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**ANNUAL REVIEW OF BIOMEDICAL ENGINEERING** (/content/journals/bioeng) **Volume 2, 2000** (/content/journals/bioeng/2/1)

## Microfabricated Microneedles for Gene and Drug Delivery

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Vol. 2:289-313 (Volume publication date August 2000)

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### ■ Abstract

By incorporating techniques adapted from the microelectronics industry, the field of microfabrication has allowed the creation of microneedles, which have the potential to improve existing biological-laboratory and medical devices and to enable novel devices for gene and drug delivery. Dense arrays of microneedles have been used to deliver DNA into cells. Many cells are treated at once, which is much more efficient than current microinjection techniques. Microneedles have also been used to deliver drugs into local regions of tissue. Microfabricated neural probes have delivered drugs into neural tissue while simultaneously stimulating and recording neuronal activity, and microneedles have been inserted into arterial vessel walls to deliver antirestenosis drugs. Finally, microhypodermic needles and microneedles for transdermal drug delivery have been developed to reduce needle insertion pain and tissue trauma and to provide controlled delivery across the skin. These needles have been shown to be robust enough to penetrate skin and dramatically increase skin permeability to macromolecules.

**Keyword(s):** DNA (/search?value1=%22DNA%22&option1=pub\_keyword), injections (/search?value1=%22injections%22&option1=pub\_keyword), MEMS (/search?value1=%22MEMS%22&option1=pub\_keyword), micromachining (/search?value1=%22micromachining%22&option1=pub\_keyword), needles (/search?value1=%22needles%22&option1=pub\_keyword)

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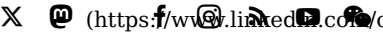
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