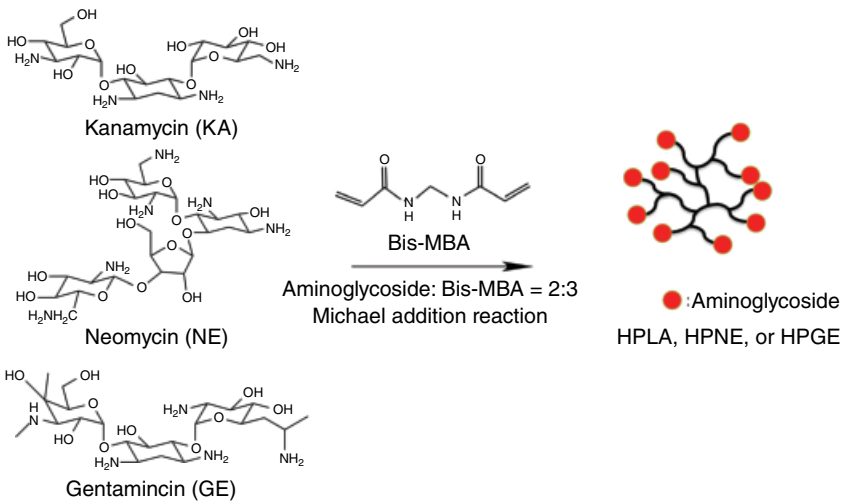
an antibacterial nanomaterial utilizing mesoporous silica nanoparticle (MSN) as the porous core and lysozyme (Lys), hyaluronic acid (HA), and 1,2-ethanediamine (EDA)-modified polyglycerol methacrylate (PGMA) as the shell (Wu et al. 2015). In this study, amoxicillin (AMO) was chosen as the model drug loading at the MSN, and biocompatible layer-by-layer (LBL) technique was used for coating the hyaluronidase-responsive shell. After being treated with Gram-positive bacteria or Gram-negative bacteria, the shell could be disassembled by hyaluronidase of pathogens, with that the AMO was released to react on and kill drug-resistant bacteria.

In 2018, the concept of constructing hyperbranched polymer using antibiotics was proposed and practiced by Schoenfisch's group (Yang and Schoenfisch 2018). As shown in Scheme 16.14, they synthesized and characterized a series of hyperbranched polyaminoglycosides via respective polymerization of kanamycin, gentamicin, and neomycin. The resulting polymers with great branching degrees and antibiotic terminal groups are more effective in eradicating all selected dental pathogens. It was a promising model for the therapeutic index in future biomedical application. In addition to the above mentioned examples, traditional antibiotics can be modified with a numerous of classical or modern materials, and the collision of materials science and antibacterial drugs will enormously contribute to the development of antibacterial materials for treating clinical infections.



Scheme 16.14 Schematic illumination of the synthesis process of aminoglycoside-terminated hyperbranched polyaminoglycosides. *Source:* Reprinted from Bai et al. (2017b) with permission. Copyright 2018, American Chemical Society.