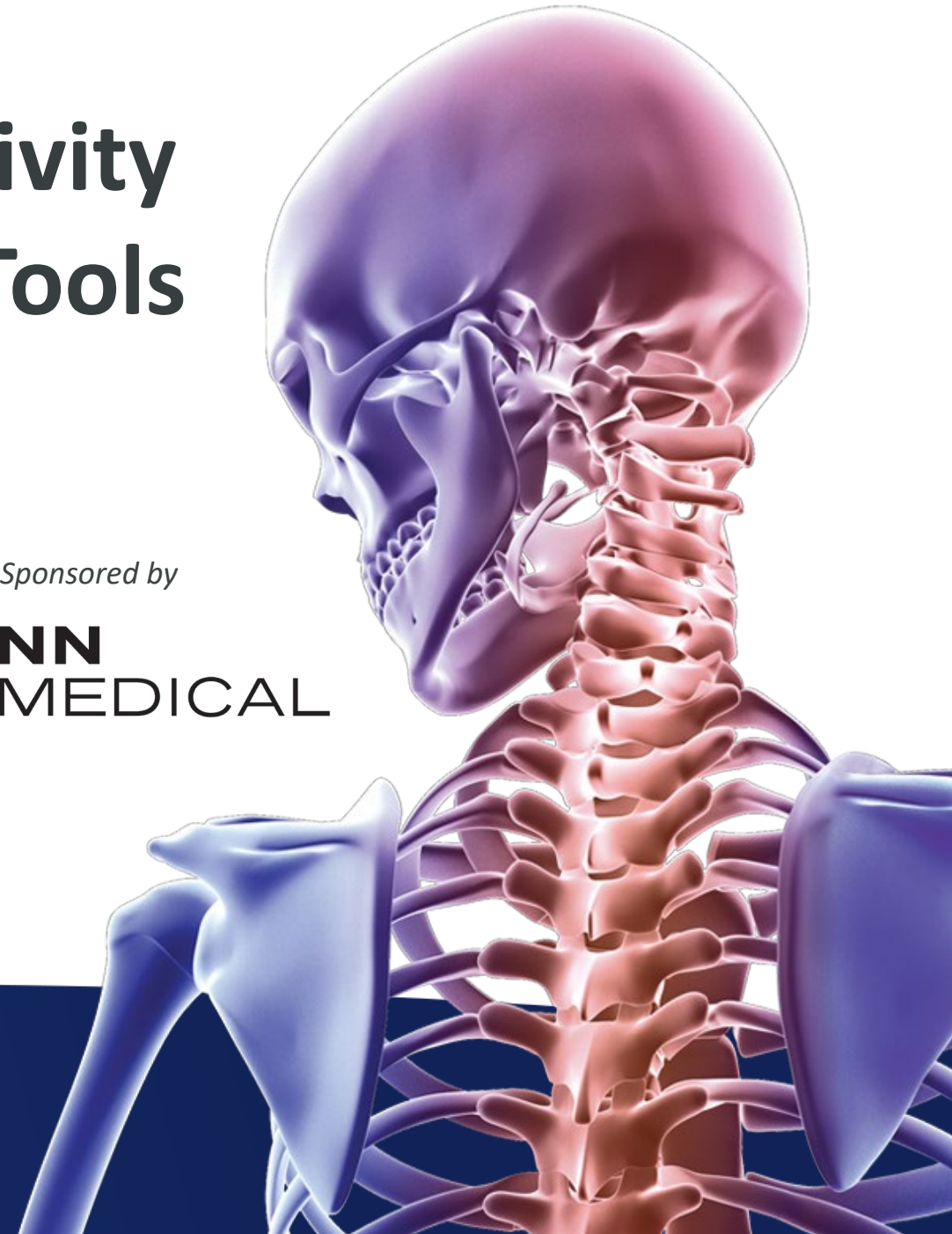
Boost Engineering Productivity With This Ultimate List of Tools

Tony Kelbert, goodthink labs

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NN
MEDICAL



Intro and Background



Augmentation Project - Retractable Claws



Client Profile



Vision



Budget

Design Parameters: Mr. Marten's Claws

- Rapid deployment
 - 0.2 s extension (dramatic reveal)
 - 2.0 s retraction (also dramatic)
- Implant performance
 - Single hand only (budgetary reasons)
 - Reduced functionality of left hand permissible
- Packaging
 - Must be invisible until deployed

