Twenty-one buildings are situated on the picturesque campus, which overlooks the city of Butte (pop. 34,000).
Montana Tech is comprised of three colleges:

- **College of Letters, Sciences & Professional Studies**
  Biological Sciences – Business and Information Technology – Chemistry and Geochemistry – Computer Science – General Science – General Studies
  Health Care Informatics – Liberal Studies – Mathematical Sciences

- **School of Mines & Engineering**
  Safety, Health and Industrial Hygiene

- **Highlands College of Montana Tech**
  Business and Accounting Technology – Health Programs – Network Technology – Trades and Technical
Montana Tech is comprised of three colleges:

- **College of Letters, Sciences & Professional Studies**

- **School of Mines & Engineering**

- **Highlands College of Montana Tech**
  - Business and Accounting Technology – Health Programs – Network Technology – Trades and Technical
Bachelor of Science Degree Programs:

- Electrical Engineering
- Environmental Engineering
- General Engineering
  - Civil, Mechanical, Robotics, and Welding Options
- Geological Engineering
- Metallurgical and Materials Engineering
- Mining Engineering
- Occupational Safety and Health
- Petroleum Engineering
Bachelor of Science Degree Programs:

- Electrical Engineering
- Environmental Engineering
- General Engineering
  - Civil, Mechanical, Robotics, and Welding Options
- Geological Engineering
- Metallurgical and Materials Engineering
- Mining Engineering
- Occupational Safety and Health
- Petroleum Engineering
Master of Science Degree Programs:

- Environmental Engineering
- Electrical Engineering
- General Engineering
- Geoscience
- Industrial Hygiene
- Metallurgical/Mineral Processing Engineering
- Mining Engineering
- Petroleum Engineering
- Project Engineering and Management
- Technical Communication
Master of Science Degree Programs:

- Environmental Engineering
- Electrical Engineering
- General Engineering
- Geoscience
- Industrial Hygiene
- Metallurgical/Mineral Processing Engineering
- Mining Engineering
- Petroleum Engineering
- Project Engineering and Management
- Technical Communication
Molten iron being charged to a Basic Oxygen Steelmaking Furnace

Conceptual drawing of nanobots on a cancer cell search-and-destroy mission
Combination of Theoretical and Practical Experiences

- M&ME course every semester including freshman year
- 15 Labs/8 M&ME Labs/at least 1 lab every semester

Broad Materials Processing Coverage

- Physical processing
- Chemical processing
- Development, application, and maintenance of fabricated materials

Small Classes with a strong emphasis on practical, industrial examples.

Strong Industry Support from advanced materials, mining, chemical, engineering & construction, environmental, and recycling companies.
What is metallurgical and materials engineering?

What can I expect in the metallurgical and materials engineering program at Montana Tech?

What types of employment opportunities are available for metallurgical and materials engineering graduates?

What is the employment outlook for metallurgical and materials engineers?
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is metallurgical and materials engineering?</td>
<td></td>
</tr>
<tr>
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THE MATERIALS LIFE CYCLE
THE MATERIALS LIFE CYCLE

RAW MATERIALS:
Ore, coal, sand, oil, wood, plants

Mine, Drill, Harvest
THE MATERIALS LIFE CYCLE

RAW MATERIALS:
Ore, coal, sand, oil, wood, plants

Mine, Drill, Harvest

Extract, Refine, Process

BULK MATERIALS:
Chemicals, lumber, metals, cement, paper, fibers
THE MATERIALS LIFE CYCLE

BULK MATERIALS:
Chemicals, metals, cement, paper, fibers

ENGINEERING MATERIALS:
Alloys, crystals, ceramics, plastics, composites, textiles

Process
THE MATERIALS LIFE CYCLE

PRODUCT MATERIALS:
Machines, structures, roads, consumer goods

ENGINEERING MATERIALS:
Alloys, crystals, ceramics, plastics, composites, textiles

Design, Manufacture, Assemble
THE MATERIALS LIFE CYCLE

PRODUCT MATERIALS:
Machines, structures, roads, consumer goods

WASTE & SCRAP MATERIALS
Use, Service, Performance
METALLURGICAL AND MATERIALS ENGINEERS ARE INVOLVED IN EVERY STAGE OF THE MATERIALS LIFE CYCLE!

