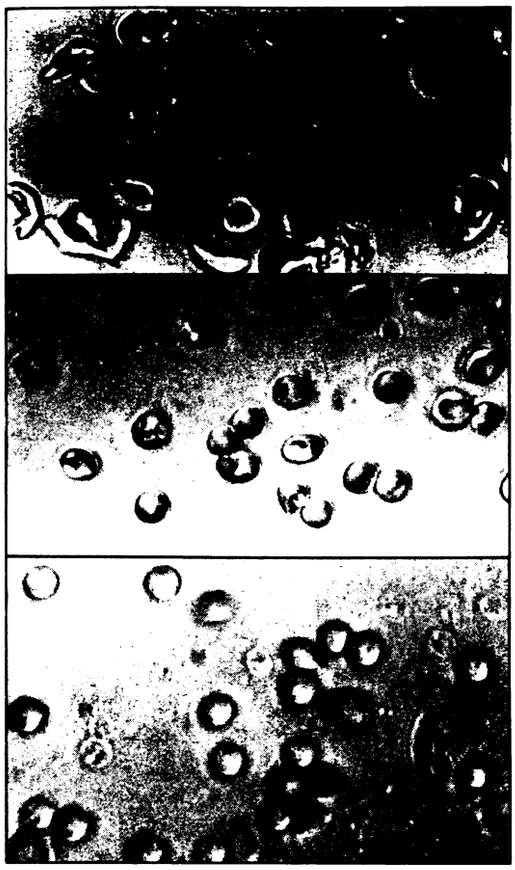

Rich et al./PNAS

Top to bottom: sickle cells; normal cells; cells treated with benzyl esters.

found that if they put certain small proteins (peptides) into red blood cells from sickle cell patients, the peptides would keep the red blood cells from sickling. But it took fairly heavy concentrations of peptides to penetrate red blood cells. Rich and his colleagues have since tested derivatives of the peptides and found them to be just as effective as the peptides but able to get into red blood cells easier. They report in the January PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES that peptide derivatives called amino acid benzyl esters do the trick nicely — apparently by binding to sickled hemoglobin molecules, by modifying the membranes of sickled red cells, or both.

After Rich and his co-workers determined that amino acid benzyl esters were able to prevent sickling of sickle cell patients' red cells, they compared the ability of various esters to produce the effect. They found that esters from amino acids with a high degree of hydrophobicity (aversion to water) were especially potent. They tested the esters on normal red blood cells' membranes to make sure that the esters did not damage them. Then they injected one of the most promising esters into mice and, as they hoped, it showed low toxicity. On the basis of all this data, they concluded: "Benzyl esters of hydrophobic amino acids and related compounds may prove to be useful in the treatment of sickle cell disease." □

R(3.17) or the color chemistry of quarks

Once upon a time the quark theory seemed like a fairly simple way of explaining the properties of nearly all the subatomic particles of physics. The particles were divided into two broad classes, the baryons, which are made of three quarks, and the mesons, which are made of two. Three varieties or "flavors" of quark, called up, down and strange, managed to serve to constitute all the particles known in various permutations.

Nothing in life stays simple. Theorists now see a need for six flavors of quark — charm, bottom and top have been added. This introduces new physical properties and increases the number of possible quark permutations. But until now the dual classification into baryons and mesons had held. Nobody had seen a single particle that had more than three quarks in it.

Evidence for just such a thing, a five-quark particle, may now have been found at the CERN laboratory in Geneva, according to a report at the recent meeting of the American Physical Society by Gerald A. Smith of Michigan State University. The finding was by a collaboration of physicists from Michigan State, the Universities of Birmingham, Cambridge, Glasgow and Paris, and CERN.

One of the recent complexities of quark theory is the attempt to study the behavior of quarks and their interrelationships inside particles. In such a quark dynamic study, one in which K mesons (a strange and an up quark) were struck against protons (two ups and a down), a particle appeared that gave indications of containing three strange quarks. Ordinary quark theory does not permit that combination.

A possible explanation of this unusual particle, which is being tentatively called R(3.17) is a "three-baryon resonance," a fleeting state in which three baryons are very temporarily stuck together. Its mass, 3.17 billion electron-volts, goes well with that supposition. The more exciting explanation is that the R(3.17) is a five-quark baryon, precursor of a whole new genus. Five-quark baryons (they have as yet no more distinctive technical name) are not part of the ordinary quark theory but are predicted by an extension called color chemistry. (Color is the name of the force that holds quarks together.) This is "chemistry" because the geometry of the configurations formed by the quarks is important. Smith suggests that R(3.17) consists of "two distinct clusters of two and three quarks respectively connected as on the ends of a dumbbell and rotating about its center with high velocity," a direct analogy to a molecule. If R(3.17) is a five-quark baryon, others should begin to appear. □

Pot: Off the streets, into the drugstores

In a move reminiscent of a pre-game pep rally, the government met with pharmaceutical companies Jan. 18 to whip up enthusiasm for Delta-9-Tetrahydrocannabinol (THC), the active ingredient in marijuana. The government's rallying cheer? Take THC to the marketplace!

Since then the National Institute on Drug Abuse and the Food and Drug Administration have met a second time with one of ten companies that attended the January session and plan similar meetings with four other drug companies that also have shown interest in marketing THC. Although government-sponsored sessions on potentially marketable drugs are not unusual, the history behind THC and the fact that several pharmaceutical companies now have shown interest in developing it weave an interesting tale.

Before it became an illegal substance in the 1930s, marijuana had been used in a number of medical preparations. But it was not until a young cancer patient noticed less nausea and vomiting, a side-effect of chemotherapy, after smoking street marijuana that interest was revived in marijuana as medicine. Researchers applied to FDA for grants to investigate the anti-nausea phenomenon and began experimenting with NIDA-supplied THC. Scientists have also found THC to be an effective treatment for glaucoma and the spasms associated with multiple sclerosis.

Still, from an economic viewpoint, the three potential applications of THC comprise only a "small market," causing drug companies to think twice about the high-risk investment of developing THC, explains Edward Tocus, a pharmacologist for the FDA's bureau of drugs. Furthermore, "THC has a reputation that some companies just don't want to mess with," Tocus says, referring to the social stigma attached to marijuana. Also, drug companies traditionally have shunned THC because of the red tape and security involved in researching a Schedule I drug — a substance classified as having high abuse potential and no redeeming medical value. Other deterrents include marijuana's notorious euphoria, the problem of encapsulating the resinous, sticky THC and the fact that THC is unevenly absorbed by the body when taken orally. Finally, although marketing processes can be patented, THC as a composition of matter cannot be patented.

Despite THC's complicating attributes, Robert Willette, chief of NIDA's research technology branch, believes THC already has passed through enough flaming laboratory hoops. Stephen E. Sallan and coworkers of Sidney Farber Cancer Institute