Materials Specs and Availability

- Tools for proving to a client that adamantium isn't real

MatWeb

TIMET TIMETAL® 6-4 ELI Titanium Alloy (Ti-6Al-4V ELI; ASTM Grade 23) (Annealed; 2.50 - 4.00 in Rod or Thickness; Per ASTM F136)

Categories: [Metal](#); [Nonferrous Metal](#); [Titanium Alloy](#); [Alpha/Beta Titanium Alloy](#)

Material Notes: Medium To High Strength General-Purpose Alloy. Minimum tensile property data below are specific to this MatWeb entry; other specific form/thickness entries are also available in MatWeb.

Features: A lower strength version of TIMETAL 6-4 with improved toughness, cryogenic ductility, and SCC resistance. Major uses are in the medical implant field, marine structural components, and oil and gas production. This variant is available for fracture critical applications. This alloy is available in most common product forms including billet, bar, wire, plate, and sheet.


Data provided by TIMET.

Key Words: Titanium 6-4 ELI; UNS R56401

Vendors: No vendors are listed for this material. Please [click here](#) if you are a supplier and would like information on how to add your listing to this material.


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[Export data to your CAD/FEA program](#)

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Physical Properties	Metric	English	Comments
Density	4.42 g/cc	0.160 lb/in³	Typical
Mechanical Properties	Metric	English	Comments
Tensile Strength, Ultimate	>= 825 MPa	>= 120000 psi	L, LT and ST Directions
Tensile Strength, Yield	>= 760 MPa @Strain 0.2 %	>= 110000 psi @Strain 0.2 %	L, LT and ST Directions
Elongation at Break	>= 8.0 %	>= 8.0 %	L, LT and ST Directions
Reduction of Area	>= 15 %	>= 15 %	0.2% YS; L, LT and ST Directions
Modulus of Elasticity 	95.0 - 111 GPa @Temperature 230 °C	13800 - 16100 ksi @Temperature 446 °F	varies with heat treatment and texture
	107 - 122 GPa @Temperature 20.0 °C	15500 - 17700 ksi @Temperature 68.0 °F	varies with heat treatment and texture
Poissons Ratio	0.31	0.31	
Shear Modulus	41.0 - 45.0 GPa	5950 - 6530 ksi	
Bend Radius, Minimum	5.0 t @Thickness 2.00 mm	5.0 t @Thickness 0.0787 in	Typical; sheet

Online Metals

OnlineMetals.com

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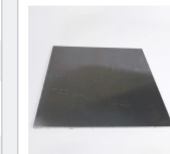
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- MATERIAL** 
- ☒ Titanium
- SHAPE** 
- ☒ Sheet/Plate
- ALLOY/TYPE** 
- ☒ 6AL-4V Grade 5
- UNIT OF MEASURE** 

0.125" Titanium Sheet 6AL 4V Grade 5 - Part #: mp-00003661



QTY
1

\$956.66 ea.
\$956.66 for 1

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Dimensions

Thickness: 0.125"

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Sold and shipped
by Slice of Stainless

