2023 BEST MEDICINE Engineering Fair
Health/Medicine PROJECT IDEAS

Grade	Category	Project	Comments
All Ages	Polymer Medicine	Improve the design of nasal gastric tubes. (Tubes that go in the nose.)	Sample Project: Nasal Gastric tubes require repetitive flushing/cleaning; can this be done automatically?
All Ages	Biomaterials	Imitate the structure of a pufferfish to develop a system for delivering medicine to a wound. (Consider adding features to a balloon that cause spikes to open and deliver medicine.)	This would be a real breakthrough! If a doctor could place a balloon in a wound and then have medicine flow through small spikes into the patient's wound, this may cause wounds to heal faster!
All Ages	Health Medicineor Clinical Trials	Develop an automatic pill dispenser.	Sample Project: Patients with high blood pressure and heart failure take many pills. Can this be simplified?
All Ages	Cardiovascular or Modeling/ Simulation	Design a model to simulate how the diameter of a blood vessel is related to the flow rate, in order toexamine the various aspects of atherosclerosis.	Hint: Bernoulli's Principle applies!
All Ages	Clinical Trials	Compare and contrast the effects of temperature and humidity on heart rate during exercise.	Are some conditions better to exercise in than others?
All Ages	Clinical Trials	Will frequent texting affect the fingers?	In the U.K. more than 1 billion text messages are sent every week.
All Ages	Clinical Trials	Research the onset of diabetes in second generation immigrants	Are the children of immigrants more susceptible to diabetes?

All Ages	Clinical Trials	Develop an easier way of replacing the wire in braces	Going to the orthodontist isn't any fun.
All Ages	Clinical Trials	Design a new method of putting restraining rubberbands on braces	Could a new tool be developed to make this process easier?
All Ages	Health Medicine or Biomaterials or Modeling/ Simulation	Develop an experiment to test via human circulation cycles, if your body temperature can tell the time ofday.	Helpful Link: http://www.sciencebuddies.org/science-fair-projects/project_ideas/HumBio_p020.shtml
All Ages	Health Medicine or Biomaterials or Polymer Medicine	Develop a study to compare dental cements.	Hint: Compare materials that cure via catalyst and light!
All Ages	Health Medicineor Modeling/ Simulation or Biomaterials or	Develop a study to investigate the role of herbal products, clove oil, turmeric and neem extract on theprevention of periodontal disease.	Helpful Link: http://www.usc.edu/CSSF/History/2006/Projects/J1327.pdf
All Ages	Health Medicineor Modeling/ Simulation or Biomaterials	Develop a study to compare the antioxidant effects of natural and synthetic preservatives.	Helpful Link: http://www.virtualsciencefair.org/2010/songxa2
All Ages	Health/Medicine	A sticky backed roll of exam table paper that won'tslip around when a patient sits on the table.	It still needs to come off cleanly and quickly!

All Ages	Health/Medicine	Create a device that sterilizes teeth.	Could possibly utilize drug release technology or UV light sterilization
All Ages	Health/Medicine	Create a system for warming saline bottles for use during abdominal surgery.	Be sure to not overheat the saline!
All Ages	Health/Medicineor Medical IT	Design an electronic menu for ordering food inhospitals.	Sample Project: Create a menu that knows a patient's history, and only displays meal options that are appropriate when patients require strict dietary control.
All Ages	Health/Medicine or Biomaterials or Sensors/Imaging	Assess the merits of various gel-like materials for use with ultrasound or EKG probes.	Does honey work as well, or are there other gels freely available in Third World countries that could work equallywell?
All Ages	Health/Medicineor Clinical Trials	Research the effects of ginger on digestion.	Natural remedies are always better!
All Ages	Health/Medicineor Clinical Trials	Research the effects of turmeric as an antibiotic.	Many cultures use turmeric to clean their meat and fish
All Ages	Health/Medicineor Clinical Trials	Design a new method to help people stop snoring.	Sample Project: Create a mouth guard that reduces snoring.
All Ages	Health/Medicineor Clinical Trials	Develop an experiment to test whether the major supplements available at health and nutrition stores actually increase muscle enhancement.	Hint: Recruit the football team, and work with a nutritionistto monitor protein intake!

All Ages	Health/Medicineor Clinical Trials	Develop a study to compare generic to name brand medications.	Think about the different aspects of medication- size, components, dissolve time- that need to be tested.
All Ages	Health/Medicineor Clinical Trials	Develop a new and improved method to help smokers quit.	There are many programs out there, and they don't all work --- think outside the box.
All Ages	Health/Medicine or Clinical Trials or Wound Healing or Sensors/Imaging	Design a shoe that senses when "too much" pressure falls on a particular part of the foot (anything over 60mmHg).	Hint: Think of both the plantar and dorsal surfaces of the foot!
All Ages	Medical IT or Clinical Trials	Design a program or system that can unobtrusively study dementia patients.	People act differently when they know they are beingwatched
All Ages	Microgravity	Create an exercise device to combat muscle atrophy for hospital patients or astronauts.	After returning from a 211-day mission in 1982 a team of Soviet cosmonauts were unable to walk and had to go through extensive physical therapy to regain their strength
All Ages	Microgravity Medical Devices	Design face masks to protect astronauts from breathing fine lunar dust. Note that lunar soil has very fine particles.	This problem is similar to that faced by many miners. Read up about lung silicosis!
All Ages	Microgravity Medical Devices	Develop a game for astronauts to relieve stress during long-duration space missions.	The game should not have pieces that can get lost in a microgravity environment.