RAW MATERIALS
- Ore, coal, sand, oil, wood, plants

BULK MATERIALS
- Chemicals, metals, cement, paper, fibers

ENGINEERING MATERIALS
- Alloys, crystals, ceramics, plastics, textiles

PRODUCT MATERIALS
- Machines, structures, roads, consumer goods

WASTE & SCRAP MATERIALS
- Recycle (to Bulk Materials)

Use, Service, Performance

Design, Manufacture, Assemble

Extract, Refine, Process

Process

Mine, Drill, Harvest

Disposal
Materials and processes are interdependent arenas:

- **Materials** are involved in every stage of the cycle. Without materials, there would be nothing to process.

- The stages are connected by a series of **processes**.

- Every process adds value to the materials.
  - Every process requires energy and/or resources.
  - Every processes generates by-products or waste.
Students learn to develop processes and materials in environmentally responsible ways that maximize efficiency and minimize energy consumption.

*Sustainable Development* “meets the needs of the present without compromising the ability of future generations to meet their own needs.”
What is metallurgical and materials engineering?

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The Metallurgical and Materials Engineering Department faculty are dedicated to the purpose of providing our students with a challenging and rewarding academic experience.

Our core philosophy is to promote intellectual and professional growth by emphasizing and reinforcing the importance of responsibility, self-reliance, diligence, and perseverance.

Our objective is to graduate engineers with the technical competence and professional maturity to perform productively on behalf of their employers.

Our graduates are ready to go to work!
The Department is staffed by six full-time faculty and one full-time administrative assistant.

- All faculty members have Ph.D.'s and three earned their undergraduate and/or graduate degrees at Montana Tech.
- The faculty have extensive industrial experience, a network of contacts, and perform research programs with industry.
- The student-to-faculty ratio in upper division department classes is typically about 10:1.
Metallurgical and Materials Engineering is a multidisciplinary field -- a metallurgist must be a jack of all trades and a master of many...

- The program includes courses in mathematics, chemistry, physics, humanities and the social sciences.
- Students gain hands-on experience in laboratories; our program features 15 laboratories – more than any other program!
- Students earn credit for working on summer internships.
To earn a bachelor of science degree in Metallurgical & Materials Engineering, the student is required to complete **136 credit-hours:**

- Metallurgical & Materials Engr. 57 credit hours
- General Engineering 14
- Physical Sciences 38
- Humanities & Social Sciences 18
- Science & Technical Electives 9
Small class sizes give students opportunities that simply do not exist in larger departments. For example, students become proficient at delivering technical presentations.
Unique M&ME Materials Engineering Core:

- **Year 1:**
  - M&ME Seminar – Plant Tours and Speakers
  - M&ME Safety and Health
  - Mineral Processing I

- **Year 2:**
  - Metallurgical Thermodynamics – Basics
  - Materials Science I – Basics of Structure, Processing and Properties
  - Minerals Processing II
Freshman Class Field Trip to the Montana Resources Operations in 2011
Unique M&ME Materials Engineering Core:

- **Year 3:**
  - Mass Transfer and Kinetics/Advanced Transport
  - Materials Science II
  - Ceramic Materials

- **Year 4:**
  - Polymeric Materials
  - Process Instrumentation and Control
  - Processing of Aqueous Systems/Elevated Temp. Systems
  - Environmental Degradation of Materials (Corrosion)
  - Composites or Flowsheet Design
  - Technical Electives – Additional Specialized Courses
Preparing to execute a well conceived demonstration under the scrutiny of Department Head Courtney Young.

The Department has over $3.5 million of analytical instruments and process equipment.

Undergraduate students are encouraged to use equipment that is typically available only to graduate students at other schools.

The department does not believe in demonstration laboratories; ours feature “hands-on” learning experiences.
The Unique M&ME Lab Experience:

- **Year 1:**
  - Particulate Processing I Lab
    - Sieve Analysis, Wilfley Table, Magnetic Separator, Spiral Separator, Flotation Cell, Knelson Concentrator

- **Year 2:**
  - Particulate Processing II Lab
    - Electrostatic Separation, Coulter Counter, Thickeners, Jaw Crusher, Roll Crusher, Rod & Ball Mills, Bond Work Index
The Unique M&ME Lab Experience:

- **Year 3:**
  - Microstructural Interpretation Lab
    - Grain Size Determination, Steel Metallurgy, Heat Treatment, Identification of Phases
  - Physical Metallurgy and Materials Lab
    - Annealing, Casting, Precipitation Hardening, Heat Treating, Non-metals

- **Year 4:**
  - Materials Characterization Lab
    - SEM/MLA, XRD, ICP
  - Aqueous and Elevated Temperature Lab
  - Senior Design I and II
Contemplating the intricacies of froth flotation.

