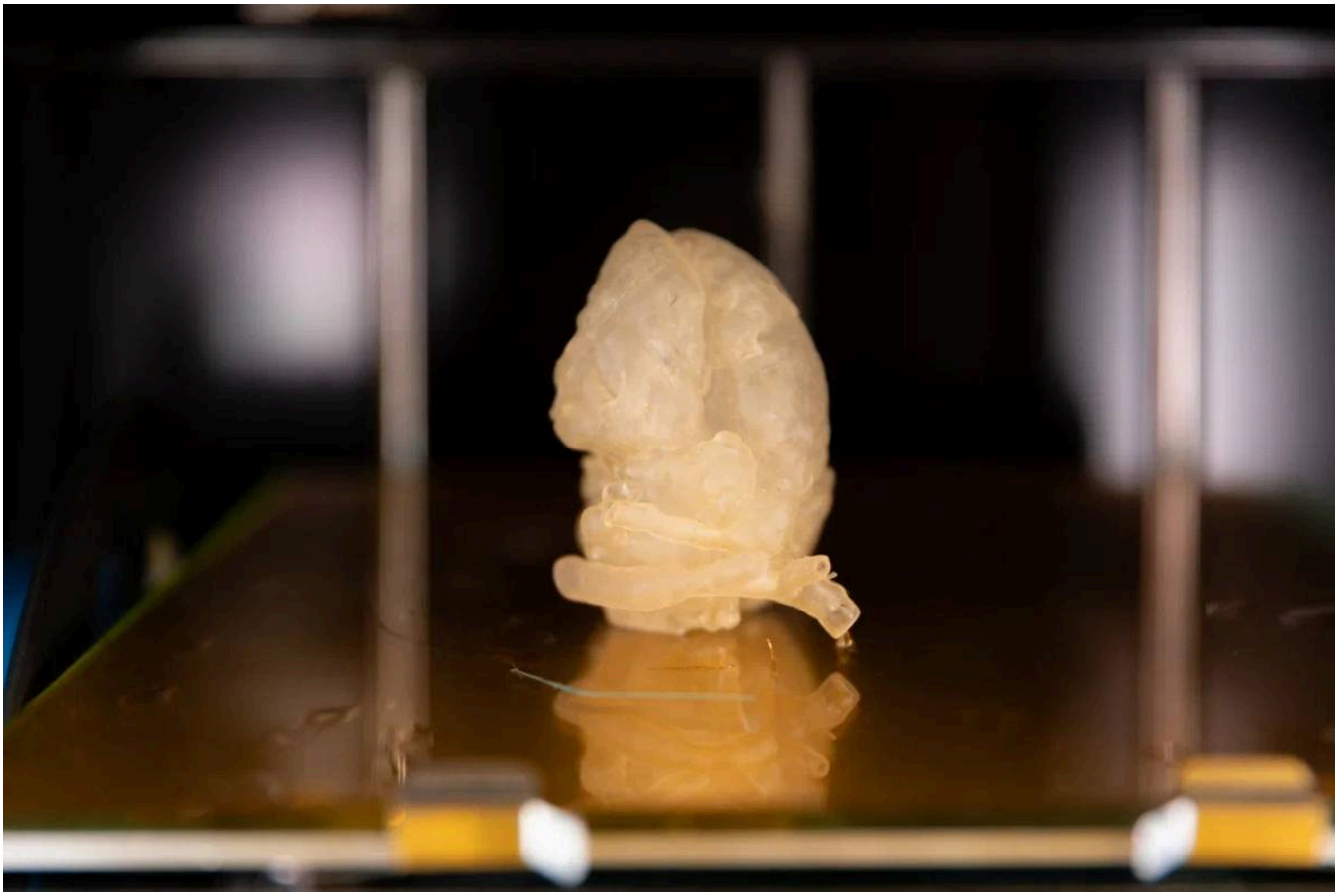
SPbPU has developed a new algorithm for pre-printing, which makes it possible to obtain a ready-made model of the heart for 3D printing in a few seconds

Peter the Great St. Petersburg Polytechnic University has developed a technology that allows to create a model of the heart and its main vessels based on computed tomography. The model reflects the patient's heart abnormalities and enables cardiac surgeons to make the most optimal individual plan of surgical correction.



Employees of Polytechnic University have developed an algorithm that converts a computed tomography (CT) scan of the heart into a digital model with high accuracy in 20 seconds. Before this algorithm, specialists needed at least two hours for the same work. Then the digital model is printed layer by layer on a 3D printer. A few hours later, the output is a finished heart prototype.

A special material — photopolymer resin — is used in 3D printing. Thanks to the plasticity of the material, the heart model resembles organic tissue both anatomically and structurally.

The printed model will help surgeons conduct an accurate preoperative evaluation of the anatomy of the defect and make the best individualized plan for surgical

correction. In addition, the doctors will be able to perform the planned surgery directly on the model and evaluate the effectiveness of the intervention.

According to approximate estimates by SPbPU researchers, by modeling important operations on the anatomical model, doctors can save up to 20 minutes when performing similar interventions and the risk of complications for patients will decrease.

There are 3D printing agencies on the market that provide a wide range of services: from printing industrial products to printing various implants. In our project, we focused specifically on printing objects intended for cardiac surgery: we brought the algorithm for converting CT images into a digital model to a high level, selected the most suitable materials similar in structure to a living heart, and perfected the printing technology. Thanks to this, the created heart model corresponds exactly to the anatomical organ. There are no analogues of such technologies in Russia, says Olga Loboda, Ph.D. in Physics and Mathematics, research associate of the Modeling of Production Technologies and Processes Laboratory at the NTI Center of SPbPU.

Such volumetric models of the heart are a good addition to the training in medical universities — students will be able to study not only the structure of the organ, but also the anatomy of the defect, as well as simulate basic surgical interventions and practice possible ways of treatment by example.

We intend to create more advanced models of other organs as well to simulate a number of important surgical procedures with high precision. This approach will improve the training of surgeons, says Olga Loboda.

In the near future, the project team plans to implement the developed technology of three-dimensional printing of the heart in medical institutions — negotiations are already underway with the cardiac surgeons of the St. Petersburg State Pediatric Medical University.

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Text: Polina Apolon

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