

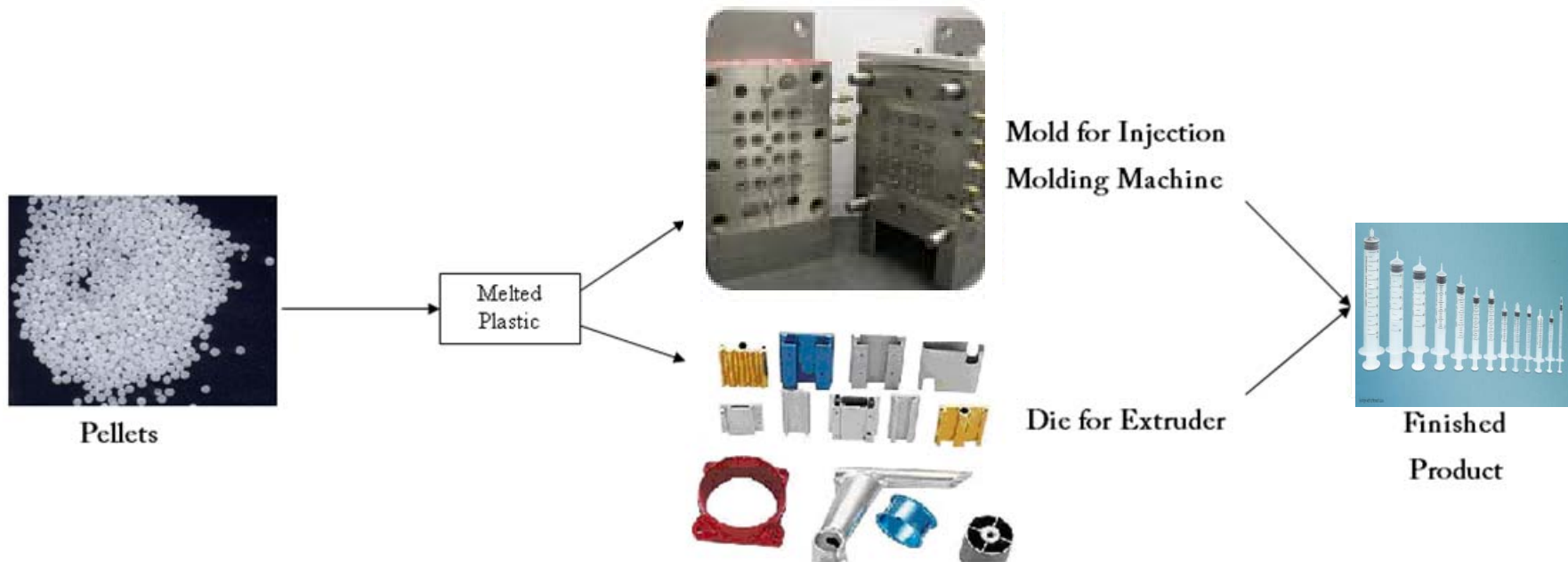
Medical Plastics

Processing Methods

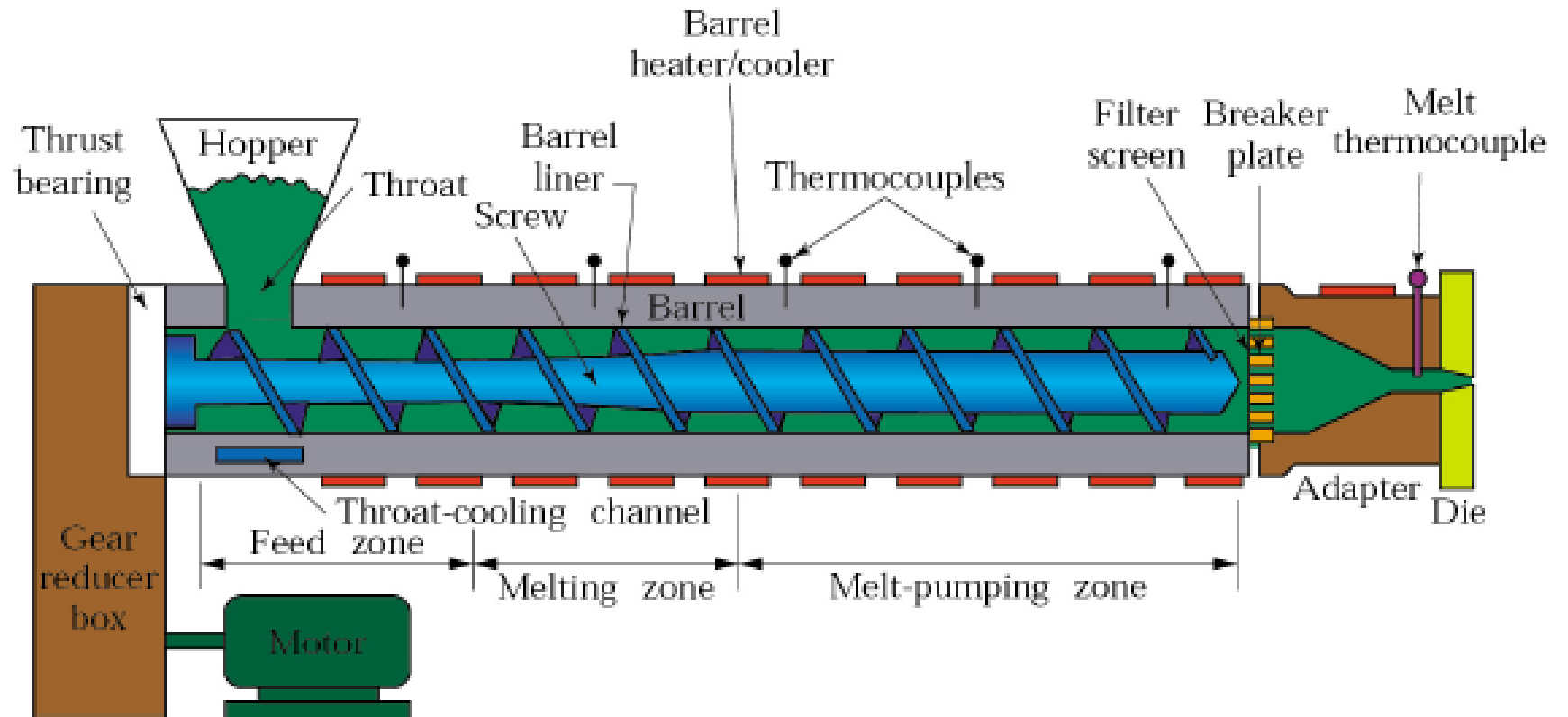
Processing Methods

- Extrusion
- Injection Molding
- Blown Film Extrusion
- Dipping
- Blow Molding
- Various other product specific methods