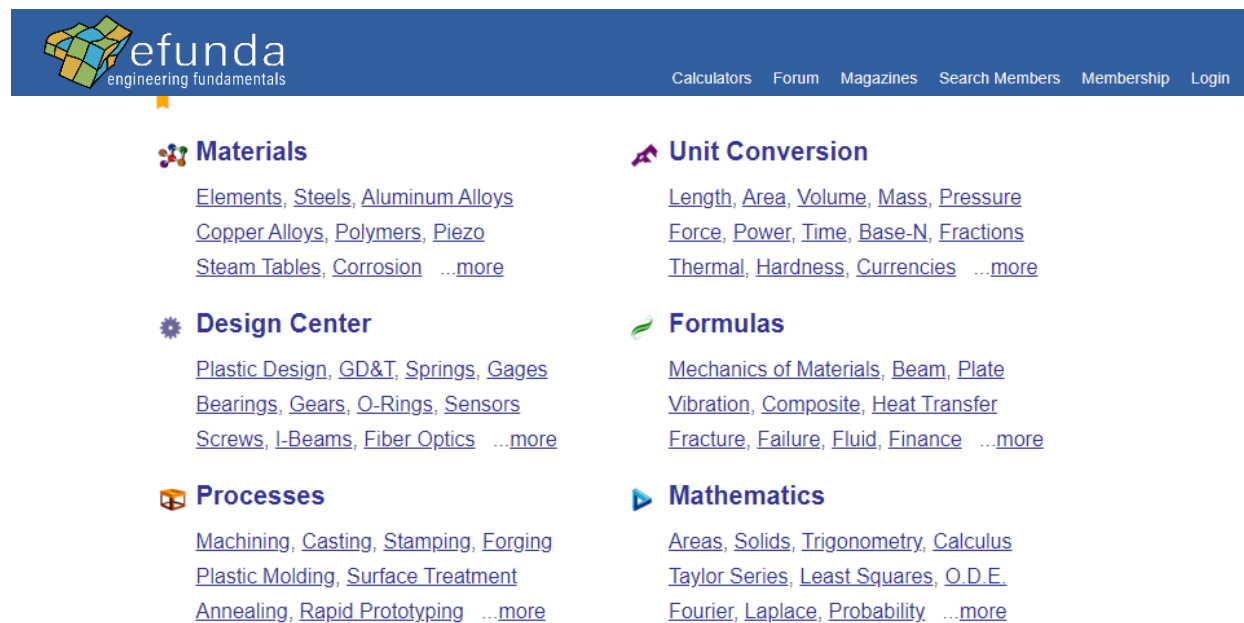
Engineering Fundamentals

- Tools for leveraging best practices and getting back to basics

Theoretical Machinist



efunda



Off-the-shelf Component Information

- Tools for specifying the right widget and getting it into CAD

McMaster-Carr

Automation Direct

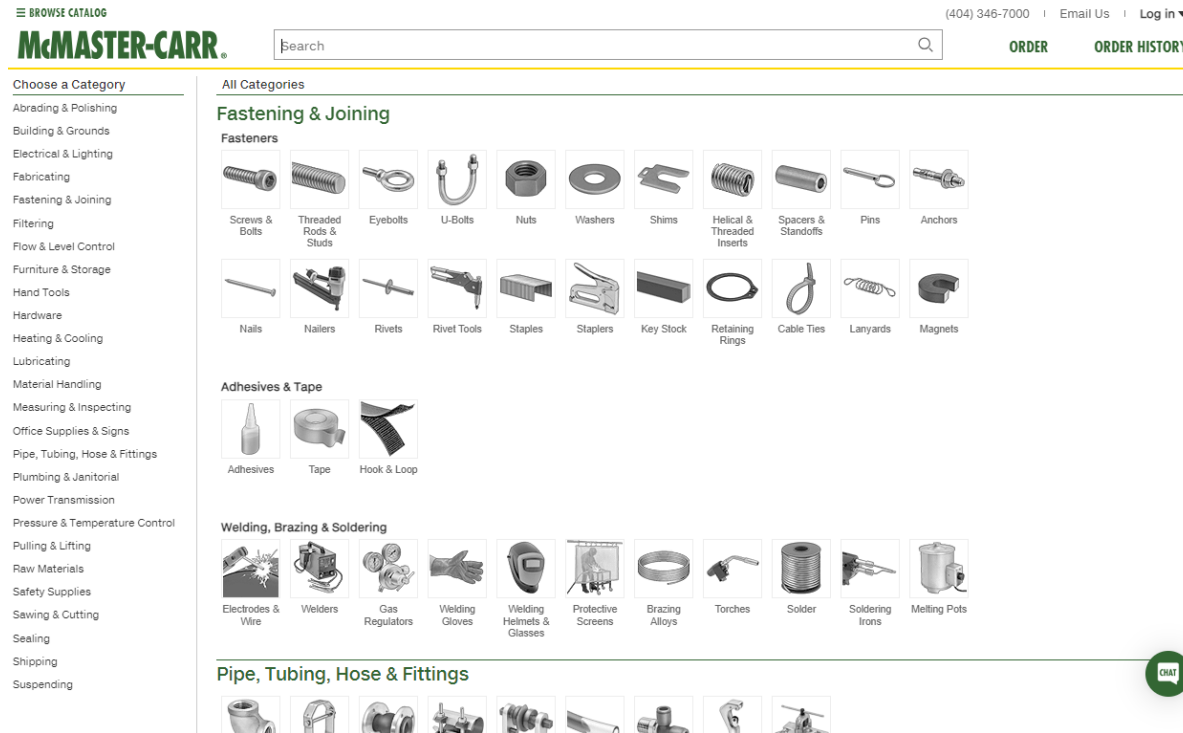
Quotebeam

Grainger

Zoro

Traceparts

Misumi



Design and Analysis

- Tools for showing a client why a retractable claw implant might be a bad idea

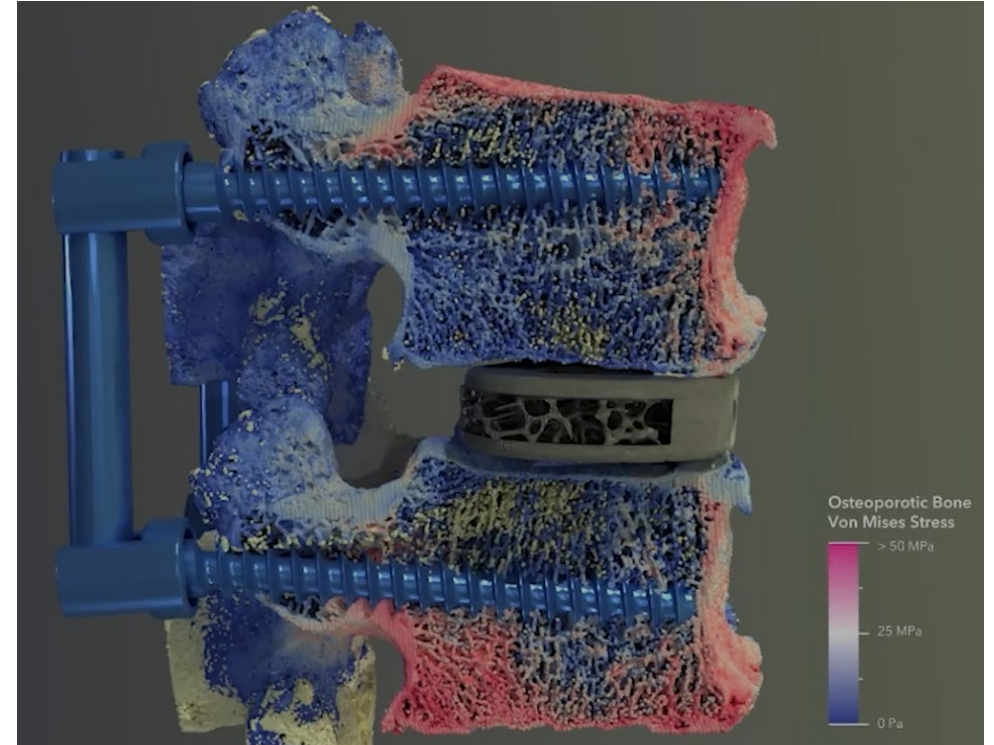
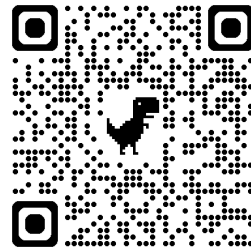
CAD

(CATIA, Solidworks, Siemens NX, AutoCAD, Alibre, OnShape, Inventor, Creo, Rhino, Fusion360, etc.)

Simulation

FEA: CAD native software, ANSYS, Femap,

Particle Based Simulation: Alfonso



Workflow Management and Documentation

- Tools to facilitate full-rate production, just in case this works out

PDM

(Teamcenter, ENOVIA, Smarteam,
Windchill, SAP PLM, 3DEXperience Works)

Documentation and Project Management

Sigma, Quarter20, Git, Jira, Project, Trello

Everything Else



Small Groups

We've got the retractable claw concept for the device. Now...

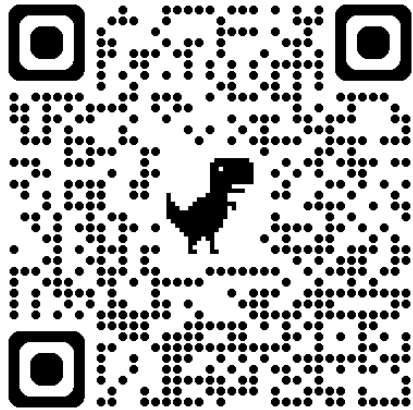
How do you implant it?

