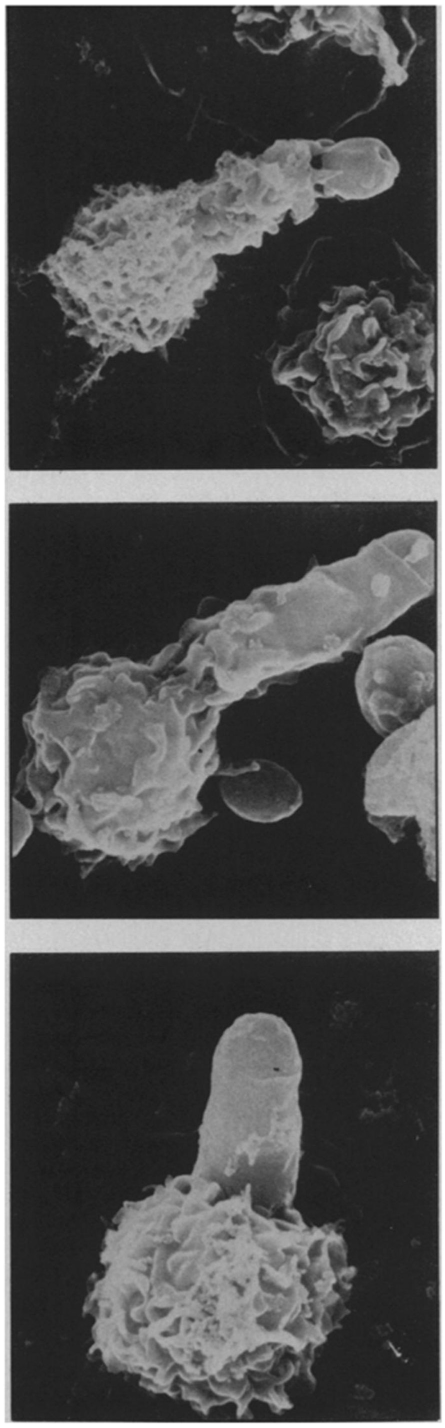
Scanning the action of cleanup cells

Small particles enter the lungs with every breath of air. Some, like asbestos, are extremely harmful, but others can be handled by a physiological cleanup crew. Macrophage cells take in particles identified as foreign by their surface characteristics. For many years, microscopists have observed that a macrophage, on contact with an appropriate particle, appears to grow an extension to enclose the foreign material. Now researchers at Battelle Memorial Institute in Richland, Wash., have obtained scanning electron micrographs showing the steps of macrophage action.

"Macrophages can reach out with tubular extensions of a membrane that can ingest, or eat, particles within a 50-60 micron radius of the cell body," says John Hadley. In their experiments Hadley and Charles Sanders incubate macrophages from rabbit lungs, with yeast cells as the foreign bodies. In the micrographs, the macrophages can be identified by their ruffled surfaces; the yeast cells look like grapes. When one of a macrophage's fine hair-like cilia senses a yeast cell, the cilium immediately swells. The enlarged cilium is called a pseudopod or agrapod (meaning "seizing foot"). The agrapod gradually engulfs the yeast and then brings it back to the macrophage cell body. There it is digested by intracellular enzymes. In this manner the macrophage can clean a deep lung area forty times its own size, Hadley and Sanders say. As part of a Department of Energy-sponsored project analyzing respiratory system response to environmental pollution, the researchers plan to investigate how heavy metals, such as cadmium, affect the macrophage's cleaning action. □



James E. Coleman/Battelle

Macrophages caught in sequential stages of their cleanup act. Rabbit lung macrophages locate and ingest yeast cells.

Helium 3 attracts more attention

Liquid in a vessel is interesting to solid state physicists because of the variety of phenomena that typically occur along the boundary between the fluid and solid walls. Not unlike a wartime front, this interface between dissimilar materials is a site of dynamic and enigmatic activity.

In particular, physicists have lately had a keen interest in the unusual effects that transpire between liquid helium 3 (a rare natural isotope whose nuclei each contain two protons and one neutron) and various solid elements like silver, copper, platinum and carbon. In these cases, at very low temperatures, it has been measured that heat is able to traverse an interface with much greater facility than normally expected. This circumstance, of course, has direct implications on our ability to assess the relative merits of various cooling and insulating devices, especially as they apply to helium 3.

A recent experiment by a group at Helsinki University of Technology produced results that bear, albeit indirectly, upon this puzzle. A. J. Ahonen (now at Cornell University), T. A. Alvesalo, T. Haavasoja and M. C. Veuro found evidence that strongly corroborates earlier indications that the He3 atoms lying very close to — but not including those in direct contact with — the other material (in this case carbon) seem to undergo a major alteration of their mutual relationship at less than one-thousandth of a degree above absolute zero. Although the precise connection between this observation and the cause for the anomalous heat conduction remains unclear, the recent data illustrate the generally peculiar nature of the interactions between helium 3 and carbon.

Indications of the dramatic transformation occurring within the boundary layers of the helium came via measurements of its magnetic properties and are characteristic of a phenomenon called ferromagnetism. This is best understood by first recalling that an atom can be like a small magnet, with its own north and south poles. Under normal circumstances, liquid helium 3 has almost as many of its atomic magnets aligned one way as the opposite and is referred to, consequently, as a paramagnetic material. Its abruptly at low temperatures becoming ferromagnetic simply means that the atomic magnets all spontaneously orient themselves in one direction, thereby behaving cooperatively as a single permanent magnet.

Remarkably, however, all this drama occurs only within a very thin portion — about .00000002 centimeters thick — and situated between the helium atoms that actually touch the carbon and the rest of the liquid. Judging from its peculiar nature, however, the helium-carbon interface is being mediated by a concomitantly unusual interaction. Normally, interfaces of this kind are the domain of the so-called van der Waals interaction, which is a feeble force generally felt between atoms and molecules that derives from their electrically charged constitution. Apparently, however, there are forces besides this one that presumably underlie both the anomalous magnetic behavior and thermal properties of liquid helium 3 interfaces. More details can be found in the Aug. 14 PHYSICAL REVIEW LETTERS. □

Equality: Still a goal in United States

Terms such as "equal opportunity," "human rights" and "civil liberties" float through social and political circles like so much verbal particulate. But when the smog clears, how does one determine the progress of a society toward achieving such goals? The U.S. Commission on Civil Rights has attempted it by measuring available statistics in areas of education, employment, income and poverty and housing.

The data — developed from 1960 and 1970 censuses and from the 1976 Survey of Income and Education Public Use Sample Tapes — "show that . . . women and minority men have a long way to go to reach equality with majority men, and in many instances are relatively further from equality in 1976 than they were in 1960," the commission concludes in its newly released report, "Social Indicators of

Continued on page 158