Extrusion/Injection Molding



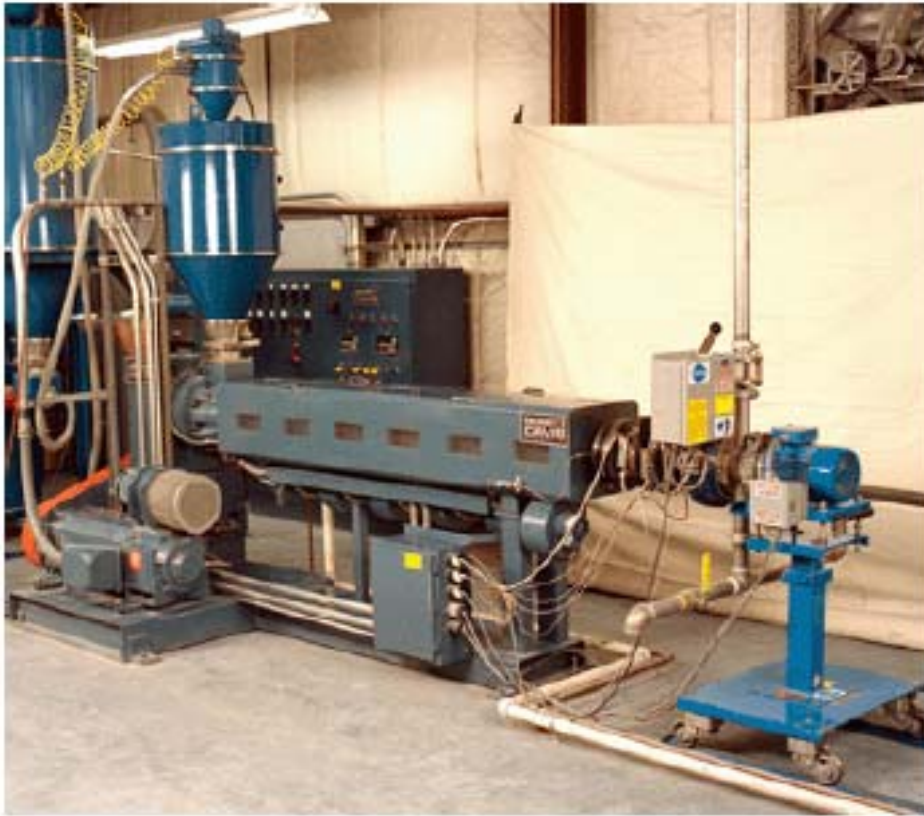
Extruder



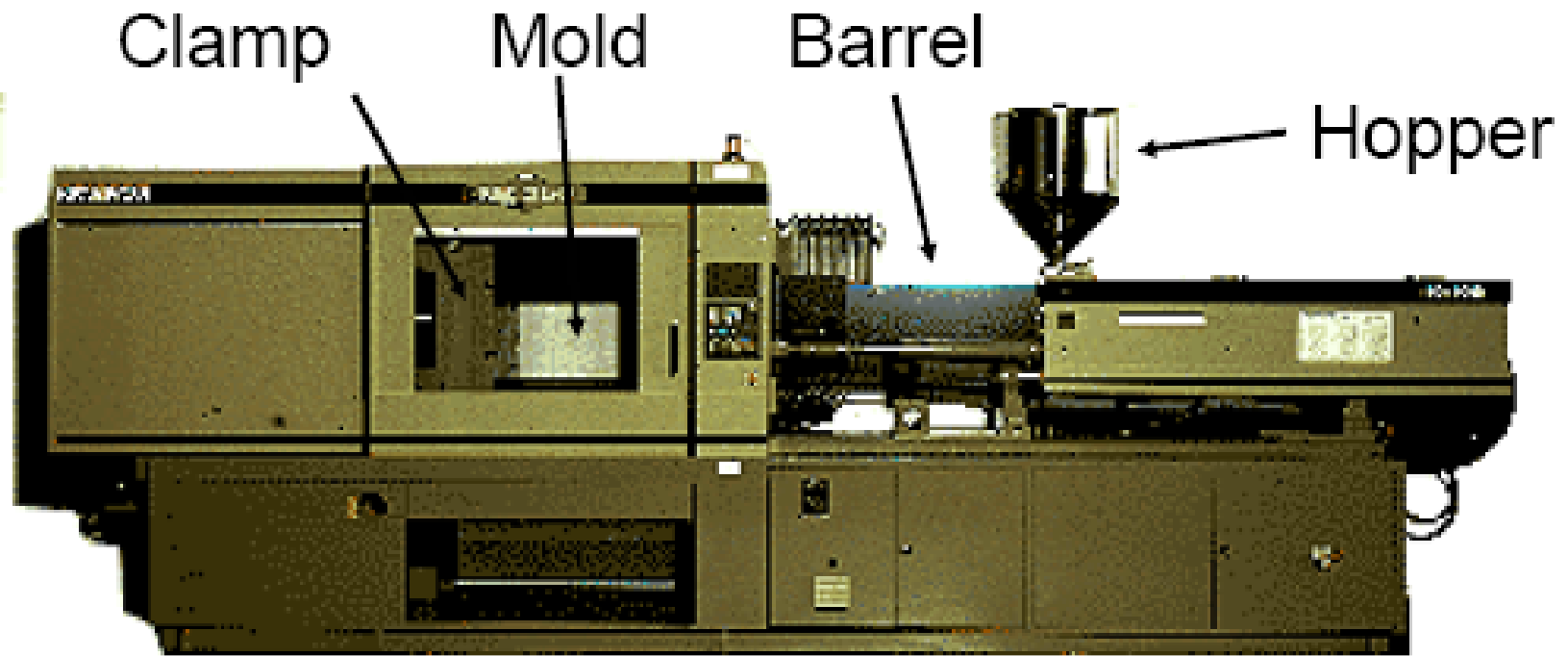
An industrial extrusion machine is shown in a factory setting. It features a large hopper at the top for material input, followed by a series of rollers and a long extrusion die. The machine is complex and metallic. The word "Extrusion" is overlaid in a stylized, 3D font across the center of the image.

