# Study finds DNA carrying antibiotic resistance genes can remain functional after common lab decontamination steps

LA JOLLA, CA, UNITED STATES, May 8, 2026 /EINPresswire.com/ -- A new study in the journal Cell Reports Methods raises a practical biosafety question that begins after an experiment ends: What happens to engineered DNA once a culture has been decontaminated and discarded?

> “As biotechnology becomes more routine, biosafety practices should account for what can persist after disposal—not only what gets inactivated.”
>
> *Tae Seok Moon, Ph.D.*

Scientists at the J. Craig Venter Institute (JCVI) tested two of the most common decontamination steps used before disposing of bacterial cultures—bleach treatment and autoclaving—and found that antibiotic resistance genes carried on engineered DNA can persist in a form that remains biologically active. In laboratory tests, DNA recovered after decontamination could still transform bacteria, indicating that intact engineered DNA survived these disposal methods.

Antibiotic resistance genes are widely used in research as selectable markers—tools that help researchers identify cells containing engineered genetic material. In many cases, engineered genetic material is carried on plasmids, which are small, circular DNA molecules commonly used in genetic engineering to introduce or maintain specific genes in bacteria.

Biosafety guidance and routine laboratory practice typically focus on ensuring organisms are no longer viable prior to disposal. The new study suggests that, under certain conditions, recombinant DNA can persist even when the cells that carry it have been effectively inactivated.

“Decontamination is usually defined by whether cells are still alive,” said Tae Seok Moon, Ph.D., the study’s senior author and professor at JCVI. “Our results show that even when that goal is met, engineered DNA can remain intact enough to function. As biotechnology becomes more routine, biosafety practices should account for what can persist after disposal—not only what gets inactivated.”

In the study, the researchers exposed bacterial cultures containing engineered DNA to bleach across a range of concentrations and contact times, and to autoclaving under commonly used conditions. They then assessed whether antibiotic resistance gene sequences persisted using

PCR and sequencing approaches, and whether recovered DNA could still confer antibiotic resistance in laboratory models of gene transfer.

The team found that standard bleach and autoclave treatments did not completely destroy antibiotic resistance genes carried on engineered DNA in bacterial cultures. They also showed that bacteria could be transformed using DNA recovered after decontamination, indicating that intact engineered DNA constructs persisted, although transformation outcomes varied by method and host.

“Bleach and autoclaves are designed to decontaminate cell cultures,” said first author Austin Gluth, Ph.D., a postdoctoral researcher at JCVI. “What we found is that engineered DNA can sometimes remain functional afterward. That doesn’t mean real-world transfer is happening, but it does show why it’s worth testing the DNA side of biosafety assumptions, especially because the cost of synthesizing and deploying engineered DNA has rapidly decreased. Looking ahead, more and more scientists around the world will be decontaminating cell cultures containing these plasmids."

Importantly, the authors emphasize what the study did and did not test. The transformation experiments were performed under ideal laboratory conditions using purified DNA recovered from treated cultures, and the study did not track the fate of recombinant DNA in real waste streams or provide direct evidence of environmental transfer from laboratory-derived DNA.

The authors say the findings are intended to strengthen biosafety practices, not to raise alarm. Modern biotechnology operates within robust institutional and regulatory frameworks, and continuous improvement is central to biosafety culture. The study provides data that could inform future policy discussions, refined disposal guidance, and the development of antibiotic-free selection systems that reduce reliance on antibiotic resistance markers in routine research.

The study also aligns with JCVI’s long-standing commitment to responsible innovation. Through its policy research programs, the institute has examined issues such as DNA synthesis and biosecurity, governance of emerging biotechnologies, and the responsible development of synthetic biology. The new work extends that legacy by focusing on a fundamental but often overlooked aspect of laboratory practice—what remains after decontamination.

The complete study, “Resilience of recombinant antibiotic resistance gene-containing plasmids against common cell culture disposal methods,” may be found in the journal Cell Reports Methods.

Funding for this work was provided by the National Science Foundation (OISE-2435184), the National Institutes of Health (RO1 AT009741), the United States Department of Agriculture (2020-33522032319), and the US Environmental Protection Agency (84020501).

About J. Craig Venter Institute

The J. Craig Venter Institute (JCVI) is a not-for-profit research institute in Rockville, Maryland and La Jolla, California dedicated to the advancement of the science of genomics; the understanding of its implications for society; and communication of those results to the scientific community, the public, and policymakers. Founded by J. Craig Venter, Ph.D., JCVI is home to approximately 120 scientists and staff with expertise in synthetic biology, human and evolutionary biology, genetics, bioinformatics/informatics, information technology, high-throughput DNA sequencing, genomic and environmental policy research, and public education in science and science policy. JCVI is a 501(c)(3) organization. For additional information, please visit www.jcvi.org.

Matthew LaPointe
J. Craig Venter Institute
+1 301-795-7918
email us here
Visit us on social media:
LinkedIn
Bluesky
Instagram
Facebook
YouTube
Other

---