All ages	Modeling/ Simulation or Health/Medicin e	Design an experiment to test how the digestion of protein differs at various pH levels. Please do not use corrosive pH levels in your study.	Hint: Experiments with agar gel can be used!
All Ages	Modelling/Simula tion/Medical IT	Design a game (could be a board game or a computer game) that is fun and playable for both sighted and blind people.	The game should bring sighted and blind people together.
All Ages	Musculoskeletal	Create a simple way for fastening a back brace onto a person with a fractured spine.	If the person has to fasten the brace by themselves their backs cannot be stressed.
All Ages	Orthopedics	Create a device that reduces the stress on a drummer's wrist when he or she drums.	Drummers can get Carpal Tunnel Syndrome at a young age asa result of the stress on their wrist when drumming.
All Ages	Orthopedics	Make a parachute deployment system that causesless stress on the body	Make it possible for elderly people to sky dive!
All Ages	Orthopedics or Biomaterials or Modeling/ Simulation	Develop a model to simulate bone degeneration.	Hint: Hard setting foam is a helpful material!
All ages	Orthopedics or Biomaterials or Modeling/ Simulation	Develop a mechanical model of the knee.	Sample Project: Examine how different weight bearing situations affect the risk of injury. Consider making a model of a knee using elastic bands and wood.
All Ages	Orthopedics or Biomaterials or Polymer Medicine	Design an experiment to test different materials, and determine which has the properties most similar to bone.	Hint: Bending, breaking strength etc.!

All Ages	Health Medicineor Modeling/ Simulation	Develop a study to determine if drinking water from a bottle by mouth, or straw will contaminate the remaining water more with bacteria from the mouth.	Helpful Link: http://www.usc.edu/CSSF/History/2005/Projects/J1302.pdf
All Ages	Orthopedics or Modeling/ Simulation or Health/Medicine	Design an office chair that can help reduce back/neck pain.	Find out how our spine should ideally be, and why people experience back/neck pain. Then focus on a design that will not put tension on the back or neck
All Ages	Rehabilitation	A way to splint a fractured arm/leg when they have a laceration which also needs care.	Think multiple pieced splints and/or inflatable splints.
All Ages	Rehabilitation	Design a household feature that allows for easier wheelchair access. Sample Projects: Adjustable counter heights, washers and dryers with relocated controls, redesigned refrigerator with automated	In 2011, Harison Bhanoo, a 6th grade student from Notre Dame Elementary School designed an "E-Z shelf". This allowed wheelchair users to widen a corridor in their houseby raising a shelf using pulleys and cables.
All Ages	Rehabilitation	Develop a portable device that can be used to provide wheelchair access to different buildings.	Study how wheelchairs currently access buildings
All Ages	Rehabilitation or Clinical Trials	Design a game to be used for speech therapy.	This could help children with speech impediments open up to therapists.
All Ages	Rehabilitation or Clinical Trials	Develop customized musical instrument supports for patients in wheelchairs.	Create a mount that could work for a various array ofinstruments.

All Ages	Rehabilitation or Clinical Trials	Design a device for turning pages to help patients with disabilities read.	The challenge will be the devices ability to only flip a page at a time.
All Ages	Rehabilitation or Clinical Trials or Health Medicine	Develop a study that uses an AmmSensor to monitor movement during sports/physical therapy.	Helpful Link: http://www.ammsensor.com/
All Ages	Rehabilitation or Medical IT	Create and build a voice-controlled household appliance.	This would be helpful for disabled people.
All Ages	Rehabilitation or Orthopedic	Design a device that enables dressing without hands, for patients with upper-limb amputations.	Don't choose something too easy (like using elastic bands for shoe laces). Try to think of examples that would be a challenge – as an example, how would you connect a zipper on a ski jacket if you only had one hand?
All Ages	Rehabilitation or Orthopedic	Redesign daily household items for patients with arthritis.	Sample Projects: Gear shifters, hairbrushes, gas pump handles etc.
All Ages	Rehabilitation or Orthopedic	Design weight training equipment for patients withamputations.	Hint: Pick a specific type of amputation, and focus on a design for that specific condition!
All Ages	Rehabilitation or Orthopedic	Modify the design of crutches for increased comfort.Sample Project: Does weight bearing always need to occur at the axillary (underarm) region?	Study where the most weight is placed
All Ages	Rehabilitation or Sensors/Imaging or Health Medicine	Develop a device that allows quadriplegic patients to take pills without assistance.	Hint: Movements originating from the neck upwards can be used!

