Building a Scholastic Community That Supports the Advancement of Underserved Students Into the Careers of Medical and Biomedical Research
Duluth Campus Celebrates 50th Anniversary in 2022
Sesquicentennial of the Morrill Land-grant assigned a tripartite mission by the federal government to teach, conduct research and provide service to communities.
I acknowledge that the University of Minnesota Medical School, Duluth is located on the traditional, ancestral, and contemporary lands of Indigenous people. The University resides on land that was cared for and called home by the Ojibwe people, before them the Dakota and Northern Cheyenne people, and other Native peoples from time immemorial. Ceded by the Ojibwe in an 1854 treaty, this land holds great historical, spiritual, and personal significance for its original stewards, the Native nations and peoples of this region.
Northern Minnesota

- Arrowhead Region
  - 6 counties
  - 18,222 square miles
  - 322,073 (2000 US Census)
  - 3.4% are Native American, most reside on four reservations, Bois Forte, Grand Portage, and Fond du Lac; reservations in proximity are Lac Courte Oreilles Milles Lac, Leech Lake and Red Lake
  - Region has a lower family median with a financial incomes
  - Economy has historically depended on mining and forestry, and has experienced an economic downturn over the previous 60 years

<table>
<thead>
<tr>
<th>State</th>
<th>County</th>
<th>Population 2010</th>
<th>Native American (%)</th>
<th>African American (%)</th>
<th>Hispanic American (%)</th>
<th>High School Graduation (%)</th>
<th>Some College (%)</th>
<th>Median Family Income</th>
<th>Income Inequality (Gini Index)</th>
<th>Children in Poverty (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minnesota</td>
<td>Aitkin</td>
<td>5,303,925</td>
<td>1.2</td>
<td>5.2</td>
<td>2.4</td>
<td>81</td>
<td>67</td>
<td>$56,869</td>
<td>4.4</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Carlton</td>
<td>35,821</td>
<td>2.4</td>
<td>0.35</td>
<td>0.9</td>
<td>79</td>
<td>65</td>
<td>$58,290</td>
<td>4.4</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Cook</td>
<td>33,386</td>
<td>5.9</td>
<td>1.4</td>
<td>1.4</td>
<td>88</td>
<td>67</td>
<td>$48,406</td>
<td>4.2</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Lake</td>
<td>5,168</td>
<td>7.59</td>
<td>0.29</td>
<td>0.75</td>
<td>93</td>
<td>71</td>
<td>$47,132</td>
<td>4.7</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Pine</td>
<td>11,058</td>
<td>0.7</td>
<td>0.1</td>
<td>0.57</td>
<td>83</td>
<td>69</td>
<td>$46,980</td>
<td>4.4</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>St. Louis</td>
<td>26,530</td>
<td>3.1</td>
<td>2.0</td>
<td>2.4</td>
<td>79</td>
<td>52</td>
<td>$44,058</td>
<td>4.2</td>
<td>25</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>Douglas</td>
<td>200,528</td>
<td>2.03</td>
<td>0.85</td>
<td>0.8</td>
<td>82</td>
<td>73</td>
<td>$47,134</td>
<td>4.8</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5,754,798</td>
<td>1.0</td>
<td>6.3</td>
<td>2.2</td>
<td>88</td>
<td>67</td>
<td>$52,893</td>
<td>4.3</td>
<td>18</td>
</tr>
</tbody>
</table>

* Categorized as rural: (2–4)
Training Programs at the Duluth Campus
1978-1990

- I Come to Learn
  Middle School Summer research Camp
  NASA
- Native Americans into Marine Sciences
  Undergraduate Research
  Minnesota Sea Grant
- Ni Shou Gabawaag
  High School apprenticeship for Fond du Lac Reservation Students
  Minority Biomedical Research Support
- Howard Rockefeller Program
  High School apprenticeship program
- Indians into Research Careers,
  Undergraduate Research
  NIGMS-Minority Access to Research Careers
- Native Americans into Marine Sciences
  Undergraduate Research
  Minnesota Sea Grant
Training Programs at the Duluth Campus
Shift in emphasis to Medical Student Training

- Center for American Indian and Minority Health
- Native American Center of Excellence
- Native American Research Center for Health

CAIMH Alumni - 158 MD

Native Americans 5.2 million
Native American Physicians 3,400, 0.4% of the physician workforce
American Medical Association 2019

