

## Wagyu Beef: Rare, Well-Done, or...Printed?

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***Until now, lab-grown Wagyu beef seemed to be a pipe dream. The age of gourmet lab creations may be coming soon.***

Time is of the essence for the workers at My Ame, a popular traditional candy shop in Nagoya, Japan. They must work quickly to stack logs of red, black, and white melted sugar, forming a hefty, multicolored bundle. As the piping hot sugar cools, the bundle will be deftly stretched longer and thinner until it is ready to be cut into hundreds of tiny discs. As if by magic, the discs now bear tiny, multicolored cartoon faces. This decades-old technique for making *Kintaro ame*, or Kintaro candy, has now inspired a cutting-edge technique used to develop another Japanese favorite—Wagyu beef.



Staff at My Ame work to produce Kintaro Ame [1].

### Just what is Wagyu beef?

Wagyu beef, which refers to specific breeds and methods of raising cattle, is a premium product. The beef is the product of years of specialized care—Wagyu cattle receive a specialized diet of special grains and regular massage-like brushings to encourage even fat marbling throughout their muscles [2]. This results in a spectacularly tender

and flavorful, but prohibitively expensive final product. The highest quality Wagyu (A5 grade) can go for upwards of \$250 per pound [3]. Despite its astronomical price tag, customers are eager to spend serious amounts of cash to experience Wagyu's unparalleled *sashi*, or marbling—its high level of fat intricately dispersed throughout the beef. Given Wagyu's high price and difficulty in rearing, a lab-grown Wagyu beef has the potential to bring this luxury into many more households and bellies.



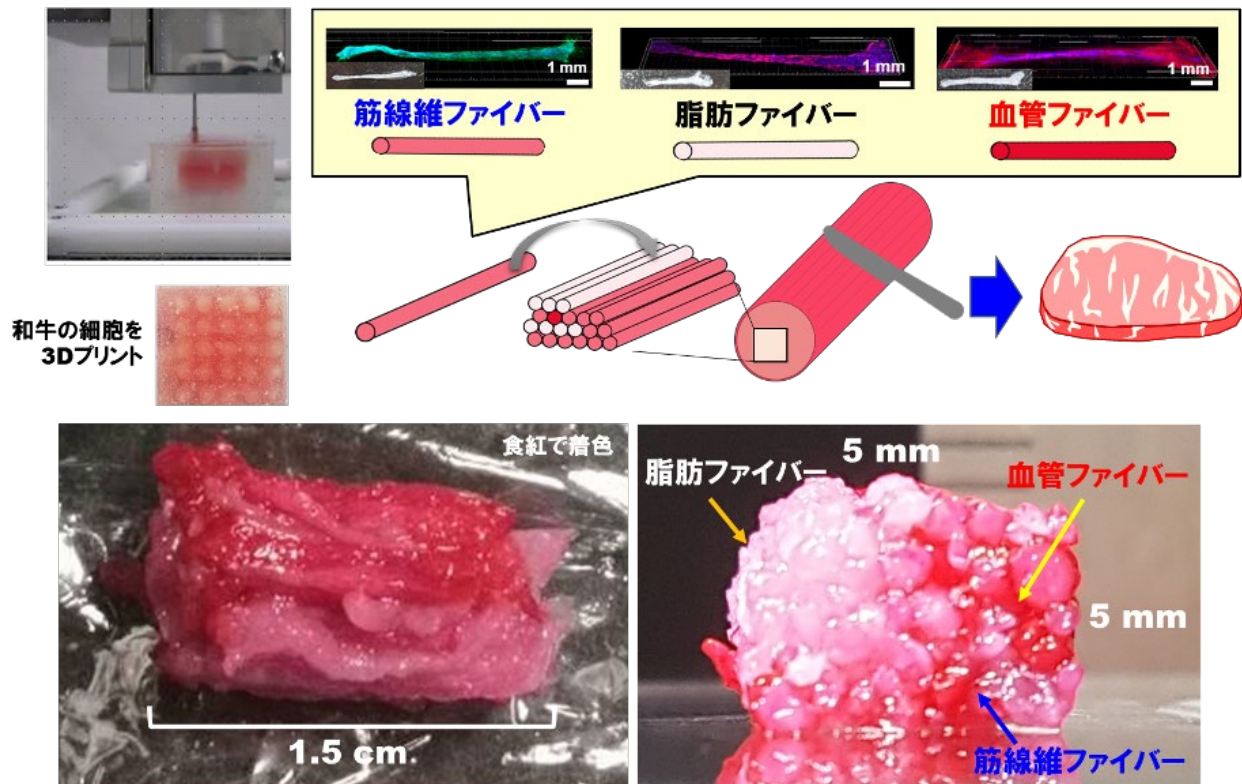
Premium A5 Wagyu beef [4].

### **Bright future for this technology**

Lab-grown meat is poised to be a meat industry disruptor with market value projected to reach 94.54 billion dollars globally [USD?] by 2030 [5]. As environmental and ethical concerns mount over the meat industry's practices, the interest in alternatives is high. The technique for lab-grown meat has been around for several years. Recently, an Israeli company developed a lab-grown ribeye steak 3D printed using bovine stem cells. However, Wagyu beef, with its complex and unique fat marbling structure, presents a unique challenge to existing 3D printing technology.

A team of engineers at Osaka University leveraged the techniques employed in making Kintaro candy and 3D bioprinting to create the world's first 3D printed Wagyu. 3D

bioprinting works in the same way that traditional 3D printing works—with printers depositing materials such as plastic or metal to create objects modeled by a computer. However, instead of plastic or metal, bioprinters use cells to build their final product. To create the materials necessary for recreating Wagyu beef, stem cells from specific breeds of Wagyu cattle were harvested and used to print muscle tissue, adipose (fat) tissue, and blood vessels. These components were then bundled together by hand like Kintaro candy to create a meat mass measuring 5 mm in diameter and 15 mm in length [6]. By bundling the fibrous tissues together in the same manner Kintaro candy is made, the researchers were able to recreate the structure of Wagyu beef.



Wagyu beef printed at Osaka University [7].

“By improving this technology, it will be possible to not only reproduce complex meat structures, such as the beautiful sashi of Wagyu beef, but to also make subtle adjustments to the fat and muscle components,” says Michiya Matsusaki, a member of the research team. As the sample created by the Osaka University team is an early prototype, further testing is needed to confirm whether it is safe to ingest—meaning the public will have to wait awhile to see how printed Wagyu measures up to the real deal.

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