All Ages	Rehabilitation or Sensors/Imaging or Medical IT	Design a GPS device that can be used by patients with limited or no vision.	Helpful Links: Android App Inventor: http://appinventor.googlelabs.com/about/
All Ages	Rehabilitation or Wound Healing or Biomaterials	Design a casting method for the creation of boots for patients with diabetes.	Hint: Try total contact casting! Helpful Link: http://www.youtube.com/watch?v=a4LJldGHbbA
All Ages	Sensors	Design earplugs that block out harmful noises but still allow a person to hear someone talking	This could be a form of active ear protection that only cancels out noises above a certine decibel level
All Ages	Sensors/Imaging or Biomaterials	Design clothing that monitors/responds to bodytemperature.	Sample Project: Design clothing that regulates changes in body temperature, to prevent hypo/hyperthermia.
All Ages	Sensors/Imaging or Health Medicine	Design a device that detects sleep apnea, or an alarm to prevent sudden infant death syndrome (SIDS).	Some people don't even realize they have sleep apnea until their partner notices.
All Ages	Sensors/Imaging or Wound Healing	Design a monitoring system that measures how long patients remain in one position while sleeping, to prevent the occurrence of bed sores.	This would be a great electronics project with the Arduino software. You can check out a related project at http://michaelabrahamsen.com/09/2010/semester-project/
All Ages	Value-Driven Engineering	Create a low-cost post-surgery knee brace for ACL repair patients	The current knee braces to ACL patients are very expensive.
All Ages	Value-Driven Engineering	Create a low-cost way of making dental retainers.	How many kids do you know that threw their retainer awayon a school lunch tray?

All Ages	Value-Driven Engineering	Design a chair that is easier for elderly people to get out of that does not involve electric motors	Think mechanical levers.
All Ages	Wound healing	Design a suturing system based on the way a grapevine tendril wraps itself around a fence wire.	A faster method of suturing would effect every surgery performed.
All Ages	Cardiovascular	Create a design for anchoring a medical stent in place	Medical stents are devices that enlarge and hold open natural passageways that have been occluded. Stents are held open by the pressure of expanding in the passageway but often times they can migrate towards the stomach or
All Ages	Sensors/Imaging	Identify a detection method that will allow for earlydiagnosis of Inflammatory Bowel Disease	Chronic inflammation is a hallmark of the majority of diseases affecting humanity today. Look at the following factors: environment, genome, immune response, and microbiome
All Ages	Medical Device	Develop a medical device delivery system for use in field conditions in rural Africa	Keep in mind it has to be ultra-low-cost, sterile, and for single-use
All Ages	Cardiovascular	Design an early warning system for when a central venous catheter has become contaminated	Central venous catheters are long, thin, flexible tubes that are used to administer medications or fluids to hospital patients who are receiving them frequently
All Ages	Health/Medicine	Research how a genetic mutation can be associated with how a person's body processes, and responds to, a certain drug.	Hint: Explore an online drug and genetics database
All Ages	Medical Device	Create an internal medication pump for anti-muscle spasm drugs in children with cerebral palsy	

All Ages	Wound Healing	Test different adhesives and brands of band-aids to determine which surface provides the best absorbance	
All Ages	Health/Medicine	Test the effectiveness of antibacterial substances on E. Coli	
All Ages	Biomaterials	Developing a pill coating that can withstand the churning actions and acidic environment found in the stomach	test the coating durability by using a clear soda to simulate stomach acid.
All Ages	Rehabilitation	Develop your own biomedical device to aid in the recovery of a strained bicep	Keep in mind the importance of rest to muscle recovery and that muscles work together. Also, research information on the muscular system and how the body works.
All Ages	Medical Device	Develop a way to administer insulin that would workonly when the body needs it, and deliver the preciseamount of insulin	Look at the ways insulin is delivered now and think of devices that could be used in the body
All Ages	Health/Medicine	Find ways for people to make long-term habit changes in lifestyle.	
All Ages	Sensors/Imaging	Develop a test for detection of infection	

All Ages	Health/Medicine	Try testing different vitamins for antioxidant activity.How do vitamins A, B, C, and E compare? Do some vitamins have more antioxidant activity than others?	Antioxidants work by preventing oxidation reactions that produce free-radicals which can cause harm to the body
All Ages	Health/Medicine	Cyclosporin A: How does it affect immune cells?	
All Ages	Health/Medicine	Are cockroach allergens a risk for pediatric asthma?	
Grades 11-12	Biomaterials	Design a band-aid that does not stick to latex gloves	What adhesives don't stick to latex?
Grades 11-12	Cardiovascular or Sensors/Imaging	Study and identify different techniques that could be used to recharge a pacemaker, to reduce invasiveness.	Think about how pendulum watches work.
Grades 11-12	Health Medicine	Design an operating room that has no equipment that rests on the floor.	Keep in mind surgeons will need to move about the room freely and unrestricted.
Grades 11-12	Health/Medicin eor Medical IT	Create an app for a smart phone that will monitor foran unborn baby's heartbeat.	The app could also alert doctors if the baby is in danger
Grades 11-12	Medical IT	Design a device that can detect when elderly patients fall while minimizing false-positives.	Use of gyroscopes/accelerometers would likely be necessary