Extrusion

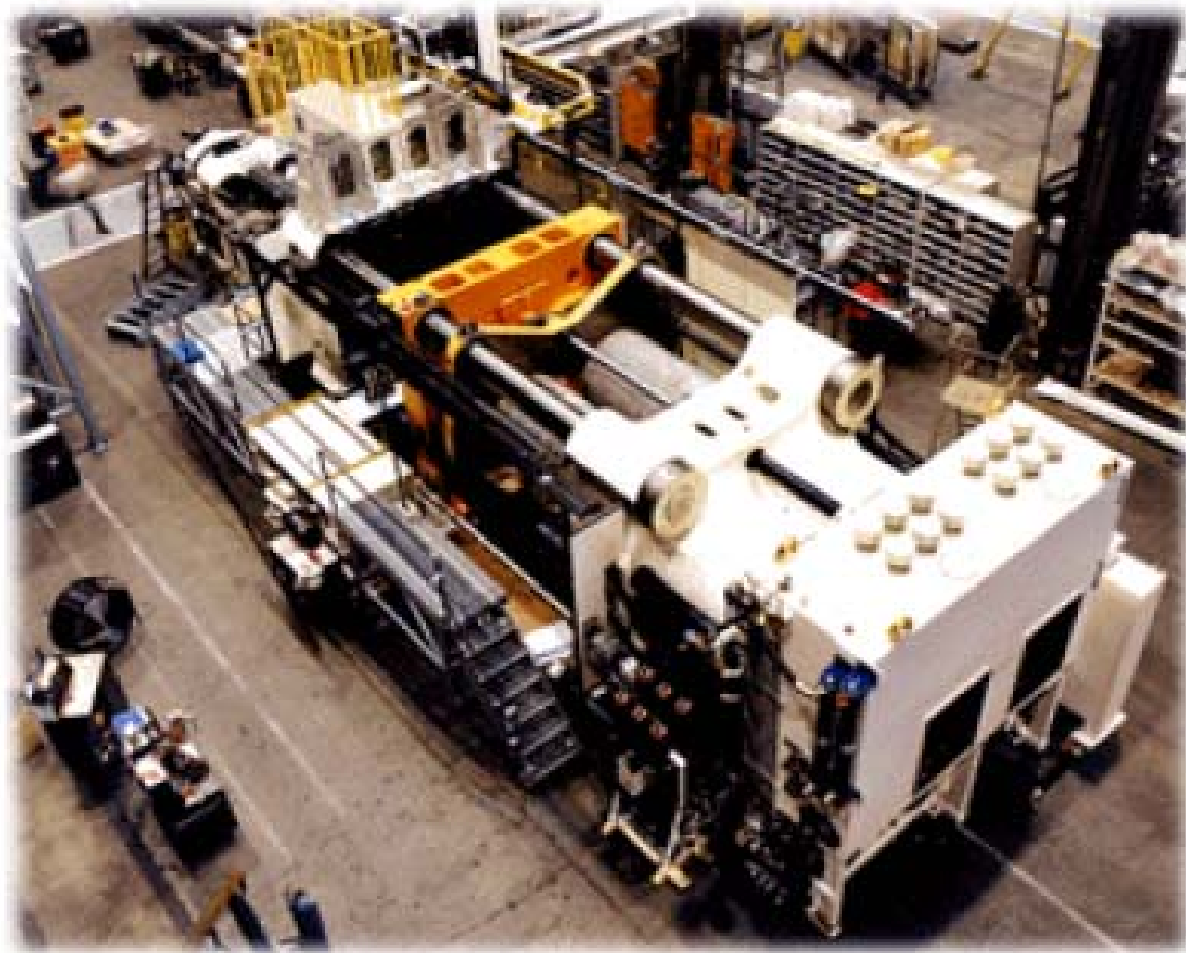
Extruder and Die



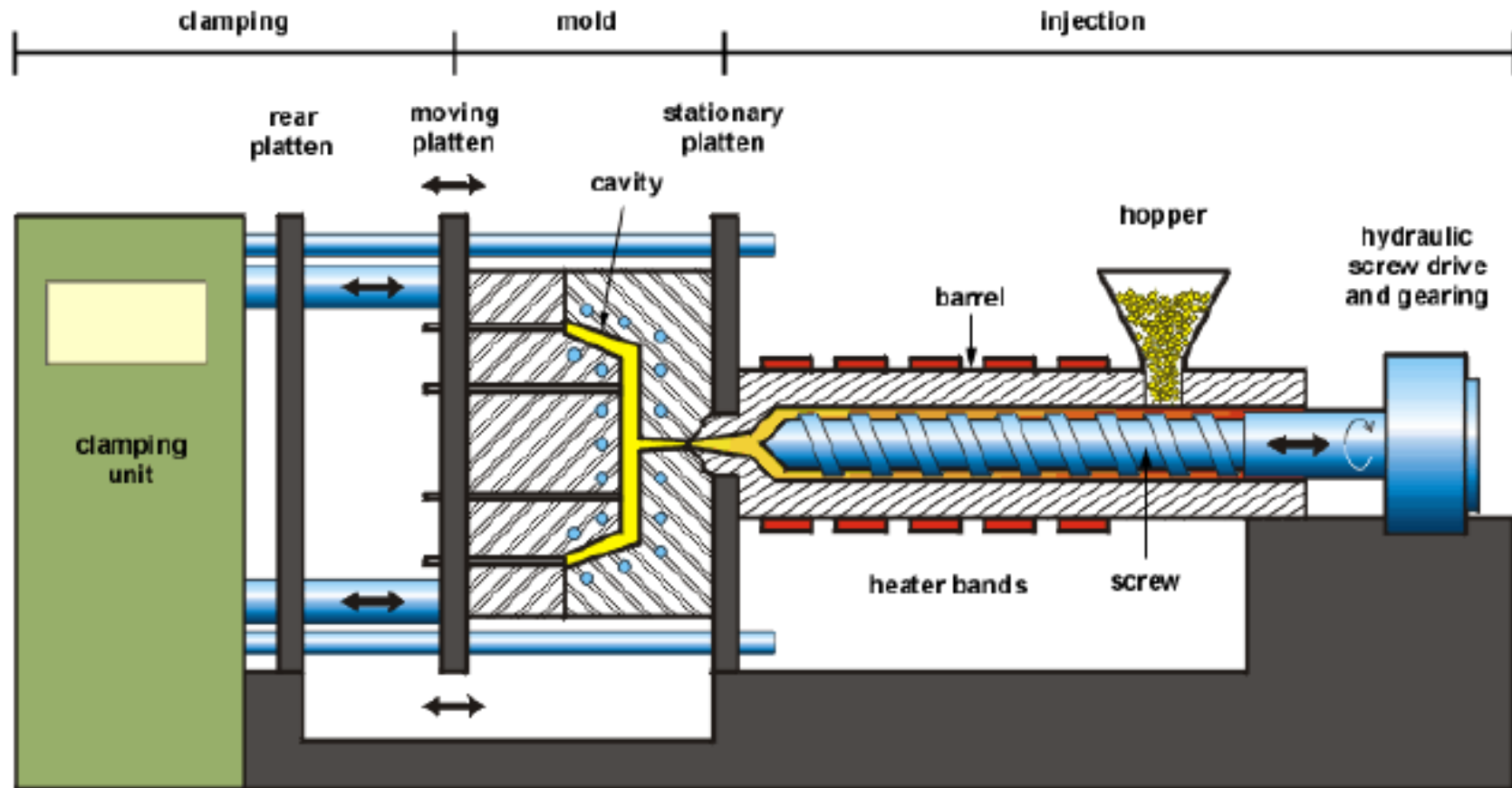
Injection Molding Machine



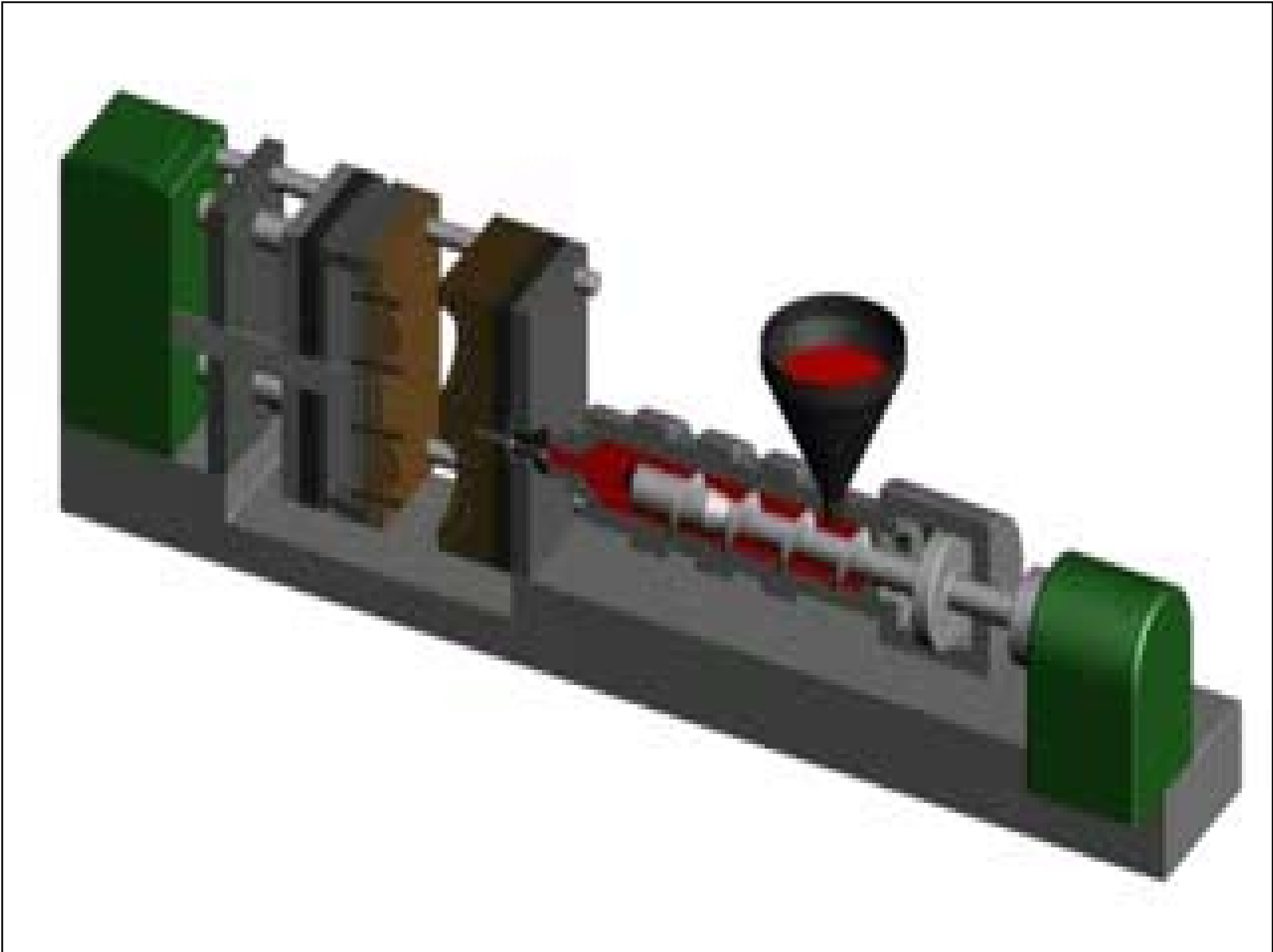
Injection Molding Machine



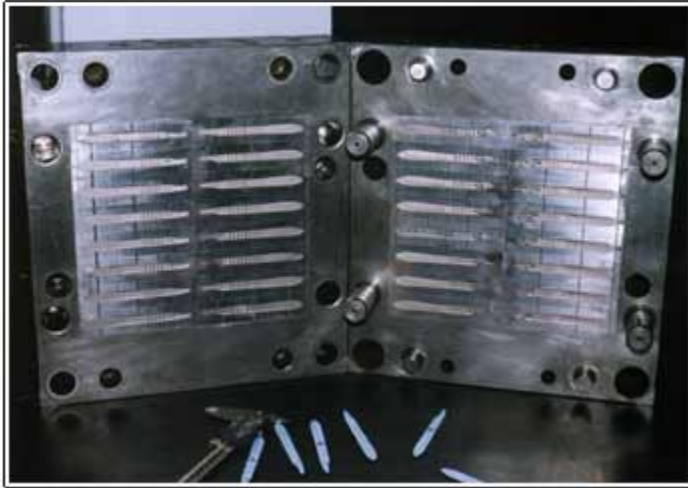
Injection Molding Machine Schematic



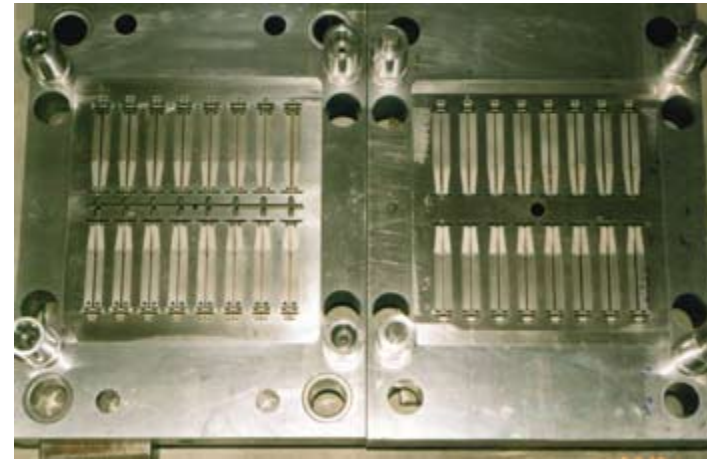
schematic of thermoplastic injection molding machine



Molds for Injection Molding



**16 Cavity Mold for Surgical
Blade Handles**



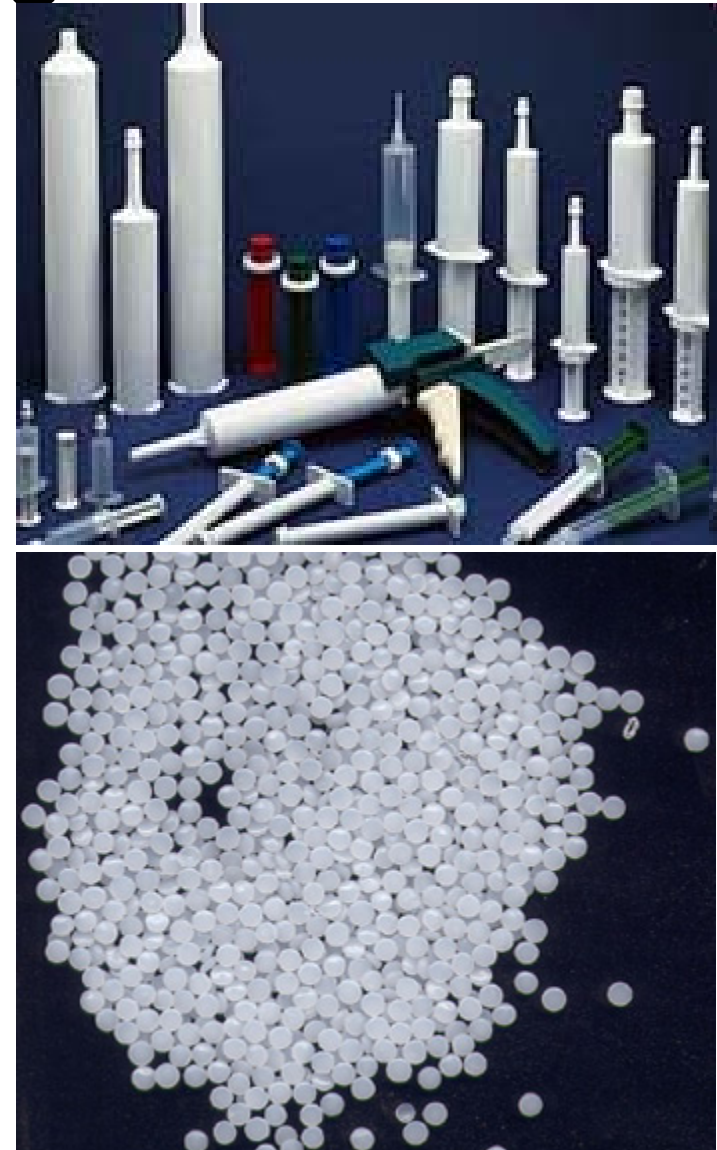
**Syringe Plunger 16
Impression Mold**



**5ML Barrel Syringe 32
Impression Mold**

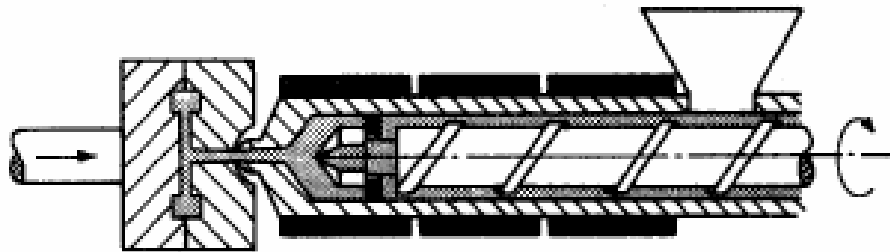
Injection Molding Process

- Pellets placed in hopper
- Pellets fall into barrel through throat
- Pellets packed to form solid bed
 - air forced out through hopper
- Pellets melted by mechanical shear between barrel and screw