- Steppingstones into Health Careers, Indian Health Services
  - K-12 activities to promote health professions
- Upward Bound Vision Quest, US Department of Education
  - Low-income HS students
Training Programs in Biomedical Research
1994-Present

- Bridges to the Baccalaureate Degree
  Undergraduate Research Assistantships, NIGMS
- Bridges to the Doctoral Degree
  Graduate student support, NIGMS
- Indians into Research Careers, Minority Access to Research Careers
  Undergraduate Research Assistantships
- Pathways to Advanced Degrees in the Life Sciences,
  Undergraduate Research Assistantships
Significance of Biomedical Training for Native Americans

- Recruiting Native American to enter medicine or biomedical research is challenging
- Barriers include poverty, substandard housing, exposure to violence, substance-abuse and high rate of suicide
- Drop-out rates exceed 50% on reservation
- Small population
- Role models
- Family and community support

- Only 9% of medical schools have more the 4 Native American students
- 43% of medical schools have no Native American students
- As of 2016- 481,753 total faculty in 141 allopathic medical schools
  - 62.4 % were white (300,642)
  - 0.11 % were Native American (530)
Increase the number of Native Students Entering Medicine and Research

- Low numbers of Native American STEM students
- Increase visibility of careers
- Mentors and role models
- Community outreach

- Reach out to regional schools and communities
Minnesota has significant racial disparities

- 2nd best for “highest educational attainment”
- 48% of the adult population has an AA or higher degree
- 2006-2016, whites graduated with a BA/BS 2.5 times more than the Native Americans
- 1 in 4 Native Americans dropped out of high school, 6 times greater than for whites
- Many Native Americans return to obtain a GED, reflects a 3-year lag in median age entering college compared to whites.
## Table 2
Demographics of Counties surrounding metropolitan Duluth

<table>
<thead>
<tr>
<th>County</th>
<th>Data for 2019</th>
<th>Educational attainment AA or higher (%)</th>
<th>Population</th>
<th>Medium family income ($)</th>
<th>People of Color (%)</th>
<th>Recipient's Financial aid (%)</th>
<th>Indian Scholarships awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Louis</td>
<td>50</td>
<td>199,922</td>
<td>50,936</td>
<td>9</td>
<td>41</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>Carlton</td>
<td>44</td>
<td>35,655</td>
<td>58,874</td>
<td>12</td>
<td>44</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Pine</td>
<td>28</td>
<td>6,685</td>
<td>47,285</td>
<td>10</td>
<td>52</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Aitkin</td>
<td>38</td>
<td>15,821</td>
<td>45,860</td>
<td>6</td>
<td>49</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

### Figure 2
Reservation located in Minnesota

### Figure 3
Location of minority populations in Minnesota
Table 1

<table>
<thead>
<tr>
<th>Race*</th>
<th>Number of Students Enrolled from 2006 to 2016</th>
<th>Women</th>
<th>With Permanent Residence Outside Minnesota**</th>
<th>Median Age at Enrollment</th>
<th>Percent Who Dropped Out of High School (including GED Completers)</th>
<th>Enrolled in a Post-Secondary School Outside the Twin Cities***</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Indian Alone or with other races except Hispanic/Latino</td>
<td>12,050</td>
<td>59.1%</td>
<td>8.8%</td>
<td>24</td>
<td>23.3%</td>
<td>60.9%</td>
</tr>
<tr>
<td>White non-Hispanic</td>
<td>641,317</td>
<td>55.6%</td>
<td>11%</td>
<td>21</td>
<td>4.2%</td>
<td>49.8%</td>
</tr>
</tbody>
</table>

* Mixed-race individuals who reported being American Indian in combination with Black, Asian, or Pacific Islander were excluded from the definition of American Indian in this analysis. Individuals who predominantly self-identified as American Indian and occasionally also reported being white or Latino, with Latino being a race category, not an ethnicity category, in our datasets, were for the most part included.
** International students who were not yet naturalized U.S. citizens at the time of enrollment were excluded.
*** Includes three tribally run colleges and universities

Source: Statewide Longitudinal Education Data System
Research opportunities for the underserved undergraduate students

- NIGMS places strong emphasis on diversity and inclusion in biomedical research
- Provide opportunities for underserved and underrepresented groups from northern Minnesota

- First round of training programs
- Bridges to the Baccalaureate
- Indians into Research Careers
- Bridges to the Doctorate
Bridges to the Baccalaureate