Grades 11-12	Medical IT	Program vision-recognizing software to detect cataracts from images.	This will help those living in rural communities
Grades 11-12	Medical IT	A cordless (battery powered?) cauterizer for the operating room.	This would allow surgeons to move about the OR more freely.
Grades 11-12	Medical IT	Create a device that converts sign-language signaling into audio communications.	Hint: Wii remote can be used for finger tracking!
Grades 11-12	Medical IT	Make a device for the deaf and blind that takes speech and turns it into braille	This would allow for easier communication between the deaf and blind.
Grades 11-12	Medical IT or Clinical Trials	Assess risk of diabetes according to school menu lists.	Cafeteria food choices and adolescent obesity are currently a hot topic.
Grades 11-12	Medical IT or Health Medicine	Write a computer program that models patient waittimes in various clinical settings.	For example, in a physical therapy setting.
Grades 11-12	Medical IT or Microgravity Medical Devices	Write a MATLAB program to predict bone loss (orstrength loss) during space missions of varying durations.	Muscle atrophy is a huge problem for astronauts!
Grades 11-12	Medical IT or Microgravity Medical Devices or Health	Use Lego Mindstorm to monitor if a patient is taking his/her pills and send text/SMS to a hospital database which remotely monitors patient compliance.	Helpful Links: Android App Inventor: http://appinventor.googlelabs.com/about/ Android Bluetooth remote controller :

Grades 11-12	Medical IT or Sensors/Imaging or Rehabilitation	Design computerized vision for the blind.	Sample Project: Haptic feedback in walking stick that senses obstacles.
Grades 11-12	Orthopedics or Biomaterials	Design a new artificial ankle joint for patients witharthritis	Many problems exist with current technology such as an extremely complicated installation surgery.
Grades 11-12	Polymer Medicine or Biomaterials or Modeling/ Simulation	Assess effects of knots on suture strength and develop a model to predict failure point.	This could be used to determine the number of sutures needed.
Grades 11-12	Rehabilitation or Biomaterials or Wound Healing	Design a self-shifting seat cushion to prevent bed sores.	Bed sores are a huge problem in nursing homes.
Grades 11-12	Rehabilitation or Modeling/ Simulation	Design a device that simulates upper-limb amputation.	Sample Project: Use the device to model the current problems with today's prosthetics, or use your model to identify new problems with today's prosthetic solutions.
Grades 11-12	Sensors/Imaging	Design a device that notifies blind people when theperson standing in front of them in line has movedforward.	Note: This should be a sensor, tapping someone with a walking cane isn't an option. Hint: Infrared sensors and vibratory alert?
Grades 11-12	Sensors/Imaging or Rehabilitation	Explore the role of non-Newtonian fluids as a means of creating artificial knee joints.	Sample Project: Regular use of a prosthetic (walking) vs. tripping, where the stiffness of the knee has to be different.Hint: Consider use of Oobleck!

Grades 11-12	Sensors/Imaging or Rehabilitation	Design a go-kart that can be controlled by a joystick for children paralyzed below the waist.	They will also have to be buckled in securely.
Grades 11-12	Value-Driven Engineering	Create a low-cost cochlear implant.	Sometimes insurance companies won't cover the cost of a lost or damaged part.
Grades 11-12	Value-Driven Engineering	Create a low-cost negative pressure system for removing fluid from wounds.	Applying negative pressure to wounds has been shown to help the healing process.
Grades 9-12	Biomaterials	Create a material that blocks the radiation that isemitted from a cellular phone	Is the radiation emitted from a cell phone harmful to us?
Grades 9-12	Biomaterials	Contact lenses that offer UV protection	How do sunglasses achieve UV protection?
Grades 9-12	Clinical Trials	Design a method for minimizing scar tissue formation	There is a huge market for this in the healthcare industry!
Grades 9-12	Clinical Trials	Develop a system for removing food that's jammed in your esophagus.	A large number of people are brought to the ER because they are choking on something.
Grades 9-12	Clinical Trials or Health Medicine	Design a study to test the effectiveness of alternative methods for preventing motion sickness, without therisks and side-effects of current pharmaceutical options.	Motion sickness prevents some people from travelling on airplanes and going on cruises all together.