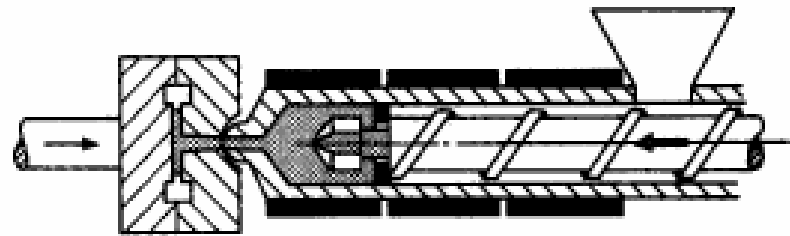
Injection Molding Process

- Melted plastic forms shot in front of screw
 - screw moves back as plastic moves forward (reciprocating screw)

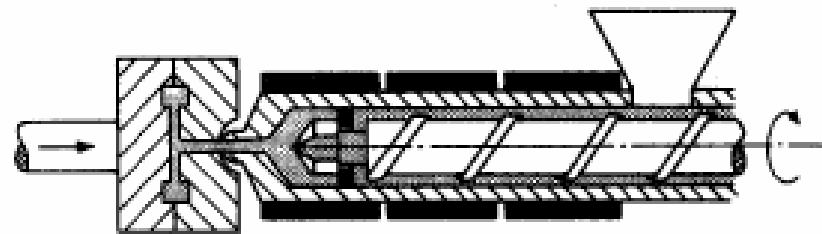


Injection Molding Process

- Screw moves forward to inject plastic into mold cavity

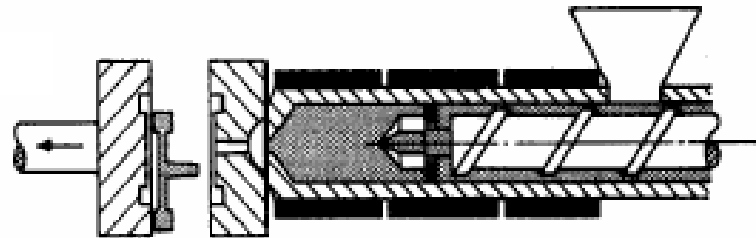


- Part cools and solidifies
 - next shot is made



Injection Molding Process

- Mold opens
- Ejection pins move forward to eject part



- Mold closes
- Process starts again

Blow Molding

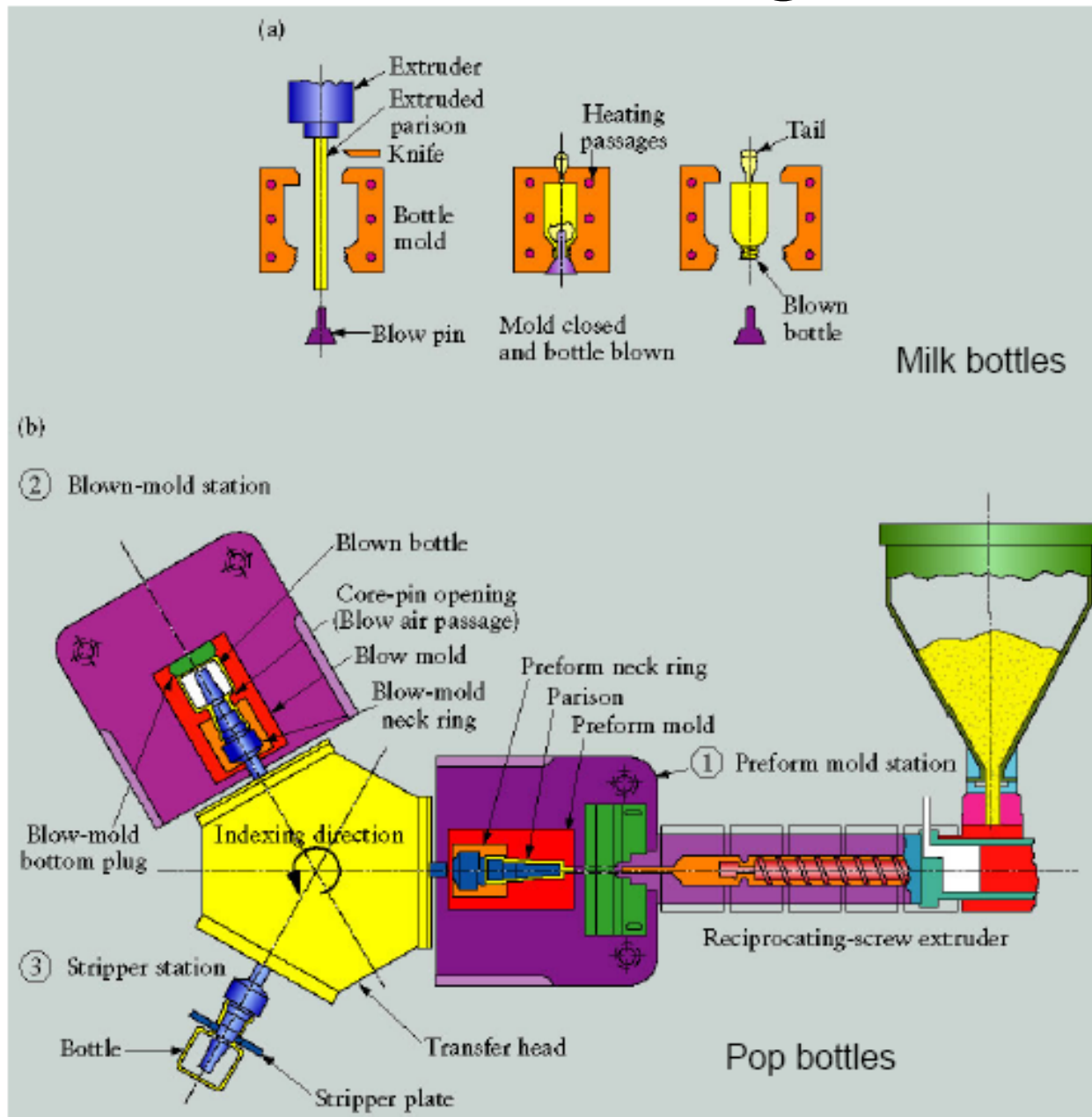
- Blow molding is a process typically used to make bottles
- In blow molding a pre-molded form is heated and then has air blown into it to expand it to fit the mold shape





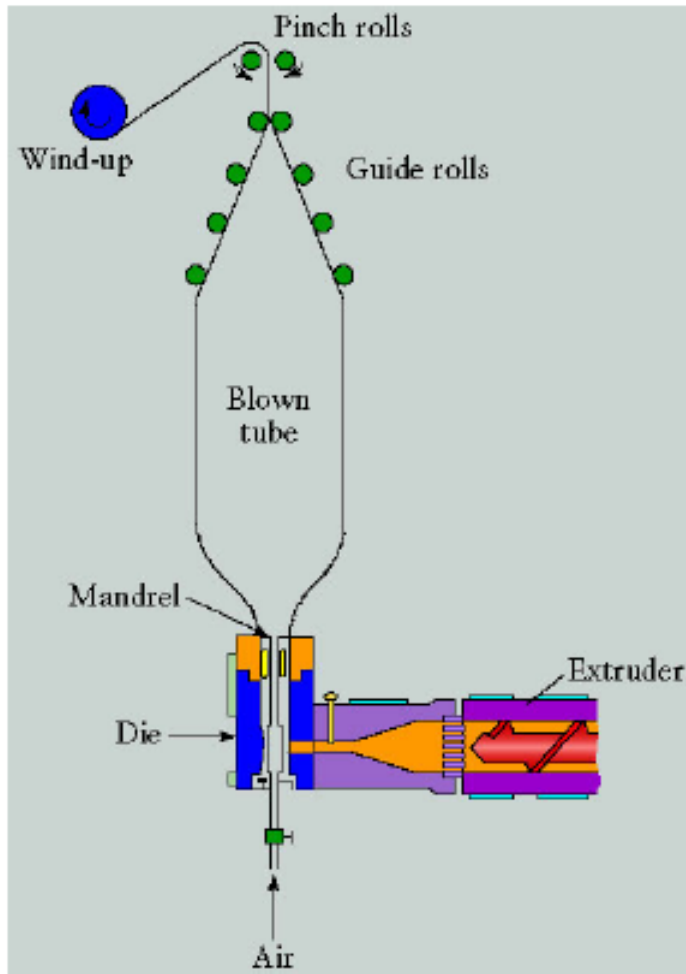


Blow Molding





Blown Film Extrusion



Dipping



- Latex gloves are made by dipping formers into latex



FORMER CLEANING PROCESS

Product Specific Processes

- Molded Ocular Prostheses
- Contact Lenses
- Molded Dentures

TriWood1973

RFDEC7715



TriWood

Medical Plastics

Types of Polymers used in
Medical Devices

Medical Products Made from Plastic

Categories

- **Disposables: products that are not made to be reused**
- **Durables: products that are made to be reusable**
- **Implants: products that are implanted within the human body**
- **Surgical Instruments**

Disposables

Band-aids



Syringe



IV Tubing



IV Bag

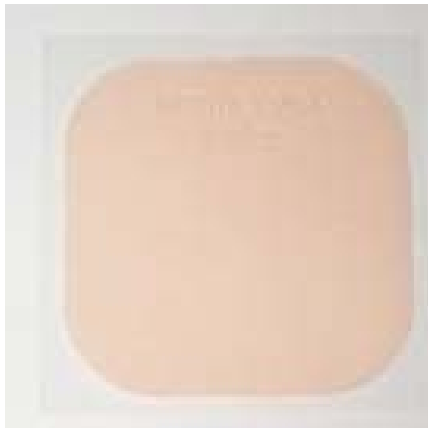


Disposables



Lancets

Transdermal Patches



Tongue Depressors
Non-rebreather mask



Disposables



- Covers for thermometers
- Needle-free IV system
- EpiPens
- Oxygen mask



Disposables

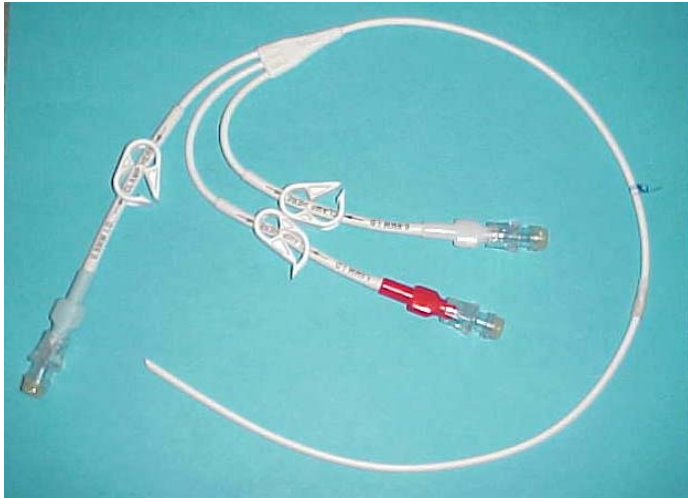
- Exam gloves
- Medical Packaging
- Plastic droppers
- Single use/reusable cold/hot packs