- Original program
  - Research Assistant position
    Fond du Lac Tribal and Community College (23.8 miles)
    Lake Superior College (6.2 miles)
    Lac Courte Oreilles Ojibwe College (87.3 miles)
    Leech Lake Tribal College (136 miles)

- Bridges to the Baccalaureate, NIGMS (1995-2022)

- Current Program
  Fond du Lac Tribal and Community College
  Lake Superior College
Bridges to the Doctoral Degree

- Fellowship support for MS level graduate studies
- 1995-2000
- Bridges to the Doctorate, NIGMS
- UM Duluth students
- Transition to UM-Minneapolis
- 9 MS degrees
- 3 Ph.D.
- 2 MD
- Phased out with unitary accreditation for the Medical School in 2000
Indians into Research Careers

- Undergraduate Fellowships; tuition and stipend
- 2002-2007
- Minority Access to Research Careers, NIGMS
- UM Duluth Undergraduate students in STEM
  - 8 Trainees
  - 6 graduated with Baccalaureate degree
  - 2 MS
  - 2 received PhD
  - 2 dropped out
Outcomes for 1995-2000
Targeted to Native Americans

- **Bridges to the Baccalaureate**
  - 50 Trained
  - 32 Associates Degrees

- **Bridges to the Doctorate**
  - 8 Trained
  - 8 MS degrees
  - 3 PhD
  - 1 MD

- **Indians into Research Careers**
  - 8 Trained
  - 6 BA/BS
  - 3 PhD
Lessons learned

- Cohort size is important
- Distance from home is a major barrier
- Communication Skills improves confidence
- Family and community are important considerations
- Screening for admission was too stringent of traditional criteria, need to shift to a Holistic Admissions Criteria
- Critical Reasoning
- Develop a community within the cohort, faculty and staff
- Confidence, a sense of belonging
Reassessment of the program strategy

- Native American trainees felt isolated
- Baccalaureate Bridge trainees drop out of the program during the first year
- Intimidation towards learning laboratory procedures at the bench
- Selection into the MARC program was too stringent, lost opportunities
- Timetable imposed by the MARC program was formidable, must maintain GPA>3.5 with full time course load at 15 credits per semester
- Gatekeeper coursed were the biggest challenge
Do introductory courses disproportionately drive minoritized students out of STEM pathways?

Hatfield N, PNAS Nexus (2022) doi.org/10.1093/pnasnexus/gpac167

- Women earned 58% of all BA/BS degrees, but women only earned 36% of the STEM degrees
- Black, Hispanic and Native Americans (URM) are 30% of the US population
- 34% of incoming STEM undergraduates are from URM
- Only 18% continue to complete the STEM degree

- Concern raised by NSF, NIH and HHMI about potential structural barriers
- Explore alternative approaches to the current trend of Bridge Programs, Remedial and Developmental Courses, Undergraduate Research Experiences
Relative numbers of students from the survey

<table>
<thead>
<tr>
<th>Sex</th>
<th>White</th>
<th>Asian</th>
<th>Black</th>
<th>Hispanic/Latinx</th>
<th>Native American</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>41,868</td>
<td>2,452</td>
<td>3,613</td>
<td>3,487</td>
<td>480</td>
</tr>
<tr>
<td>Male</td>
<td>47,679</td>
<td>3,258</td>
<td>2,465</td>
<td>3,387</td>
<td>442</td>
</tr>
<tr>
<td>Total</td>
<td>89,497</td>
<td>5,710</td>
<td>6,078</td>
<td>6,863</td>
<td>922</td>
</tr>
</tbody>
</table>

Total number of students matriculated 109,070
Native Americans 922 (0.85%)

Native Americans are less than 2% of the population, but only 0.85% in STEM curriculum
Gatekeeper Courses

- URM population, in particular Native Americans are small numbers
- A more robust sampling of student data was obtained from MIDFIELD, (Multiple Institution Database for Investigating Engineering Longitudinal Development)
- R1/R2 scholastic records
- 6 schools were selected with sufficiently complete records.
- Compared Graduation and record of DFW (D or F grade and Withdrawal)

- White students with 1-2 DFWs are just as likely to graduate with a STEM degree as a Black student with 0 DFWs
- For academically prepared students passing all introductory STEM classes
  - 48% of white male students will graduate with the STEM degree
  - 35% of the URM female students will graduate with a STEM degree
Figure 5
Pathway to Identify as a Biomedical Scientist