- Sketch a strategy
- Generate the list of tools you'd use
- Changes to the implant are ok if needed

You've got 10 minutes!

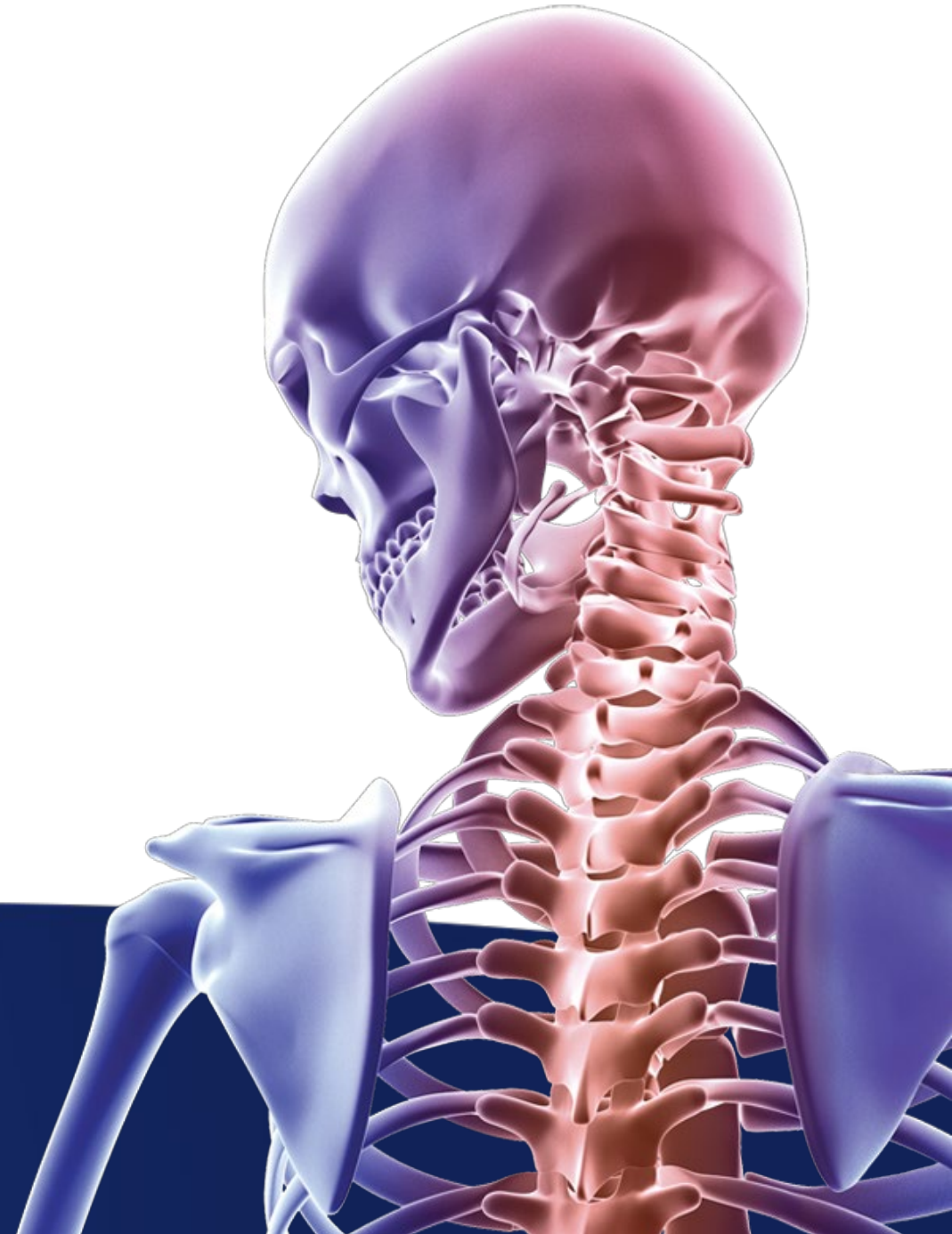
Thank You

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← get updates on the final design!

 MTEC[®]



THANK YOU

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