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Ergonomics in the Biosciences

Ira Janowitz, PT, CPE
Lawrence Berkeley National Laboratory
"What the cathedral was to the 14th century and the office building was to the 20th century, the laboratory is to the 21st century."

Don Prowler, LS&EM Conference, 2001
Ergonomics Risk Factors

Many lab activities involve repetitive, forceful pinching in awkward postures
High precision demand
Static postures → Fatigue, Contact stress
Manual Pipetting

• Frequent use (>300 hrs/yr) associated with high risk of hand & shoulder problems

• Elevated rates MSDs (Bjorksten, 1994)
  – Hand problems (OR 5.0)
  – Shoulder problems (OR 2.4)

• Increased risk (David & Buckle, 1997)
  – pipetting > 1-1.5 hours per day
Microscopy

- 85% of cytotechnologists with musculoskeletal symptoms: headache, neck pain/stiffness, back pain, upper-extremity discomfort.
- numbness, tingling, and/or pain in the fingers: >1/3 Left, 1/2 Right

(Thompson, 2003)
<table>
<thead>
<tr>
<th>Anatomical Location</th>
<th>Employee Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>50-60</td>
</tr>
<tr>
<td>Shoulders</td>
<td>65-70</td>
</tr>
<tr>
<td>Back (Total)</td>
<td>70-80</td>
</tr>
<tr>
<td>Lower Back</td>
<td>65-70</td>
</tr>
<tr>
<td>Lower Arms</td>
<td>65-70</td>
</tr>
<tr>
<td>Wrists</td>
<td>40-60</td>
</tr>
<tr>
<td>Hands and Fingers</td>
<td>40-50</td>
</tr>
<tr>
<td>Legs and Feet</td>
<td>20-35</td>
</tr>
</tbody>
</table>
Workstation adjustability is a key factor in our ability to adapt work areas to the constantly changing people, task, and equipment in the lab environment.

“Biosafety cabinets and laboratory workbenches …present ergonomic hazards which are mostly due to lack of adjustability & leg room.”

CDC, Laboratory Ergonomics website, 9-24-07
http://www.cdc.gov/od/ohs/Ergonomics/labergo.htm
Where should things go?
Height adjustability adapts to changes in equipment and technology over time
Modular lab furniture
Bench top DNA Hood before ergo modification: Inadequate legroom & long reach distances → flexed back and awkward neck/shoulder posture
Early mock-ups for 454 group input & collaboration w/ Ergo Team (June 07)
Bench top DNA Hood design

Ergonomic features:
1. Recessed area & tilted receptacles reduce awkward wrist postures
2. Padding protects elbows & forearms
3. Programmable pipette (Eppendorf Xstream) improves hand position, reduces force & repetitive movement
SOMA Hybrid chair
References

JGI Ergonomics Program

“A recipe for success to improve worker safety and health”

Presented by
Melanie Alexandre
and
Christine Naca
Overview

- Description of the JGI
- Review of Production Tasks
- JGI Ergonomics Program
Mission:

DOE JGI, Serving as a genomic user facility in support of the DOE missions: bioenergy, carbon cycling, and bioremediation.
Office & Manufacturing
Work Environments

60% staff in computer-intensive office settings

40% staff in hand-intensive production tasks
(2 shifts)
Root Causes of Ergonomic Injuries

- Equipment/instruments designed for small batches/small lab use now being used for high throughput operation

- Culture:
  - Understanding Efficiency vs. Speed

- High force finger-intensive tasks

We are striving to determine how much is too much
History of Ergonomics at JGI  
(Dec 2005-Current)

- **Dec’05**
  - Establish Ergonomics Program for JGI

- **Dec’06**
  - JGI Wins 2007 Ergo Cup Award at Applied Ergonomics Conference

- **Mar’07**
  - December Stand Down of Production Line

- **Aug’07**
  - JGI Ergo Points In House Risk Assessment Tool

- **Nov’07**
  - Required Practices Established to control risk
  - Early Intervention Program Established

- **Feb’08**
  - Daily Monitoring

- **Oct ‘09**
Early intervention
Targets employees with discomfort
Includes bi-weekly review meeting

Proactive Efforts
Labs and offices
Monitoring
Walk-abouts
Comfort surveys

Safety Culture Working Group
Promotion
Awareness
Communication

Training/education
Risk targeted classes
Stretch break programs
Potty training
Website resources

Relaxation/Rejuvenation Room

Ergonomics Demo Room

Work tool and practices
Ergo Points
Required Practices
Top 3 High Risk Factor Tasks (Then-2007)

- **Thermal Cycler Loading**
- **Peeling Seals**
- **Freezer Rack Lifting**
Top 3 High Risk Factor Tasks (Now-2007)

- Pipetting
- Capping/uncapping
- Vortexing
Employee Driven Designs
454 & Illumina Pipetting

Viaflo

Vistalab Ovation

Eppendorf Xstream
Best Practices

Don’t use thumbs to open tubes.

Use uncapping tool to open ALL tubes, .2mL, 1.5mL, 2.0mL
Ergo Points

• Supervisors want to know…
  “HOW MUCH IS TOO MUCH?”

• Guidelines for schedulers
  – What tasks can be scheduled together
  – How many tasks can be conducted in one day

• No ergonomics risk tool exists for low force high repetition tasks

GOAL: Reduce ergonomic risk caused by the combination of tasks assigned
‘Ergo Points’
<table>
<thead>
<tr>
<th>Field</th>
<th>Weight Watchers Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Fries</td>
<td>10</td>
</tr>
<tr>
<td>Cheeseburger</td>
<td>7</td>
</tr>
<tr>
<td>Handling bio-assay trays</td>
<td>20</td>
</tr>
<tr>
<td>Loading/Unloading Stackers (Top Loading)</td>
<td>16</td>
</tr>
<tr>
<td>Big Mac</td>
<td>14</td>
</tr>
<tr>
<td>Loading/Unloading Stackers (Front Loading)</td>
<td>18</td>
</tr>
<tr>
<td>Casing Cobs and Seals</td>
<td>18</td>
</tr>
</tbody>
</table>
Tour of Ergo Projects
This work was performed under the auspices of the US Department of Energy's Office of Science, Biological and Environmental Research Program, and by the University of California, Lawrence Berkeley National Laboratory under contract No. DE-AC02-05CH11231, Lawrence Livermore National Laboratory under Contract No. DE-AC52-07NA27344, and Los Alamos National Laboratory under contract No. DE-AC02-06NA25396.