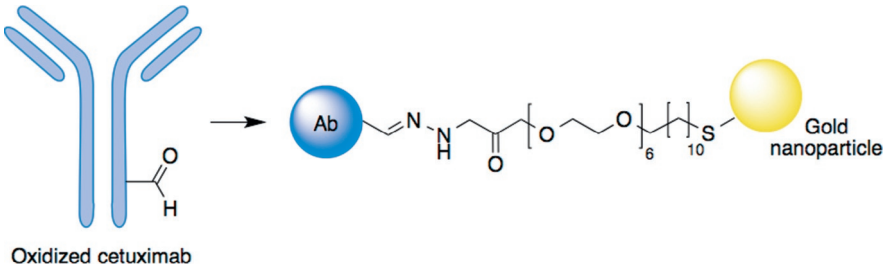

FIGURE 13.51

An antibody-targeted gold nanoparticle.

carbohydrate moieties to aldehyde groups on the Fc region of the antibody. It was then allowed to covalently bind to the linker by formation of an hydrazine. Finally, this Ab-linker species was attached to the gold nanoparticles via a thiol–gold binding reaction (Figure 13.51).

Mild hyperthermic cancer treatments have been in clinical use since the early 1980s because normal tissues tolerate hyperthermia at higher temperatures and for longer periods of time than do malignant tissues. In 2008, it was shown that gold nanorods (single-walled carbon nanotubes) could be used in near-infrared (NIR) laser photothermal therapy to achieve selective tumor cell ablation and resorption/remission *in vivo*. NIR-absorbing PEGylated gold nanorods were systemically or intratumorally administered in mice bearing head and neck tumor models (squamous cell carcinoma), and the subsequent exposure to near-infrared lasers of the nanoparticle-loaded tumors for just 10 minutes resulted in temperature increases of more than 20°C, with minimal damage to surrounding tissues.

7.4 DENDRIMERS AS CARRIERS FOR THE DELIVERY OF CHEMOTHERAPEUTIC AGENTS

Dendrimers are a family of nanosized, three-dimensional polymers characterized by a unique treelike branching architecture and compact spherical geometry in solution. Their development started in the 1970s, but the first family of hyperbranched polymers was developed in 1984. They are sought for a variety of applications in chemistry, biology, and medicine, being particularly interesting for the delivery of anticancer drugs and imaging agents. However, their translation into cancer therapies is lagging due to the difficulty of synthesizing the proposed systems in large quantities at clinical-grade purity and to the regulatory hurdles that demand detailed characterization of the polymeric carriers, the linkages, and the incorporated drug.[115]

7.5 NANOPARTICLE ALBUMIN-BOUND TECHNOLOGY

In addition to angiogenesis, tumors have adapted other mechanisms to meet their increased need for nutrients. One of them is the gp60 pathway, by which nutrients are preferentially transported across the endothelial barrier when attached to albumin. They also secrete into the tumor's interstitium the glycosylated 43-kDa specialized protein called SPARC (secreted protein, acidic and rich in cysteine), also known as osteonectin and as BM-40, that modulates the interaction between cell and extracellular