Counseling
Academic Advisement
Communication Skills

Faculty Mentors
Peer Mentors
Research Seminars

Experimental Skills
Critical Thinking
Data analysis

Develop a Research Project
Present Data Club
Present Program Symposia

Present at a National Meeting
Publish research product
Progress into Graduate School
<table>
<thead>
<tr>
<th>School</th>
<th>Total Enrollment</th>
<th>Full-Time Enrollment</th>
<th>25-64 Years (%)</th>
<th>Female (%)</th>
<th>Native American (%)</th>
<th>African American (%)</th>
<th>Hispanic American (%)</th>
<th>Full-Time Retention Rate (%)</th>
<th>Graduation Rate (%)</th>
<th>Transfer Rate (%)</th>
<th>First Time as Undergraduate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSC</td>
<td>5394</td>
<td>2140</td>
<td>38</td>
<td>57</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>53</td>
<td>29</td>
<td>22</td>
<td>28 (associate’s degree)</td>
</tr>
<tr>
<td>FDLTCC</td>
<td>1727</td>
<td>419</td>
<td>29</td>
<td>59</td>
<td>16</td>
<td>8.5</td>
<td>2.8</td>
<td>62</td>
<td>20</td>
<td>20</td>
<td>36 (associate’s degree)</td>
</tr>
<tr>
<td>UMD</td>
<td>9239</td>
<td>8890</td>
<td>10</td>
<td>47</td>
<td>0.6</td>
<td>2.2</td>
<td>2.5</td>
<td>78</td>
<td>36</td>
<td>N/A</td>
<td>82.5 (four-year BS/BA)</td>
</tr>
</tbody>
</table>
Table 3
Profile of UMD Students in the SCSE

<table>
<thead>
<tr>
<th>Group</th>
<th>SCSE</th>
<th>% Total SCSE</th>
<th>UMD</th>
<th>% Total UMD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Originate from Minnesota</td>
<td>2748</td>
<td>84.7</td>
<td>9194</td>
<td>84.7</td>
</tr>
<tr>
<td>Originate from Midwest</td>
<td>389</td>
<td>10.0</td>
<td>1087</td>
<td>10.0</td>
</tr>
<tr>
<td>American Indian</td>
<td>47</td>
<td>1.4</td>
<td>256</td>
<td>2.4</td>
</tr>
<tr>
<td>African American</td>
<td>94</td>
<td>2.6</td>
<td>280</td>
<td>2.6</td>
</tr>
<tr>
<td>Hispanic/Latinx</td>
<td>100</td>
<td>2.8</td>
<td>308</td>
<td>2.8</td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>5</td>
<td>0.1</td>
<td>23</td>
<td>0.2</td>
</tr>
<tr>
<td>Asian</td>
<td>204</td>
<td>6.1</td>
<td>516</td>
<td>4.8</td>
</tr>
<tr>
<td>International</td>
<td>115</td>
<td>3.4</td>
<td></td>
<td>3.4</td>
</tr>
<tr>
<td>White</td>
<td>2751</td>
<td>82.1</td>
<td>8198</td>
<td>75.5</td>
</tr>
<tr>
<td>Undetermined</td>
<td>35</td>
<td>9.4</td>
<td>1036</td>
<td>9.5</td>
</tr>
<tr>
<td>19-20 year olds</td>
<td>1295</td>
<td>33.4</td>
<td>3867</td>
<td>35.6</td>
</tr>
<tr>
<td>21-23 year olds</td>
<td>1121</td>
<td>30.9</td>
<td>3360</td>
<td>30.9</td>
</tr>
<tr>
<td>Young Adults (19-23 year olds)</td>
<td>2416</td>
<td>66.6</td>
<td>7227</td>
<td>66.6</td>
</tr>
<tr>
<td>Male</td>
<td>2252</td>
<td>67.2</td>
<td>5538</td>
<td>51.0</td>
</tr>
<tr>
<td>Female</td>
<td>1099</td>
<td>32.8</td>
<td>5298</td>
<td>48.9</td>
</tr>
<tr>
<td>Unknown gender</td>
<td>1</td>
<td>.03</td>
<td>22</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Total population</strong></td>
<td><strong>3352</strong></td>
<td><strong>100.0</strong></td>
<td><strong>10858</strong></td>
<td><strong>100.0</strong></td>
</tr>
<tr>
<td>Disabilities</td>
<td>110</td>
<td>3.3</td>
<td>N/A</td>
<td>NA</td>
</tr>
<tr>
<td>Under-represented</td>
<td>246</td>
<td>8.0</td>
<td>867</td>
<td>7.3</td>
</tr>
</tbody>
</table>
Thriving in the Research Environment