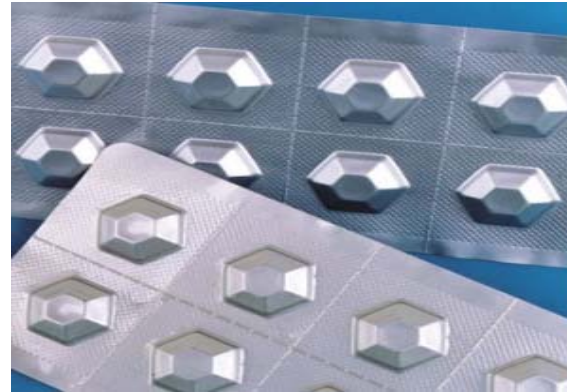


FORMER CLEANING PROCESS

Disposables



Catheters



Blister packs for medications



Basins



Phlebotomy tubes

Disposables

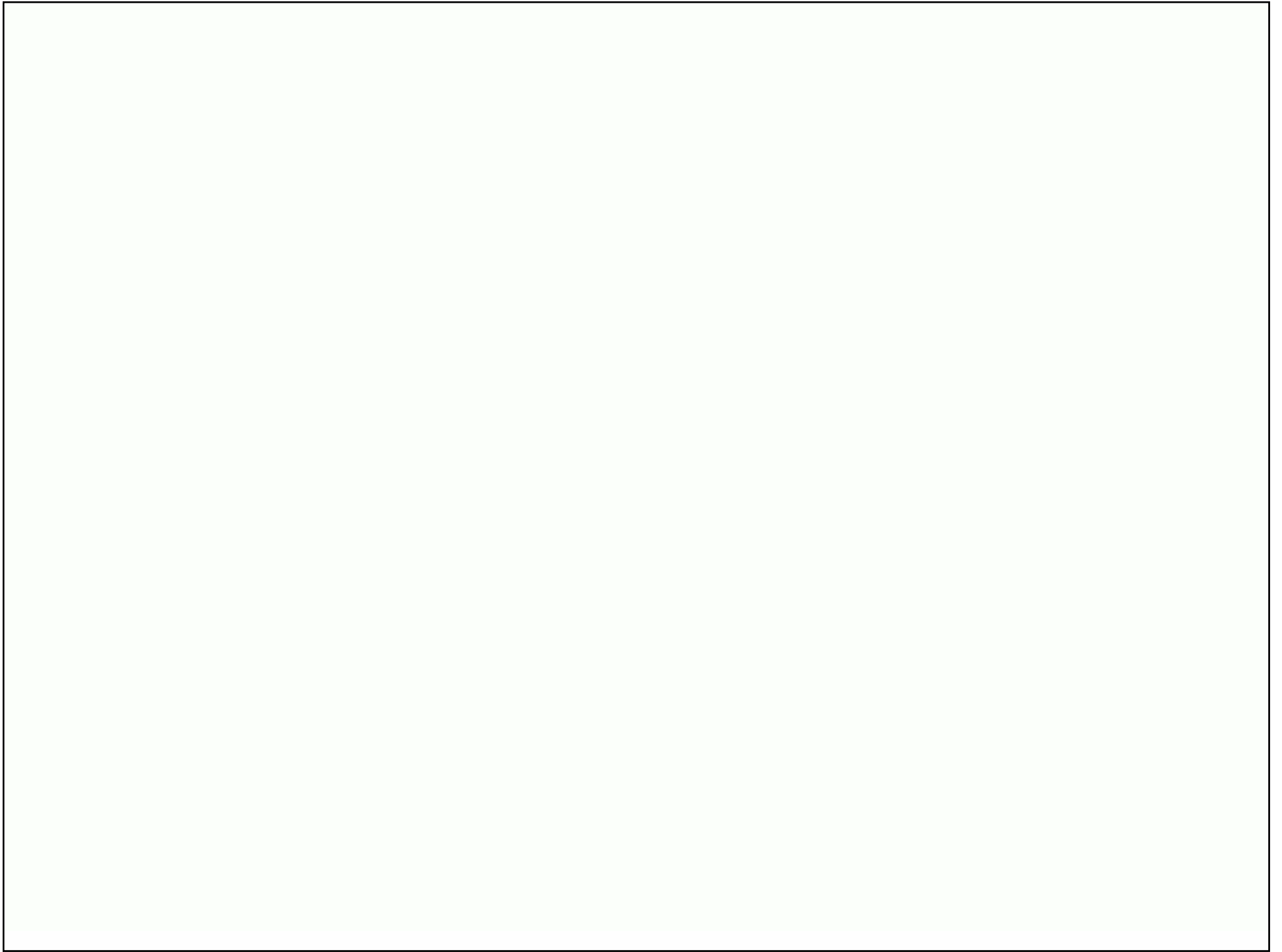


- Endotracheal tubes
- Medical Adhesives
- Contact lenses
- Culture tubes for collagen vascular grafts



