[0011] Yet another objective is to provide systems, devices, and methods for regulating the autonomic, sympathetic, and/or parasympathetic traffic to/from, and/or so as to affect the growth rate, hormone secretion rates, or development of an organ (e.g. a prostate, a testicle, etc.), or a tumor (e.g. a prostate cancer tumor, a perineural invading cancerous tumor, etc.).

[0012] Another objective is to provide systems, devices, and methods for treating a disease of the lower urinary tract (LUT).

[0013] The above objectives are wholly or partially met by devices, systems, and methods according to the appended claims in accordance with the present disclosure. Features and aspects are set forth in the appended claims, in the following description, and in the annexed drawings in accordance with the present disclosure.

[0014] According to a first aspect there is provided, a surgical tool for monitoring and/or altering electrophysiological activity within the vicinity of a prostate within a body, the surgical tool comprising:

- an elongate member with a distal tip, the distal tip shaped and dimensioned so as to fit within a lumen of the body, the elongate member shaped and dimensioned so as to extend from outside the body, through an entry site on the body and into the lumen; and

- the distal tip comprising a plurality of elements arranged there upon and coupled to the distal tip such that biasing of the distal tip towards the prostate, engages one or more of the elements with a wall of the lumen;

wherein the plurality of elements comprises an array of electrodes arranged on a face of the distal tip such that biasing of the distal tip towards the wall of the lumen brings the electrodes into intimate contact with the prostate through the wall of the lumen;

wherein the plurality of elements comprises one or more imaging elements, one or more sensing elements and a plurality of energy delivery elements; and

wherein the plurality of energy delivery elements are configured to be individually controlled based on feedback from one or more of the imaging elements and sensing elements to direct energy into surrounding tissues with a desired pattern and desired penetration depth.

[0015] In aspects, the surgical tool may include one or more imaging elements coupled to the distal tip, configured to couple with tissues in the vicinity of the prostate upon biasing of the distal tip towards the prostate. Some non – limiting examples of imaging elements include one or more of an ultrasound transducer array, an ultrasound element, a transducer, a piezoelectric element, an optical coherence tomography (OCT) element, a capacitive micromachined ultrasound transducer, a camera, an infrared camera, a near infrared camera, a deep tissue penetrating imaging element, a fiber optic array, a combination thereof, or the like.

[0016] In aspects, the imaging element may be configured to convey information about a neural structure in the vicinity of the prostate to an operator during operation of

CLAIMS

1. A surgical tool for monitoring and/or altering electrophysiological activity within the vicinity of a prostate within a body, the surgical tool comprising:

- an elongate member with a distal tip, the distal tip shaped and dimensioned so as to fit within a lumen of the body, the elongate member shaped and dimensioned so as to extend from outside the body, through an entry site on the body and into the lumen; and

- the distal tip comprising a plurality of elements arranged there upon and coupled to the distal tip such that biasing of the distal tip towards the prostate, engages one or more of the elements with a wall of the lumen;

wherein the plurality of elements comprises an array of electrodes arranged on a face of the distal tip such that biasing of the distal tip towards the wall of the lumen brings the electrodes into intimate contact with the prostate through the wall of the lumen;

wherein the plurality of elements comprises one or more imaging elements, one or more sensing elements and a plurality of energy delivery elements; and

wherein the plurality of energy delivery elements are configured to be individually controlled based on feedback from one or more of the imaging elements and sensing elements to direct energy into surrounding tissues with a desired pattern and desired penetration depth.

2. The surgical tool in accordance with claim 1, wherein the one or more imaging elements are configured to couple with tissues in the vicinity of the prostate upon biasing of the distal tip towards the prostate, wherein information obtained from the one or more imaging elements is utilized to control energy delivery from the plurality of energy delivery elements to focus energy delivery on a target tissue in the vicinity of the prostate while minimizing energy delivery to an adjacent tissue site.

3. The surgical tool in accordance with claim 2, wherein the one or more imaging elements comprises one or more of an ultrasound transducer array, an ultrasound element, a transducer, a piezoelectric element, an optical coherence tomography (OCT)

element, a capacitive micromachined ultrasound transducer, a camera, an infrared camera, a near infrared camera, a deep tissue penetrating imaging element, a fiber optic array, or a combination thereof.

4. The surgical tool in accordance with claim 2 or 3, wherein the one or more imaging elements are configured to convey information about a neural structure in the vicinity of the prostate to an operator during operation of the surgical tool.