- Professionalism
- Critical Reasoning
- Communication Skills
- Bench Skills
- Teamwork

Build a community within the cohort

Shared experiences

Meet with faculty and staff in group meeting to lower social barriers
Pathways to Advanced Degrees in the Life Sciences (PADLS)

- Change the approach to incorporate active learning, team science and public speaking
- Expand the number of trainees to include URM, first generation and low income
- Resources
  - Teaching laboratory
  - Study and conference area
  - Increase staff and faculty from the NIGMD
- Funding (NIGMS)
  - Bridges to the Baccalaureate
  - Initiative for Maximizing Student Development
<table>
<thead>
<tr>
<th>SRA Year</th>
<th>Program</th>
<th>Competency</th>
<th>Training Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bridges and Pathways</td>
<td>Academic skills and career planning</td>
<td>Academic self-assessment, Book club, Preparation for graduate school</td>
</tr>
<tr>
<td>1</td>
<td>Bridges and Pathways</td>
<td>Interdisciplinary research skills</td>
<td>Safety and appropriate behavior in the laboratory, Research techniques, Keeping a laboratory notebook, Computer programming</td>
</tr>
<tr>
<td>1</td>
<td>Bridges and Pathways</td>
<td>Responsible conduct in research</td>
<td>Ethical behavior, Research integrity, Research subjects protection, Reproducibility of data</td>
</tr>
<tr>
<td>1 and 2</td>
<td>Bridges and Pathways</td>
<td>Communication</td>
<td>Public speaking sessions, Debates, Research presentations</td>
</tr>
<tr>
<td>1 and 2</td>
<td>Bridges and Pathways</td>
<td>Critical thinking</td>
<td>Problem-based learning, Self-directed learning, Concept mapping</td>
</tr>
<tr>
<td>2</td>
<td>Bridges</td>
<td>Team-based research</td>
<td>Interdisciplinary collaboration, Presentation at Bridges &amp; Pathways symposium</td>
</tr>
<tr>
<td>2</td>
<td>Pathways</td>
<td>Faculty-directed research</td>
<td>Develop ownership of research project, Presentation at Bridges &amp; Pathways symposium</td>
</tr>
</tbody>
</table>
FIGURE 1. Reported gains on the SURE after participation in Bridges and Pathways programs. Students reported whether they had experienced no gain or very small gain, small gain, moderate gain, large gain, or very large gain on an online survey. Questions were reordered such that areas of very large gain are at the top.
<table>
<thead>
<tr>
<th>Program</th>
<th>No. of Trainees</th>
<th>No. Completed the Program</th>
<th>No. Awarded Degree</th>
<th>No. Transferring to Baccalaureate Program</th>
<th>No. Enrolled in Postgraduate Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridges</td>
<td>51</td>
<td>39</td>
<td>43 (Associate)</td>
<td>27</td>
<td>6</td>
</tr>
<tr>
<td>Pathways</td>
<td>60</td>
<td>49</td>
<td>49 (Bachelor of Arts, Bachelor of Science)</td>
<td>Not Applicable</td>
<td>29</td>
</tr>
</tbody>
</table>
Transfer rate from Bridge was 52.9
LSC 22%
FDLTCC 20%

Graduation from the Pathways was 87% within 2-years of program completion

Peer reviewed publications 14
National Presentations 67
Student research award at ABCRMS 1
Support

- Mary Cannedy-Clarke
- Mick Gillespie (FDTCC)
- Andy Wold (FDTCC)
- Terrance Wilcox (LSC)
- Pete Willemsen (Comp Sci)
- Phyllis Lindberg
- Amy Prunuske
- George Trachte
- Larry Wittmers
- Raj Karim

- Faculty
  - Medical School
  - School of Pharmacy
  - NRRI
  - EPA
  - Biology
  - Chemistry
  - Chemical Engineering
  - Psychology
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- Dennis Clayton (UM Graduate School)
- Josie Johnson (UM VP Diversity)
- Jack Briggs (President, FDTCC)
- Steve Hedman (UMD Graduate School)