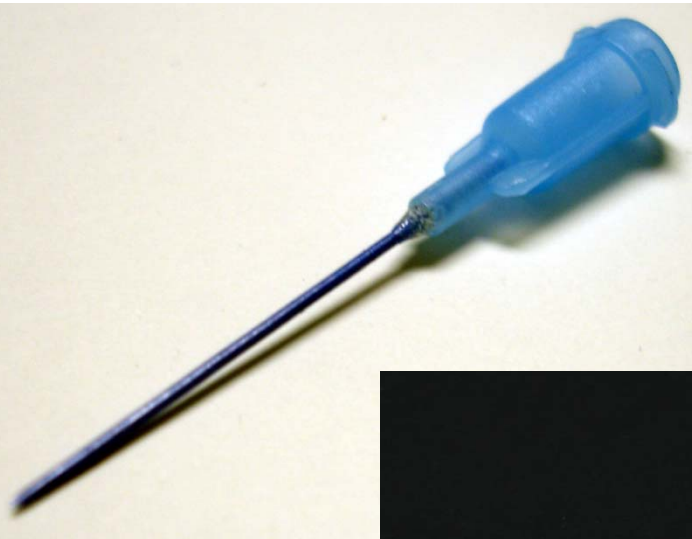
RFDEC7715





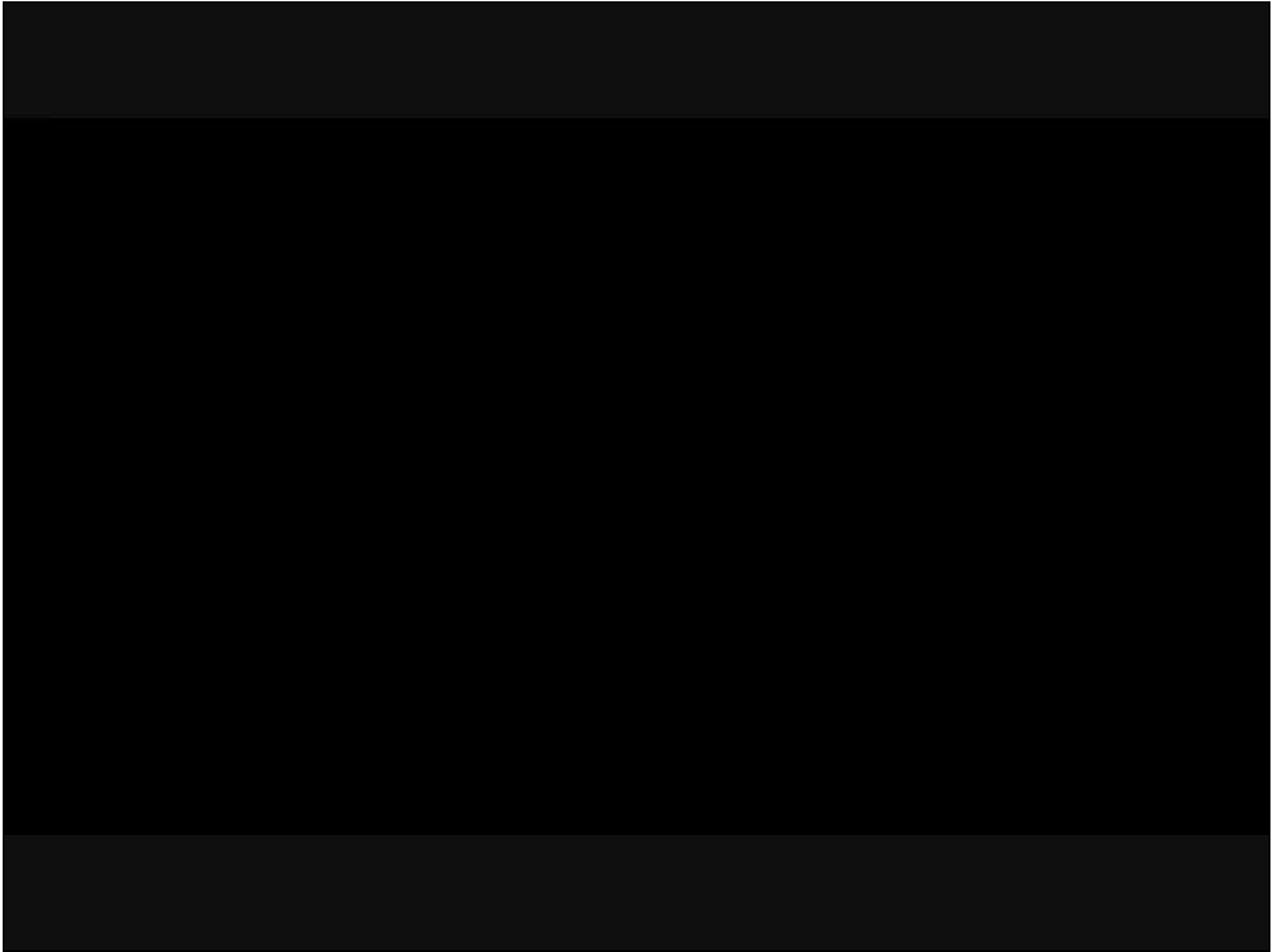
Disposables

Plastic Needles



PillCam





Durables

- Dentures
- Ricordi Chamber
- Radiation shielding



TriWood

Durables

Urine meters



i-LIMB Hand

Tie Demo

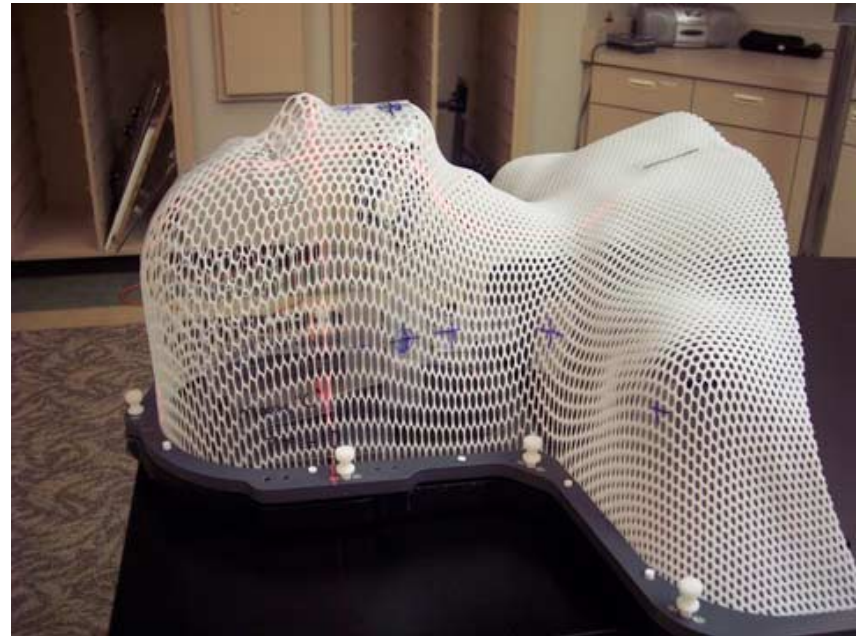


Grape Demo



Durables

- Radiation immobilization mask
- Glasses
- Blood pressure cuffs
- Computer housings



Durables



- Thermometers
- Ankle supports
- Stethoscope



Durables

- Bathtub lifts
- Wheelchairs
- Mouth guards
- Ace™ bandages



Implants

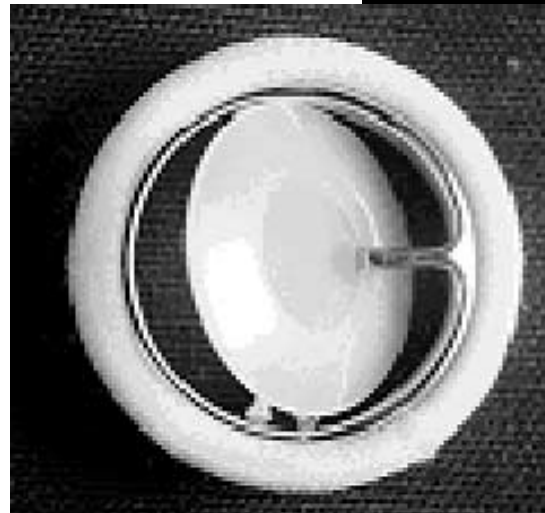
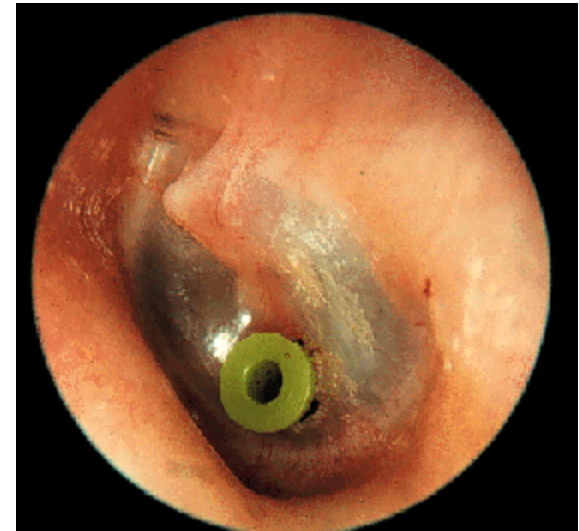
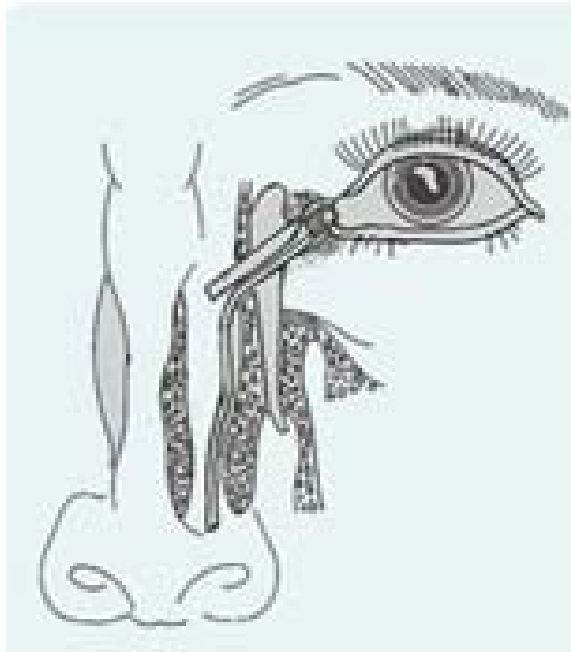


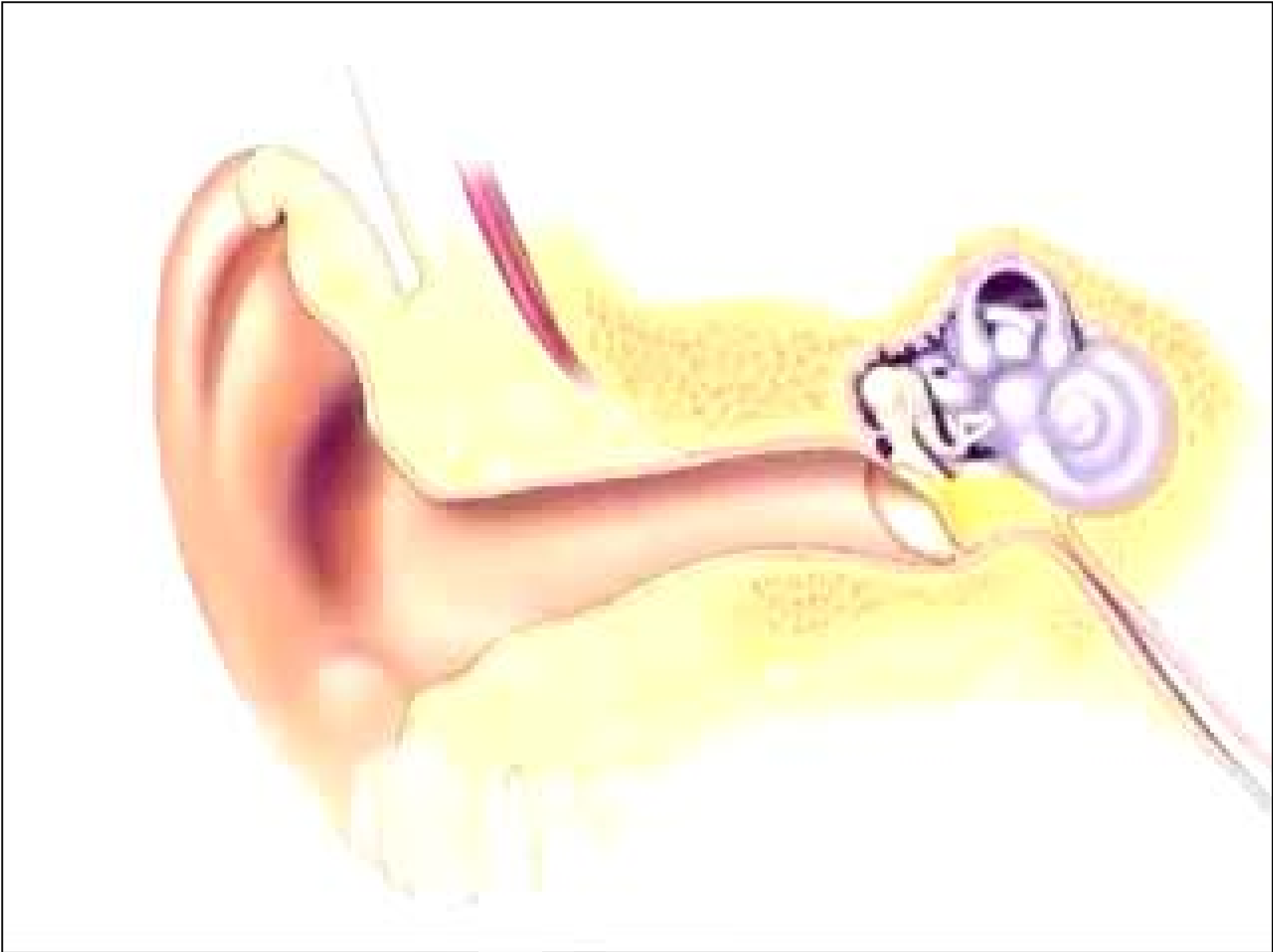
- Ocular prosthetics
- Prosthetic ears, noses, etc
- Spine implants
- Vascular grafts
- Plates to repair skull/facial injuries