Grades 9-12	Health Medicineor Microgravity Medical Devices	Design a silent (or quieter) dentist drill.	Hint: High speed hardware drills like the Dremel can be used!
Grades 9-12	Health/Medicine	Create a low-cost way of veneering teeth.	Since veneering teeth is a cosmetic operation it is very expensive.
Grades 9-12	Health/Medicine	Add a feature to a stethoscope to make it a multifunctional tool.	Try to avoid the use of a power source
Grades 9-12	Health/Medicine	A stethoscope bell/speaker unit so you could take someone's blood pressure & still talk to them (no ear tubes).	Keep the design small!
Grades 9-12	Health/Medicine	Create a at home test for strep throat.	This could reduce the healthcare costs of testing for strep
Grades 9-12	Health/Medicine	Design a system for controlling blood loss in trauma cases.	Try to make the system as simple as possible.
Grades 9-12	Health/Medicine	Create an epinephrine key chain.	This would help people allergic to bees to always remember their epinephrine.
Grades 9-12	Health/Medicine	Create a wristwatch inhaler.	Losing an inhaler can be a nightmare during an asthma attack.

Grades 9-12	Health/Medicine	Create a system for collecting saline that flows out of an open abdominal cavity during surgery.	Think vacuums and funnels.
Grades 9-12	Health/Medicineor Medical IT	Create an app for a smart phone that would present the recommended dosages of/directions for over-the-counter medications.	Enter in type of medication, age, weight, gender, etc. to discover correct dosage
Grades 9-12	Health/Medicineor Clinical Trials	Research the difference between Liquid Gels vs. Tablets	Which dissolves quicker in pH similar to stomach acid?
Grades 9-12	Medical IT	Make a device that will dispense pills for elderly patients at the right time(s) of day.	This could benefit patients with dementia.
Grades 9-12	Medical IT	Create an app for a smart phone that would assess the health of pregnant mothers.	This app would greatly reduce maternity healthcare costs
Grades 9-12	Medical IT	An alarm for use in nursing homes which would go off if a resident fell out of their chair (pressure sensitive on the seat?).	This could be done with Arduino Technology
Grades 9-12	Medical IT	Some kind of camera/projector for the end of otoscopes so physicians could show patients what they're talking about.	They have to be light enough for the user to regularly handle.
Grades 9-12	Medical IT	Design an app that can help diabetics keep track of their sugar intake.	This would help diabetics control their sugar intake.

Grades 9-12	Medical IT	Create a computer model of one major organ or organ system.	This would be a valuable asset to teach about the workings of our bodies.
Grades 9-12	Medical IT or Modeling/ Simulation	Assess the benefits of using a computer modeling program such as AIDA v 4.3b to simulate diabetes.	Hint: Visit http://www.2aida.net/welcome/
Grades 9-12	Microgravity Medical Devices	Design a method for measuring an astronaut's mass in space	Does the human body have a constant density?
Grades 9-12	Microgravity Medical Devices	Design a system for measuring psychological stress in astronauts during long duration space missions.	Cabin fever is sure to set in on a mission to Mars.
Grades 9-12	Microgravity Medical Devices	Design a surgical instrument for use by astronauts.	On long journeys in outer space astronauts may need emergency surgery.
Grades 9-12	Microgravity Medical Devices or Sensors/Imaging	Design a method for measuring bone loss in astronauts during missions lasting more than 3 months.	A trip to Mars would take approximately 260 days.
Grades 9-12	Modeling/ Simulation or Orthopedic	Develop a model to simulate implant loosening.	Sample Project: Ball and socket joint of the hip.
Grades 9-12	Modeling/ Simulation or Wound Healing	Design an Android App for measuring wound size, based on photographs taken from a cell phone.	Helpful Link: Android App Inventor: http://appinventor.googlelabs.com/about/

Grades 9-12	Modeling/ Simulation or Wound Healing	Develop a study to test if cherries and cranberries can be used as an alternative treatment for inflammation.	Helpful Link: http://www.odec.ca/projects/2003/herna3j/public_html/
Grades 9-12	Modelling / Simulation /Medical IT	Design a device that translates numbers in text to numbers in Braille to help sighted teachers teach blind kids' math.	Being able to feel the numbers is a huge advantage to blind students (just like seeing the numbers is to you).
Grades 9-12	Orthopedic or Microgravity Medical Devices	Design a new exercise device to keep astronauts' legs healthy	What types of forces can be transmitted with no gravity?
Grades 9-12	Rehabilitation	Design a wheelchair that can maneuver up and down stairs.	Hint: Limit your design to 2-3 steps!
Grades 9-12	Rehabilitation	A head support system for post-retinal surgery patients	Background: They often treat retinal detachment by injectinga bubble of air into the globe of the eye, which if the head is looking down- exerts pressure on the retina and presses it back up against the posterior eye. But, to heal properly, these
Grades 9-12	Rehabilitation	Develop an improved method for transportingpatients from one bed to another.	This is a problem with obese patients.
Grades 9-12	Rehabilitation or Clinical Trials or Health Medicine	Design a wheelchair that can be controlled by quadriplegic patients.	Hint: Movements originating from the neck upwards can be used!
Grades 9-12	Rehabilitation or Health Medicine	Design a high-efficiency respirator that draws upon, and condenses oxygen in the air rather than using a tank.	The device could be equipped with a portable power supply.