Scrutinizing the results of a spark test.
Laboratory facilities are similar to those seen on CSI and NCIS – but without the gore!
Department faculty have developed active research programs:

Undergraduate research projects (URPs)

Graduate research projects funded by government and industry. Recent examples include:

- **Minerals** – coal, precious metals, copper, rare earth elements, silicon

- **Energy** – development of fuel cell materials, purification of silicon for solar energy, nuclear fuel recycling

- **Environment** – wastewater treatment, clean coal technologies

*Our goal is to produce maximum value to the sponsor in every project that we accept.*
Friendly and helpful graduate students.
Financial advantages for M&ME students include:

Affordable Tuition & Fees – resident fees range from $3200 to $3500 per semester, and nonresident fees range from $9,000 to $10,000 per semester. Out-of-state fees are substantially reduced for students that qualify for Western Undergraduate Exchange (WUE) scholarships.

Scholarships – awarded on a competitive basis to industrious students by the department, school, industry, and professional societies and organizations.

Internships – most M&ME majors opt for lucrative summer employment with industrial concerns throughout the U.S.

CAMP – the Center for Advanced Mineral and Metallurgical Processing provides students with the opportunity to earn while they learn.

ADVANTAGE: motivated students have the opportunity to graduate and start their careers essentially debt-free.
What is metallurgical and materials engineering?

What can I expect in the metallurgical and materials engineering program at Montana Tech?

What types of employment opportunities are available for metallurgical and materials engineering graduates?

What is the employment outlook for metallurgical and materials engineers?
M&ME is one of the most **diverse and flexible** engineering degree programs. Tailor your career to fit your interests.

**Process engineers** invent, develop, and operate technologies to recover and refine metals and other materials, produce energy, and improve the environment.

**Materials engineers** create new materials from metals, ceramics, polymers (plastics), semiconductors, and composites.

The two disciplines overlap – knowledge of one discipline enhances the probability of success in the other. **M&ME graduates** are proficient in both disciplines.
Process engineers use materials and energy resources to produce value-added materials and, in some cases, energy.

Mineral processing separates valuable materials from waste rock based on differences in physical characteristics.

Thermal processing uses heat to drive the desired chemical reactions.
Aqueous processing technologies separate valuable metals in a liquid medium.

Other process use electric current to drive chemical reactions.
Materials Scientists and Engineers are concerned with the structure and properties of the four major materials categories.

Materials engineers can choose to specialize in many areas:

- Material development
- Corrosion
- Failure analysis
- Welding and joining
The Materials Pyramid
Materials engineers create new materials for specific applications:

- Body Armor [Ceradyne, Inc.]
- Biomaterials (knee replacement)
- Semiconductors
- Synthetic Diamond
- PEM Fuel Cells
- Steel Billets
Katie Schumacher
Metallurgical Engineer
Stillwater Mining Company
BS 2007, MS 2009

Sean Dudley
Environmental Consultant
CDM Smith
MS 2011

Mike Spicher
Metallurgical Engineer
Hailey Gold Mine
BS 2011

Stacy Davis
Metallurgical Engineer
Alcoa Forgings & Extrusions
BS 2010, MS 2011

Megan Black
Metallurgical Engineer
Kennecott Utah Copper
BS 2012

Zach Johnson
Metallurgist
Newmont Mining Corp
BS 2010

Josef Bilant
Plant Metallurgist
Yukon-Nevada Gold
BS 2008

Keri Caldwell
Research Engineer I
F.L. Smith
BS 2010, MS 2012

Nicole Loehr
Metallurgical Engineer
Newmont Mining Corp.
BS 2011 (NV)

Matt Wilson
Metallurgical Engineer
Newmont Mining Corp.
BS 2012

Diane Bell
Research Engineer
F.L. Smith
MS 2012

Theo Winkelman
Junior Metallurgist
Mineral Park, Inc
BS 2010

Tyler Salisbury
Project Engineer
Hazen Research, Inc
BS 2010, MS 2011

Matt Hercun
Metallurgical Engineer
Newmont Mining Corp
BS 2011

Nisanthan Myelswamy
Assoc. Technical Professional
KBR, Inc.
MS 2008

Adam Hammes
Materials Engineer
Puget Sound Naval Shipyard
BS 2008

Merle Kahlistrom
Shift Supervisor
Hecla Mining Co.
BS 2010

Katie Schumacher
Metallurgical Engineer
Stillwater Mining Company
BS 2007, MS 2009