TRINWOOD 1973

Implants

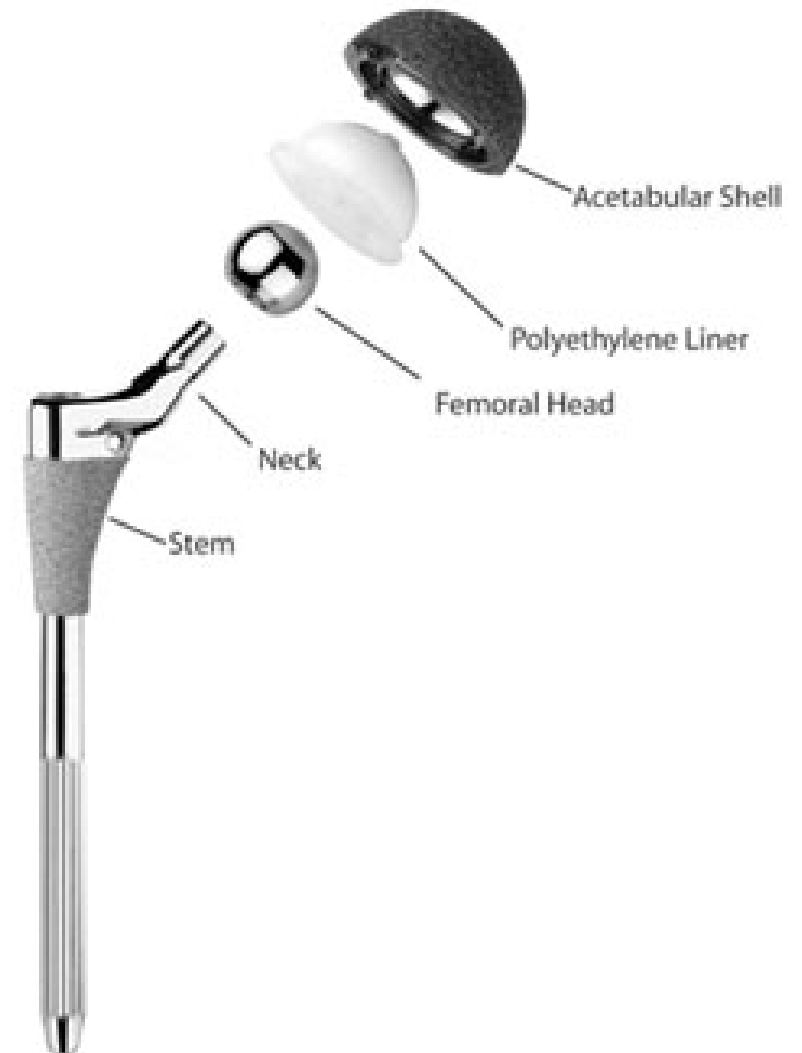
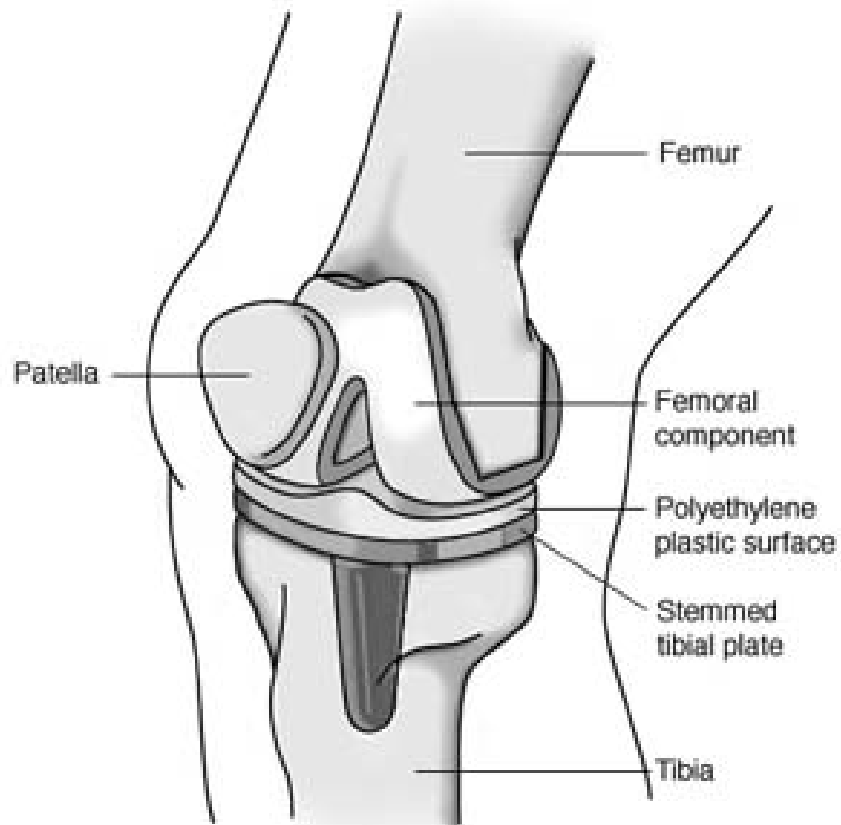
- Ear tubes
- Heart valves
- Replacement tear ducts/drains





Implants

- Hip replacement implants
- Knee Implants



Surgical Instruments



- Surgical tool handles
 - Osteomes for bone splitting
 - Micro bone mills to sculpt bone

Surgical Instruments

- Medical brush handles
- Applanation tonometer



Types of polymers

- Thermoplastics
 - can be melted and solidified repeatedly
- Thermosets
 - react to polymerize during forming
 - cross-linked networks
 - can't be remelted
 - decompose with too much heat

Types of polymers

- Elastomers
 - large, recoverable, elastic deformations
 - soft
 - low glass transition temperatures
 - partially cross-linked networks
 - can be thermoset or thermoplastic

Polypropylene (PP)

- Thermoplastic
- Syringes
- IV bags



Polyvinyl chloride (PVC)

- Thermoplastic
- Stethoscope components
- Blister packs for medications
- Endotracheal tubes



Polyethylene (PE)

- Thermoplastic
- Knee replacement implants
- Ear tubes
- Tylenol Bottles: High density polyethylene (HDPE)



Syndiotactic Polystyrene (SPS)

- Thermoplastic
- Dental equipment
- Sterilization trays
- Surgical Instruments



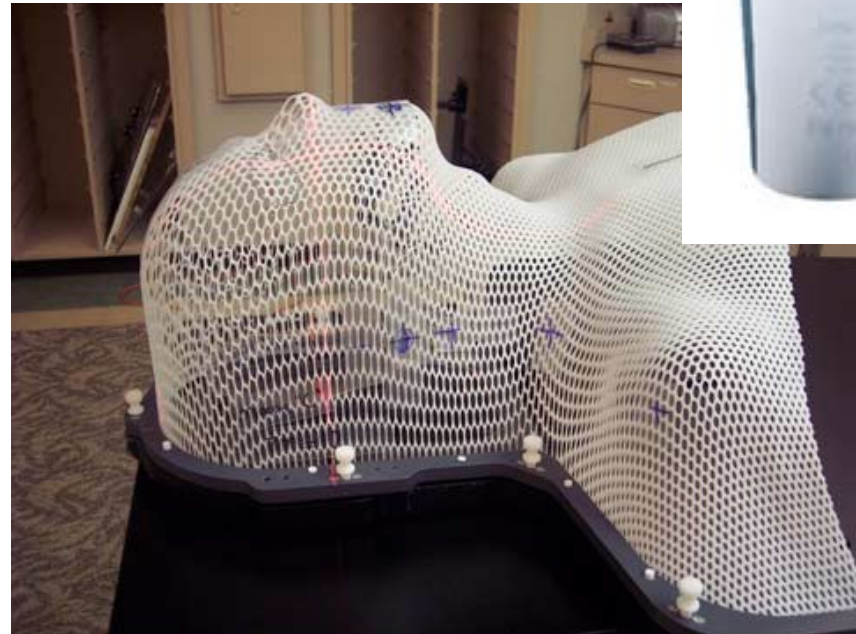
Polyester (PET)

- Thermoplastic
- Medicine bottles
- Sutures
- Blister packaging



Polycarbonate (PC)

- Thermoplastic
- Radiation Immobilization Masks
- Thermometers



PEEK

- Thermoplastic
- Spine implants
- Surgical Tool Handles



Latex

- Elastomer
- Ace™ bandages
- Latex gloves



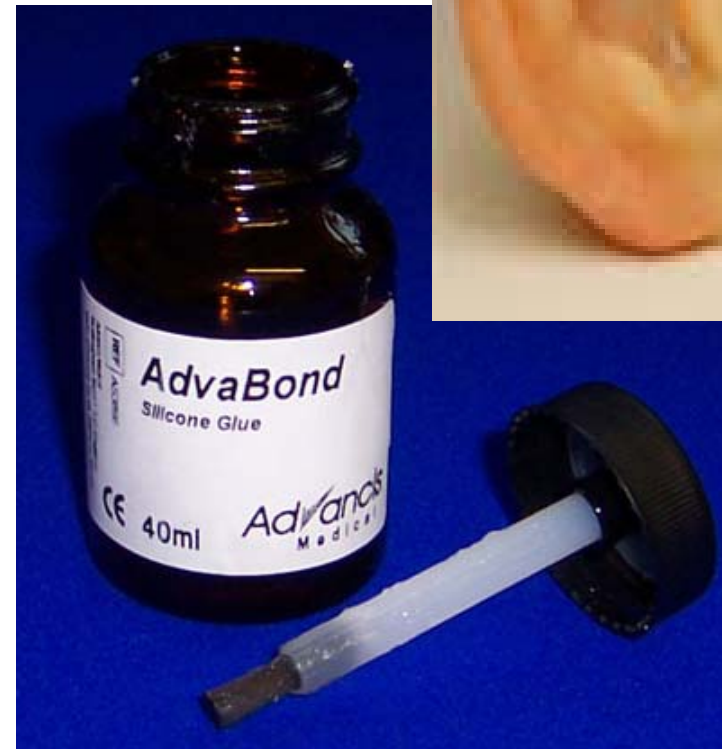
Thermoplastic Elastomers (TPE)

- Thermoplastic elastomer
- Oxygen mask tubing
- Feeding tubes
- Syringe components including plunger tips, stoppers and caps