Grades 9-12	Rehabilitation or Orthopedic	Develop a study to examine the effects of load-splitting on the lower back.	Sample Project: The effects of lifting two loads to the side, versus one heavier load to the front.
Grades 9-12	Rehabilitation or Orthopedic	Develop a method for sensing when a person stumbles and a prosthetic that will lock whenstumbling occurs.	Could multiple supports spring out of the prosthetic upon stumbling?
Grades 9-12	Rehabilitation orOrthopedic or Sensors/Imaging	Design a device to analyze strength (torque and motion) in the forearm for physical therapy.	This could be used to monitor the progress of physical therapy.
Grades 9-12	Rehabilitation or Wound Healing	Design a device for removing perspiration from a prosthetic limb.	Could the joint be cooled to prevent any perspiration at all?
Grades 9-12	Sensors/Imaging	Create binocular vision, using only one eye.	Sample Project: Explore the use of optics and lasers.
Grades 9-12	Sensors/Imaging	An alarm for an electrician to wear in case he ever got electrocuted	Time is important --- Don't test on humans
Grades 9-12	Sensors/Imaging	Develop a device for measuring punching force in boxing.	Could a force plate be in a punching bag or a glove?
Grades 9-12	Sensors/Imaging	Design a coffee mug that allows blind people to know when they have filled their coffee mug up enough, so they don’t overfill it.	This is not an easy task for blind people.

Grades 9-12	Sensors/Imaging or Biomaterials	Create an app for a smart phone that would record/monitor a person's vital signals (body temp, heart rate, etc.)	The app could also be used to directly notify a healthcare provider if signals reach dangerous levels
Grades 9-12	Sensors/Imaging or Cardiovascular	Design a device that can locate veins before the use of a needle.	Hint: Sensitive microphones can be used to "listen" to blood flow!
Grades 9-12	Sensors/Imaging or Cardiovascular	Design a device to measure glucose without needing to prick a finger.	Some patients pain threshold is very limited.
Grades 9-12	Sensors/Imaging or Cardiovascular or Clinical Trials or Health Medicine	Design clothing that can sense the acceleration of heart rates, sending an alert when the heart rate has exceeded a certain level. Hint: Use the range of 110-130 beats per minute and	This would be a great project to use Arduino software
Grades 9-12	Sensors/Imaging or Health Medicine	Develop a method for measuring grip force during sports.	Sample Projects: Baseball bat, golf club, tennis racket.
Grades 9-12	Sensors/Imaging or Health Medicine	Develop a method for measuring kicking force.	Hint: Use as a model for common football/soccer injuries!
Grades 9-12	Value-Driven Engineering	Create low-cost adjustable operating room table.	It must be easy to clean.
Grades 9-12	Value-Driven Engineering	Develop a low cost Ilizarov limb lengthening system for lengthening bones.	Helpful Links: http://www.ilizarovheightincrease.com/

Grades 9-12	Value-Driven Engineering	Create a cheap incubator for neonatal patients.	The current devices are extremely expensive.
Grades 9-12	Value-Driven Engineering	Make an inexpensive water filter forimpoverished populations	Access to clean water is a tremendous problem in underdeveloped countries.
Grades 9-12	Wound Healing or Health Medicine	Develop a study to test the effectiveness of alcohol based vs. non-alcohol based hand sanitizers.	Do different alcohols work better than others?
Grades 9-12	Sensors/Imaging	Come up with ideas for biomarkers of treatmentresponse in Retinal Neovascular Disease	Think of things that can be minimally invasive
Grades 9-12	Medical Device	Develop endoscopic methods/tools/ideas to more easily access the liver, gallbladder, and pancreas	Even though X---ray and contrast dye may be used for diagnostic purposes as well as to assist the physician in navigating the ducts, navigation in these small areas is quite difficult
Grades 9-12	Health/Medicine	Research the endocytic uptake of therapeutics	Look at how macrocycles and other large therapeutic molecules can effectively intercept and use the endocytosis process
Grades 9-12	Health/Medicine	Research ways to screen for Staphylococcus aureus in postoperative wound infections	
Grades 9-12	Biomaterials	Develop a way for a kidney to be bioengineered using stem cells	Hint: Use bioinformatics databases to determine the best protein environment for bioengineering a kidney.

