

## **Where the Action Is**

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The focus of this presentation is on the changes in structure and composition of surface and near-surface material resulting from sliding of ductile materials, with or without lubrication. The phenomena involved have been studied since the days of Beilby. However, experimental techniques and computer simulations now available to us have recently revealed much about what happens at various size scales when solids slide against each other. Although details vary considerably, certain tribological and tribochemical processes are commonly observed. These include extensive deformation, transfer and mechanical mixing, with major influences from environmental effects, for example, oxidation. Godet's third-body ideas are relevant and seem to be broadly correct, but the wide variety of sliding behavior that is observed in practice requires that we investigate in detail how third-body material is formed in different cases. Material near a sliding surface is driven far from equilibrium, so the materials produced are much different from the starting material, and they have very different mechanical properties, which affect both friction and wear. Molecular dynamics simulations suggest that material flows like a fluid near a boundary, and that mixing arises from vorticity that develops when shear strains and strain rates are large. This model is quite general—it applies to crystalline and amorphous materials, as well as to composites. It also suggests connections with other important processes, including mechanical alloying and friction stir welding.