Silicone

- Elastomer
- Medical Adhesives
- Prostheses

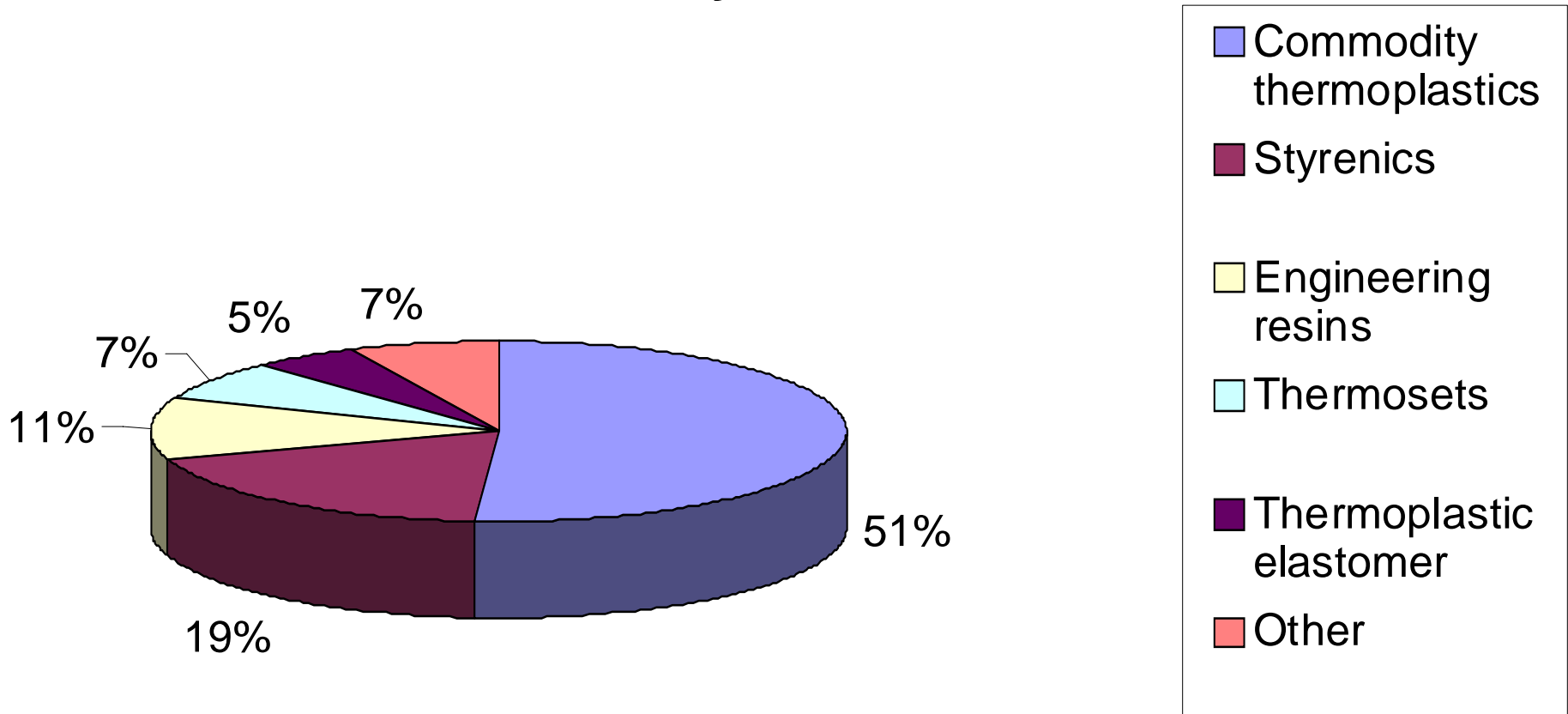


Ethylene Vinylacetate (EVA)

- IV bags
- Mouthguards

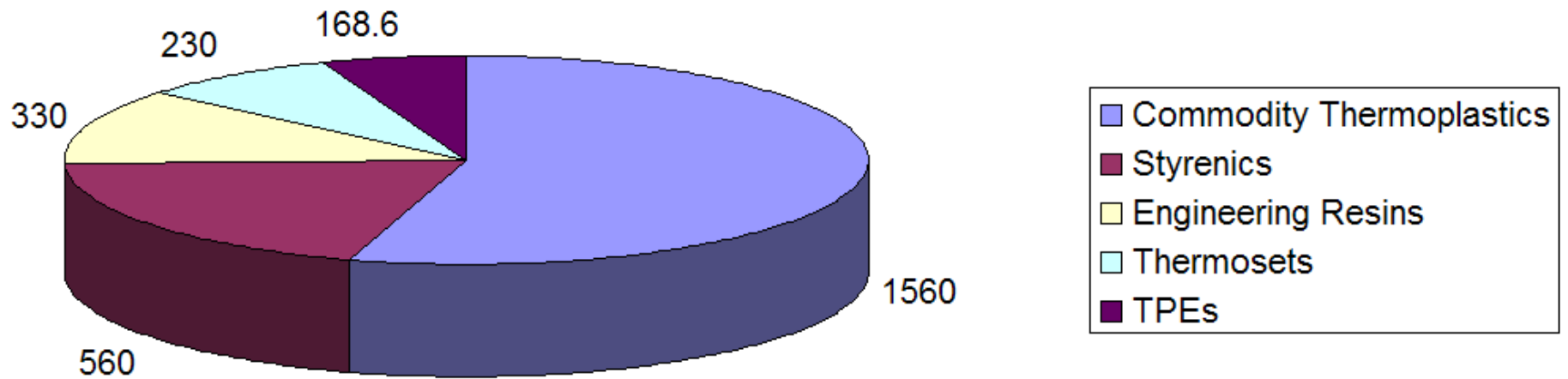


U. S. Medical Plastics Market in 2006 by resin

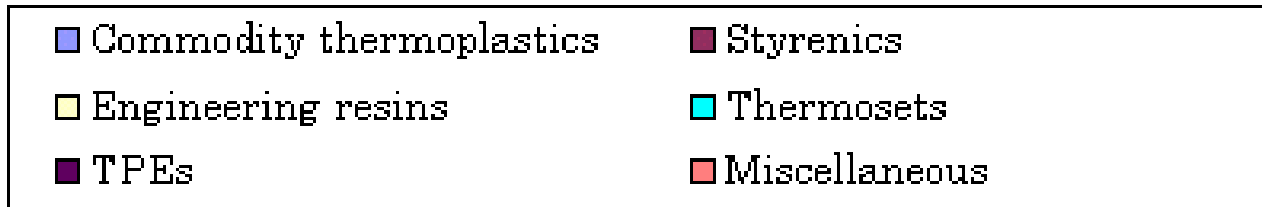
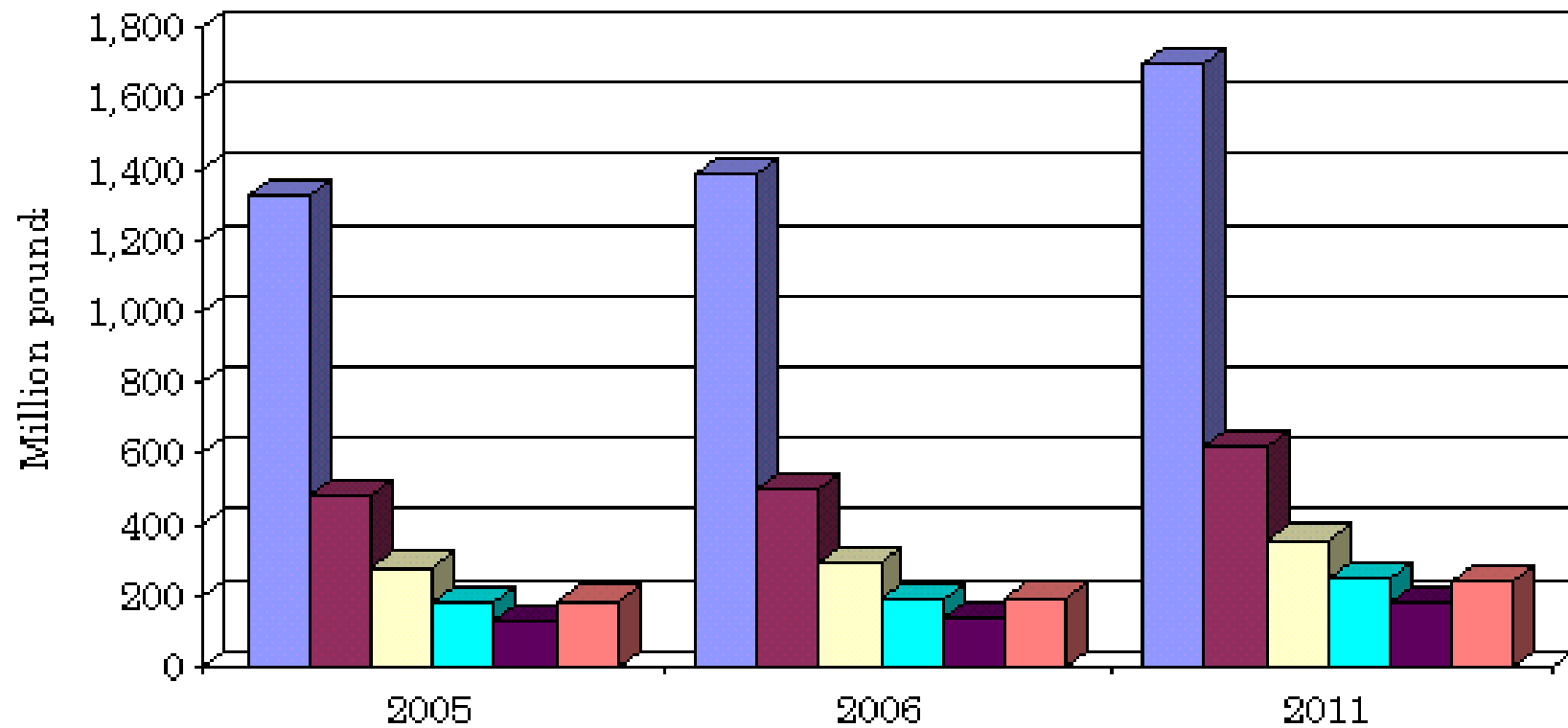


Total resin used in 2006: 2,698 million pounds

Millions of Pounds of Medical Plastics Used in 2009



Medical Plastics



Plastics for Healthcare Packaging

