THE VIRTUAL SURGICAL PELVIS

This project's primary goal is to develop an integrated histology-based, 3D virtual model of the pelvis, the Virtual Surgical Pelvis (VSP), as well as a new surgical planning system. With this system, it will be possible to perform an accurate pre-operative planning of the Total Mesorectal Excision surgical procedure. We are also developing the necessary techniques to customize the VSP to a specific patient by making use of pre-operative MRI data. Combining these components will enable the surgeon to create a detailed surgical plan, thus improving post-operative outcome. Additionally, the system will be useful for surgical training and will eventually be applicable to other surgical procedures in the pelvis.

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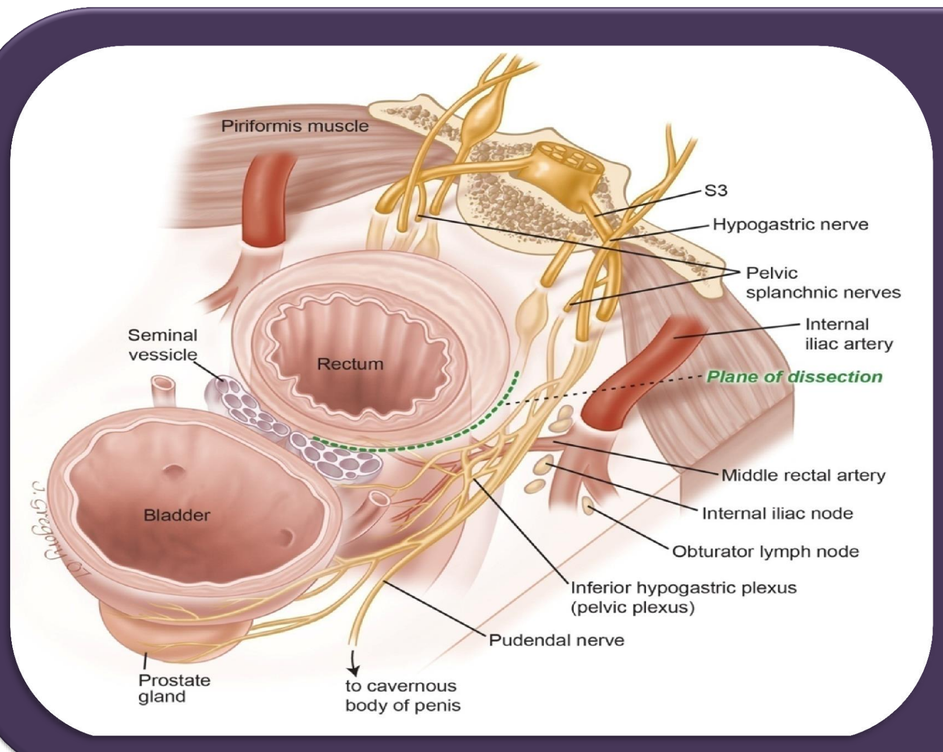
Improving health care by combining Anatomical and Medical Visualization research



Colorectal cancer is the third most frequent cancer diagnosed in men and the second most in women.

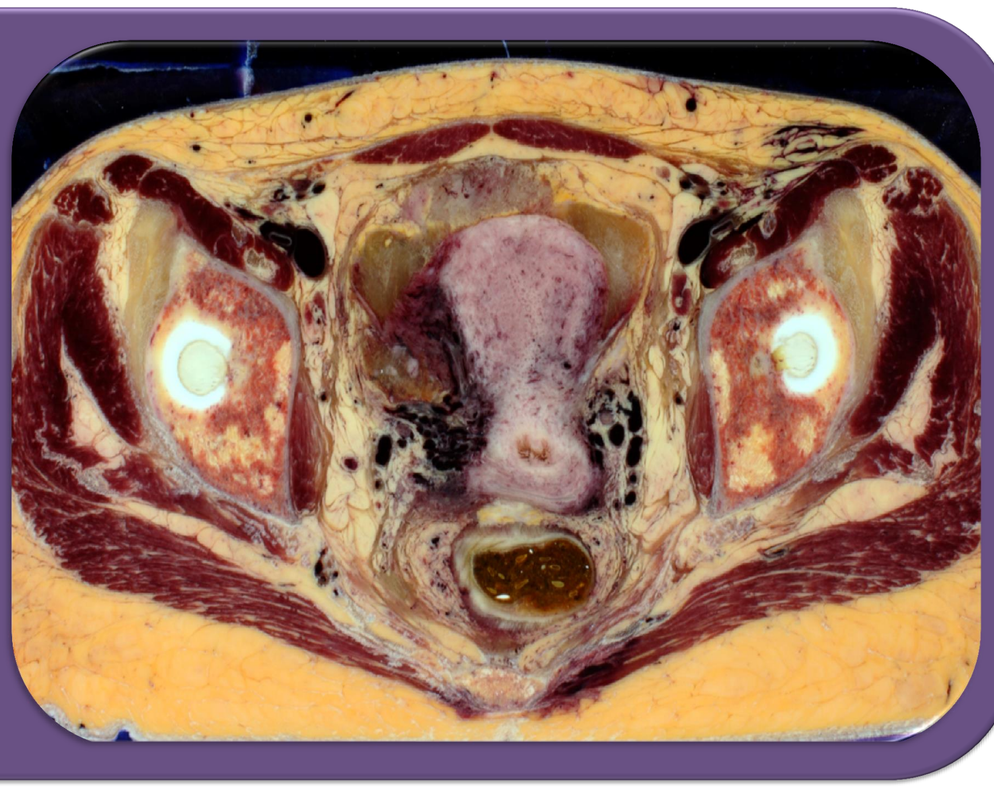
The gold standard surgical treatment is the Total Mesorectal Excision (TME), but this causes:

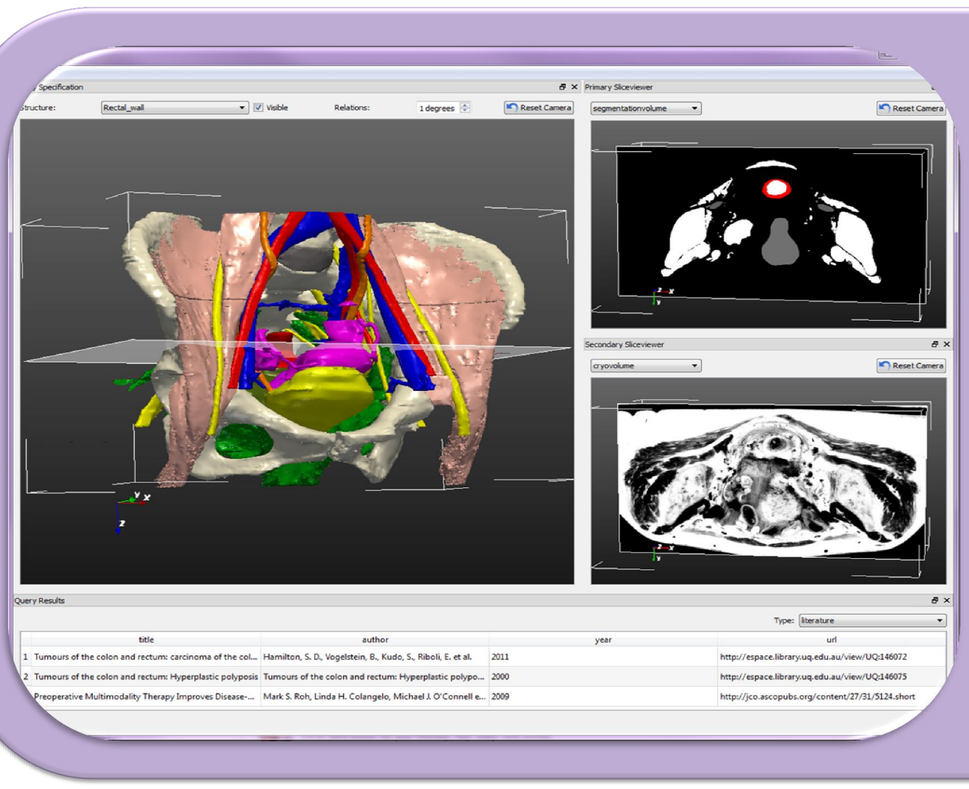
- Urinary incontinence in 34%,
- Fecal incontinence in 39%,
- Sexual dysfunction in 56-79% of the cases.

These side effects occur mainly due to damage to the autonomic nerves. Because the surgical anatomy of the pelvis is so complex and the nerves are not visible in pre-operative scans or during surgery, nerve damage is currently hard to avoid.

Based on many different datasets and modalities such as cryosections from Visible Human Datasets, (immuno) histological images and CT/ MRI images, the exact location of the nerves can be visualized. The cryosectional datasets we are currently using consist of 911 images cut at 0.2 mm intervals and have a spatial resolution of 5616 x 3744 pixels. One of these slices is visible in the image on the right.

By combining multiple different heterogeneous sources of anatomical knowledge, a highly detailed 3D model of the pelvis can be constructed. This generic model can be made patient-specific by mapping it to patient-specific scans, through a registration process. In this way, all relevant model information becomes available in the anatomical context of a specific patient.





The VSP model can be used for **education** by developing specific software for teaching medical students and training surgeons.

Furthermore, the VSP model can be used in **surgical planning**. The patient-specific and model information combined form the foundations for such a surgical pre-operative planning tool.

In this way, the VSP project can improve health care in the future by reducing surgical complications through the synergetic combination of anatomical and medical visualization research.

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