Grades 9-12	Cardiovascular	Use everyday materials to design and develop devices and approaches to unclog blood vessels	you can use PVC pipe, play dough, and balloons
Grades 9-12	Medical Device	Design a method to reconnect two fluid bearing tissues without using sutures	Some surgeries, such as radical prostatectomy, require the surgeon to sever tissues in order to proceed with the repair operation.
Grades 9-12	Sensors/Imaging	Build a model that will predict the scale of fluid loss resulting from damage to a highly branched network of vessels	A small scale, highly branched network of tubes distributesfluid under pressure around a complex structure. The tubes vary in diameter and fluid pressure & flow rates vary across the network
Grades 9-12	Sensors/Imaging	Design an "early warning" sensor for blood vessels in the path of a medical probe	Hemorrhage (bleeding) is a serious complication for medical procedures and the best way to minimize the risk of hemorrhage is to avoid damaging blood vessels in the first place.
Grades 9-12	Medical Device	Design a surgically implanted micro-sensor device that can monitor healing in the tissue	Many injuries to a ligament or tendon require surgery to repair the damage. There are currently no clinically relevant methods to monitor the critical indicators of the healing process
Grades 9-12	Sensors/Imaging	Develop a way to reproducibly and easily measure central nervous system (CNS) development during the most important years of a child's life	describe behavioral and biological/physiological measurement techniques that could be administered in a pediatrician's clinic
Grades 9-12	Polymer Medicine or Biomaterials	Design a multifunctional surgical instrument that can cut tissue and remove thin slices using a pincer arrangement in a single instrument.	Could you combine two other features commonly used by surgeons?
Grades 9-12	Sensors/Imaging or Orthopedics or Modeling/ Simulation	Complete a computational reconstruction of knee function.	Hint: MRI and CT scans require the development of non-metallic testing frames that can be utilized to position the knee and induce muscle activity with the knee in the scanner. You can also develop frames for validation of these

Grades 9-12	Sensors/Imaging or Rehabilitation	Design a recharging device for hearing aids.	Typically, hearing aids take disposable batteries.
Grades 6-8	Biomaterials	A surgical cap with an absorptive or coolant headband for sweat	Design a new cap or a small insert that is compatible with existing caps
Grades 6-8	Cardiovascular	An arm positioner to hold your forearm in placeduring a blood draw	Possibly gear this project towards younger patients. Make sure the device is not scary!
Grades 6-8	Clinical Trials	Do women/men get sufficient vitamin D?	How much vitamin D does sunscreen inhibit?
Grades 6-8	Clinical Trials	Do left-handers struggle with the mechanisms in different household objects (can openers, sewing machines, blenders, scissors…)?	This could potentially open up a huge "left---hander friendly devices" market
Grades 6-8	Clinical Trials or Health Medicine	Conduct a study to find out which type of lighting is best for the eyes in an office.	Hint: Consider the effects of different monitors on the humaneye!
Grades 6-8	Clinical Trials or Health Medicineor Medical IT	Design a method of identifying patients, without the use of plastic bracelets.	Misidentifying patients is a tremendous concern in hospitals.
Grades 6-8	Clinical Trials or Health Medicineor Sensors/Imaging	Develop an experiment to identify which parts of thehand are most difficult to wash and design a device to help the problem areas.	Helpful Link: http://www.sciencebuddies.org/science-fair-projects/project_ideas/MicroBio_p018.shtml?from=Home

Grades 6-8	Health Medicine	Develop a study to test if cooking methods affect the nutritional content of food.	Sample Project: Does baking, frying, sautéing a potato alter the nutritional content of it?
Grades 6-8	Health Medicine or Biomaterials or Polymer Medicine	Develop a method for sterilizing a toothbrush before each use.	Helpful Link: http://www.usc.edu/CSSF/History/2005/Projects/J1333.pdf
Grades 6-8	Health Medicine or Cardiovascular	Design an experiment to test which foods produce brain freeze most often.	Helpful Link: http://www.usc.edu/CSSF/History/2005/Projects/J1409.pdf
Grades 6-8	Health/Medicine	See if the tint of sunglasses affects the ability of a person to see.	Could certain tints enhance clarity?
Grades 6-8	Health/Medicine	Do gummy vitamins provide as much vitamin absorption as the chewable type?	Which dissolves quicker in pH similar to stomach acid?
Grades 6-8	Health/Medicine	A device to remove foreign materials from the ear canal.	It shouldn't damage the ear though
Grades 6-8	Health/Medicine	Environmentally friendly tongue depressors	Any recyclable version of our many disposable plastics?
Grades 6-8	Health/Medicine	Test the nutritional value of vegetables grown under different spectrums or temperatures of light.	This could revolutionize the produce industry!
Grades 6-8	Microgravity Medical Devices	Design an astronaut glove that does not cause hand fatigue when used during extra-vehicular activities.	Research the HAL (Hydraulic Assisted Limb) technology.

Grades 6-8	Microgravity Medical Devices or Modeling/ Simulation	Compare performance in an underwater simulator to that in true microgravity.	The task could involve turning a wrench to tighten a bolt.
Grades 6-8	Modeling/ Simulation or Cardiovascular	Develop a model to simulate the failure of a balloon angioplasty.	Hint: You can use dried play dough to model calcified arterial wall!
Grades 6-8	Modeling/ Simulation or Cardiovascular	Simulate the calcification of heart valves using pasta.	Hint: A zone of uncooked pasta can be used to resemble a calcified heart valve!
Grades 6-8	Modeling/ Simulation or Orthopedic	Simulate different bone fractures using carrots.	Hint: Bending/twisting and compressing carrots cause different fracture patterns. Compare these to actual bonefractures.
Grades 6-8	Modeling/ Simulation or Wound Healing	Develop a study to test the effect of electrical simulation on normal human fibroblasts, which have an active role in wound healing.	Helpful Link: http://www.sciencellonline.com/
Grades 6-8	Modeling / Simulation	Develop an experiment to test how digestion is affected by different concentrations of glucose.	Please do not use corrosive pH levels.
Grades 6-8	Modeling / Simulation	Explore the role of evolution on the morphology ofan organism by playing multiple iterations of Spore.	Sample Project: Compare morphology based on aggressive or defensive behaviors; other strategies can be compared too. See: http://www.spore.com/
Grades 6-8	Musculoskeletal	Design a device that makes it easier for people with arthritis or carpal tunnel to use a pen/pencil	There have been some instances where patients cannot button the buttons on their shirts because of the loss ofmobility in their hands