Jerek Depuydt
Mill Metallurgist
Stillwater Mining Company
BS 2012

Stacy Davis
Metallurgical Engineer
Alcoa Forgings & Extrusions
BS 2010, MS 2011

Pankaj Sharma
Project Specialist
Buckman, Inc. (TN)
MS 2009

Megan Black
Metallurgical Engineer
Kennecott Utah Copper
BS 2012

Keri Caldwell
Research Engineer I
F.L. Smith
BS 2010, MS 2012

Diane Bell
Research Engineer
F.L. Smith
MS 2012

Zach Johnson
Metallurgist
Newmont Mining Corp
BS 2010

Nicole Loehr
Metallurgical Engineer
Newmont Mining Corp.
BS 2011 (NV)

Matt Wilson
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BS 2012

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Junior Metallurgist
Mineral Park, Inc
BS 2010

Tyler Salisbury
Project Engineer
Hazen Research, Inc
BS 2010, MS 2011

Matt Hercun
Metallurgical Engineer
Newmont Mining Corp
BS 2011

Nisanthan Myelswamy
Assoc. Technical Professional
KBR, Inc.
MS 2008
**Ph.D. Students**

Nick Gow*  
Montana Tech & University of Montana (IIP program)

Jeff Kline*  
Norwegian University of Science and Technology, NTNU  
(Trondheim, Norway)

Teresa Hayward-McGrath  
Curtin University (Perth, Western Australia)

Caleb Ellefson  
Washington State University (Pullman, WA)

Caelen Anderson  
Colorado School of Mines (Golden, CO)

**M.S. Students**

Matt Esquibel  
Colorado School of Mines

Ariane Erickson  
University of Washington (Seattle, WA)

Tyler Broden  
Montana Tech

Jesse Bowden  
Montana Tech

Ashley Carter  
Montana Tech

Ryan Foy  
Montana Tech

Brandon Steinborn  
Montana Tech

* Expected to fulfill doctoral program requirements by Fall 2012.
Why consider a career in M&ME?

- The work is interesting, challenging, and intellectually stimulating.
- You may choose to work almost anywhere in the U.S. International employment opportunities are also available.
- Your work will benefit mankind.

*But most of all because ...*
It could lead to FINANCIAL SECURITY!
Financial advantages for M&ME graduates include:

- **Placement** – despite a shaky national economy, M&ME graduates have enjoyed 100% placement throughout the past decade. Most are able to secure permanent employment early in their senior year.

- **Salaries and benefits** – starting salaries begin at about $65,000/year. Graduates with prior work experience and/or internships typically command higher starting salaries.

- **Opportunities** – students generally choose among multiple employment offers. This advantage ensures competitive salaries and provides the student flexibility in establishing their preferred career path and choice of location.
Financial advantages for M&ME graduates include:

- **Placement** – despite a shaky national economy, M&ME graduates have enjoyed **100% placement** throughout the past decade. Most are able to secure permanent employment early in their senior year.

- **Salaries and benefits** – starting salaries exceed $65,000/year. Graduates with prior work experience and/or internships generally get higher starting salaries.

- **Opportunities** – students generally choose among **multiple employment offers**.
In 2010, the mean annual salary of those working in the metallurgical and materials engineering field was $86,860.

Lowest paid engineers earned just less than $51,680, which is still more than the average household income in any of the 7 largest cities in Montana.

The middle 50% of salaries ranged from $64,930 to $105,090. *M&ME graduates begin near the middle, not at the bottom!*

The top 25% earned more than $105,000.

The top 10% earned more than $126,800.

*Source: U.S. Bureau of Labor (2010)*
What is metallurgical and materials engineering?

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What types of employment opportunities are available for metallurgical and materials engineering graduates?

What is the employment outlook for metallurgical and materials engineers?
Materials engineers are employed in almost every industry – there are an estimated 300,000 types of materials and thousands more are under development!

Between 2008 and 2018, the market for metallurgical and materials engineering is expected to increase by 9%; this level of demand equates to thousands of new job opportunities.

Many engineers are near retirement – their positions must be filled by new engineers, creating even more jobs and opportunities for rapid advancement.

Due to the healthy materials and metals markets, opportunities are rapidly expanding.

METALLURGICAL AND MATERIALS ENGINEERING
QUESTIONS
METALLURGICAL AND MATERIALS ENGINEERING

THANK YOU!

Ride in and look us over.... until then, "TAP 'ER LIGHT!"

Yours truly,

Butte

MONTANA

THE RICHEST HILL ON EARTH

CENTER OF MONTANA'S WONDERLAND

LAST OF THE WESTERN FRONTIER TOWNS
METROPOLIS OF THE TREASURE STATE
WORLD'S GREATEST MINING CAMP
LAND OF THE SHINING MOUNTAINS