firefighters, painters, woodworkers, janitors, and men exposed to solvents and other chemicals at work are more likely to be miscarried or to develop cancer later in life.

Historically, women were blamed when something went awry in fetal development. But now the censure once reserved for "crack moms" can easily be extended to "crack dads."

Men manufacture new sperm continuously throughout life, with each one living about 74 days. Scientists once thought that defective sperm were doomed to die with the roughly 40 million unrequited suitors in every ejaculation. But now it seems that some kinds of damage do not hinder sperm in their race to fertilization. The result can be embryos with high vulnerability to problems including autism and cancer.

Men's reproductive health is most robust in their twenties, and after that it's downhill. Each year after puberty, a man's sperm-making cells divide about 23 times. By age 40, these vital human building blocks have gone through about 610 rounds of replication, each with a chance for genetic error.

Demographic studies have shown that babies whose fathers are under 20 or over 40 have slightly more health problems than children whose fathers were in their twenties when they were conceived. The reasons are not clear, but more and more evidence shows that current environmental factors can take a toll on the health of future generations. A gene doesn't have to develop an actual mutation in order to pass on unhealthy traits. Slight changes in chemicals can turn genes on or off at the wrong time, or label the genetic material improperly. "Scientists have discovered that chemical modifications to DNA and proteins can change the way genes are packaged and regulated without changing the genes themselves," Saey writes. It may be that the older the individual, the greater the opportunity for slight anomalies to creep in. And changes caused by aging, or exposure to toxins, form a "molecular scrapbook" handed down—from dad as well as mom—to countless future generations.

SCIENCE & TECHNOLOGY

Better Living Through Chemistry

THE SOURCE: "Better Brains, Better Selves? The Ethics of Neuroenhancements" by Richard H. Dees, in ***Kennedy Institute of Ethics Journal***, Vol. 17, No. 4.

While most people are willing to give cosmetic surgery a free pass, the debate gets stickier when it comes to enhancing human brains through artificial means. As Richard H. Dees points out, "People think that altering our brains tinkers with the core of our personalities and the core of ourselves. It changes who we are, and doing so seems wrong."

Drugs already improve humans' ability to think. Amphetamines, Dees notes, can help people to "learn skilled motor tasks, like playing the piano, more rapidly." Other drugs help Alzheimer's patients "improve their attention and memory." Another class of drugs—Prozac is the best known—improve people's sense of well-being, while beta-blockers, whose "widespread use among concert performers is legendary," decrease stress and nervousness.

If individuals feel that neuroenhancing drugs improve their lives and cause no harm either to themselves or anyone else, why object to them?

Critics dispute the "no harm" argument on several grounds. The drugs' long-term effects, for instance, are unknown. But Dees, an associate professor of philosophy and medical humanities at the University of Rochester, believes that limiting and closely monitoring the use of neuroenhancers can counter this concern. Others question the unfair edge the drugs might provide. What if someone scores higher on an SAT under the influence of a memory-improving drug? Dees dismisses this objection by comparing using the drug to procuring the services of a tutor. The unfairness lies not in the advantage the tutor gives, per se, but in the ability of some to *afford* the tutor. While this affordability argument might be extended to neuroenhancers, he still finds it "an odd place to look for a deep moral objection."

There remain two philosophical areas that present more troubling considerations: human dignity and authenticity. Do the drugs simply provide users with an easy way to overcome life's difficulties? Consider a concert pianist, gifted with an

uncanny ability to play Rachmaninoff but paralyzed by stage fright. If a pill allows him to wow audiences at Carnegie Hall, does that diminish his achievement? While Dees believes that "overcoming obstacles builds character and makes us all better people," he notes that "many technologies, from irrigation and permanent settlements to airplanes and air conditioning," make life easier. Still, the argument is a slippery one: Morally, we know that we should not degrade others in order to advance our own ends, but do we degrade ourselves when we use available technologies, such as the "stage fright" pill?

This leads to a final objection to neuroenhancers: They "fundamentally alter an individual's personality and create . . . an inauthentic life with artificial happiness." Dees believes that a person's "achievements and his relationships must be real before he can live a truly good and happy life." From Aldous Huxley to the creators of *The Matrix*, social observers have warned about the dangers of creating a happy "reality" that is simply an illusion, and Dees agrees that "a good life must be connected to the reality of people's lives and to the reality of their own accomplishments." On this basis, he excuses drugs that enhance memory: They may make people perform better on tests but don't create false memories. But Dees argues that we need to develop "a more nuanced view" regarding drugs that give a false sense of happiness. True, they may allow some individuals to overcome paralyzing grief or depression, but simply using "enhancements to separate people from the real world is morally bankrupt."

> Drugs that enhance performance are not as morally problematic as those that give a false sense of happiness.

SCIENCE & TECHNOLOGY

Earth Exceptionalism

THE SOURCE: "Where Are They?" by Nick Bostrom, in ***Technology Review***, May–June 2008.

Philosopher Nick Bostrom has surprising aspirations for the *Phoenix* spacecraft, which landed in the arctic zone of Mars on May 25. The director of the Future of Humanity Institute at Oxford University wants the probe to turn up nothing—sterility, dead rocks, lifeless sands.

Such an outcome would be a good omen for humanity, Bostrom writes. It would provide new evidence that the emergence of life is extremely improbable. It would suggest that billions upon billions of rolls of the dice have produced a score of only one. Heretofore, the notion that 100 billion galaxies containing possibly 100 billion stars each would have only once gener-

EXCERPT

Burn, Baby, Burn

[The United States] has experienced [a] trend, almost exclusive to our country . . . to reintroduce fire. Nature kindles fires galore, but reforms in American fire policy and practice also account for much of the escalation in burning on public lands, which is where nearly all large fires now reside. Federal agencies have for several decades sought to promote fire in the name of ecosystem management: Fires that would have been suppressed are left to burn. Fires are deliberately set. Fires have escaped. . . . [But] today's fires do not burn as those of the past did; they have to accommodate more than a century of human-wrought changes. . . . The sudden reliance on large fires in the public domain is comparable to economic shock therapy in Eastern Europe. . . . We are long past the time when every burned acre must be labeled "destroyed"; we are not yet to the point of recognizing that not every acre burned is "enhanced." Turning fire management over to fire likely belongs in the realm of faith-based ecology.

—**STEPHEN J. PYNE**, author of the *Cycle of Fire* series, in ***The American Scholar*** (Spring 2008)