Grades 6-8	Musculoskeletal	A device that helps people on crutches carry things like books or drinks	This would be helpful for student in high school and college with leg injuries.
Grades 6-8	Orthopedics	Research the pros and cons of running barefoot	Examine the biomechanical differences of runners with & without shoes
Grades 6-8	Polymer Medicine or Biomaterials	Research a sturdy material that can be used in prosthetics	Prosthetics must be sturdy enough for the wearer to regularly use, but light enough not to quickly fatigue them
Grades 6-8	Polymer Medicine or Biomaterials	Design an improved bottom for canes and walkers in order to prevent slipping on wet surfaces.	The bottom should not scratch nice hard wood floors.
Grades 6-8	Polymer Medicine or Biomaterials	Redesign an anesthesia mask.	Sample Project: Evaluate how children react to current masks, and redesign accordingly
Grades 6-8	Polymer Medicine or Health Medicine	Develop a study to evaluate the effectiveness of mosquito nets so as to better prevent insects from getting inside the net.	It must be possible to see through the net.
Grades 6-8	Rehabilitation or Clinical Trials or Health Medicine	Design a more comfortable backpack for joggers.	Sample Project: Think about ideal weight distribution to prevent injury from recurring use of the backpack.
Grades 6-8	Rehabilitation or Clinical Trials or Health Medicine	Design a backpack that is less stressful on a child's back.	Sample Project: Think about ideal weight distribution to prevent injury from recurring use of the backpack.

Grades 6-8	Value-Driven Engineering	Create low-cost adjustable height shoes for kids with limb length discrepancies.	Make it possible for them to play sports in the shoes!
Grades 6-8	Sensors/Imaging	Identify models or mechanisms for early detection of complications associated with diabetes	Diabetes can lead to serious medical conditions such as blindness, kidney malfunction, nerve damage, and vascular complications. Think of factors other than glycemic control
Grades 6-8	Health/Medicine	Investigate how well different ingredients in skin moisturizing products (i.e., lotions, creams, and ointments) work at keeping a model of human skin moist.	Hint: Use Jell-O to make a model of the skin
Grades 6-8	Modeling / Simulation	Determine the effectiveness of different antacids by creating artificial stomach acid	Heartburn pain usually results from stomach acids escaping from the stomach and irritating the esophagus above it. Hint: Think about the pH of stomach acid
Grades 6-8	Health/Medicine	Investigate how simethicone affects bubbles made from soap and water	Medical doctors look at bubble formation when they treat patients who have too much gas trapped in their digestive system, which can cause pain and *bloating* and also signal a serious medical problem
Grades 6-8	Health/Medicine	Test different acne medications and treatments todetermine their effectiveness at killing bacteria	
Grades 6-8	Health/Medicine	Research how drugs that may someday be used to treat deadly diseases are tested to make sure that they do not unintentionally damage our bodies.	

Grades 6-8	Modeling / Simulation	Construct a lung model and be able to answer the question, “What parts of the respiratory aids in breathing?”	Hint: Think about materials to use such as bags, rubber bands, tubing, and balloons
Grades 6-8	Health/Medicine	Demonstrate whether fans are effective means to cool body temperature	When that gust of wind is projected towards you, it's essentially projecting heated air. This experiment will explore whether fans are viable sources to cool our bodies on a hot summer day or whether their effectiveness is just
Grades 6-8	Modeling / Simulation	Create a home-made stethoscope	Keep in mind that sound waves can travel through enclosed spaces and become amplified
Grades 6-8	Cardiovascular	Investigate how blood clotting normally works, andhow it can be affected by an *anticoagulant*.	Look at diseases such as hemophilia where a person lacks certain clotting factors
Grades 6-8	Medical Device	Design and build prototypes for protective eyewear	Consider the important parts and functions of protective eyewear and how the eyes can be damaged
Grades 6-8	Modeling / Simulation	Create a model prosthetic lower leg using various materials	Keep in mind the functions the lower leg performs
Grades 6-8	Medical Device	Create your own ear trumpet devices (used before modern-day hearing aids), including testing them with a set of reproducible sounds.	Research the basic concept of a hearing-aid and how sound can be amplified
Grades 6-8	Sensors/Imaging	Develop a method of detecting pathogens within an airplane cabin environment	Surveying and maintaining the safety of air in crowded, public spaces is extremely important for public health.