5. The surgical tool in accordance with claim 4, wherein the one or more imaging elements are configured to convey information to an operator during operation of the surgical tool, the information pertaining to the location, health state, a quantity, blood flow to, blood flow through, temperature, and/or a stiffness, and/or changes therein, of an artery, a vein, a nerve, a neural plexus, a prostatic plexus, a prostatic artery, a dorsal nerve, a cavernous nerve, a vesical plexus, a hypogastric nerve, a splanchnic nerve, a pudendal nerve, an organ, a urethra, the prostate, a reference point, or a combination thereof.

6. The surgical tool in accordance with any preceding claim, wherein one or more of the sensing elements are configured to monitor one or more physiological signals associated with a tissue in the vicinity of the prostate while engaged with the wall, the electrophysiological signals related to one or more of water concentration, tissue tone, evoked potential, remotely stimulated nervous activity, sympathetic nervous activity, an electromyographic signal [EMG], a mechanomyographic signal [MMG], a local field potential, an electroacoustic event, vasodialation, vessel wall stiffness, muscle sympathetic nerve activity [MSNA], central sympathetic drive, nerve traffic, or a combination thereof.

7. The surgical tool in accordance with any preceding claim, wherein one or more of the sensing elements are electrically coupled with a microcircuit, the microcircuit configured to condition one or more of the signals conveyed therefrom.

8. The surgical tool in accordance with claim 7, wherein the microcircuit is embedded into the surgical tool and at least a portion of the electrical coupling is provided via the elongate member.

9. The surgical tool in accordance with any preceding claim, wherein one or more of the sensing elements comprises a microelectrode configured to interface with an adjacent tissue volume within or beyond the wall of the lumen while engaged with the wall, the microelectrode having an area of less than $5000\mu m^2$, less than $1000\mu m^2$, less than $250\mu m^2$, or less than $100\mu m^2$.

10. The surgical tool in accordance with any preceding claim, comprising a plurality of sensing elements arranged upon and coupled to the distal tip, the plurality of sensing elements configured to collectively map electrophysiological activity in the vicinity of the prostate while engaged with the wall.

11. The surgical tool in accordance with any preceding claim, wherein one or more of the energy delivery elements is configured to provide a radio frequency current, a microwave current, thermal energy, cryoablating action, and/or ultrasound energy, to a volume of tissue in the vicinity of the prostate while engaged with the wall.

12. The surgical tool in accordance with any preceding claim, one or more of the energy delivery elements comprise one or more stimulating electrodes electrically and mechanically coupled to the distal tip and/or the elongate member, the stimulating electrodes configured to provide a stimulating and/or ablating current to a tissue site in the vicinity of the prostate while engaged with the wall.

13. The surgical tool in accordance with any preceding claim, further comprising a fluid delivery means for providing a coupling fluid to the distal tip to enhance the engagement of one or more of the sensing elements, imaging elements, and energy delivery elements with the wall when biased there.

14. The surgical tool in accordance with any preceding claim, further comprising one or more chemical delivery elements comprising one or more probes mechanically, fluidly, and/or electrically coupled with the distal tip, arranged so as to penetrate through the wall upon engagement there with or upon a deployment procedure, one or more of the probes comprising a lumen configured to deliver a diagnostic and/or therapeutic substance to a tissue site beyond the wall of the lumen.

15. The surgical tool in accordance with claim 14, wherein the diagnostic and/or therapeutic substance is selected from a chemical, a drug substance, a neuromodulating substance, a neuroblocking substance, an acid, a base, a denervating agent, or a combination thereof.

16. The surgical tool in accordance with claim 14 or 15, wherein the therapeutic substance is a selected from a neurotoxin, a botulinum toxin, a tetrodotoxin, a tetraethylammonium, a chlorotoxin, a curare, a conotoxin, a bungarotoxin, arsenic, ammonia, ethanol, hexane, nitric oxide, glutamate, resiniferatoxin, alchohol, phenol, capaicin, an anesthetic, lidocaine, tetanus toxin, quaternary ammonium salts, a pachycurare, a leptocurare, acetylcholine, aminosteroids, or a combination thereof.

17. The surgical tool in accordance with any preceding claim, wherein the lumen is a rectum, a urethra, an artery, a vein, or a duct.

18. The surgical tool in accordance with any preceding claim, wherein the plurality of energy delivery elements are configured to be individually controlled by selectively applying energy to a subset of the plurality of energy delivery elements.

19. The surgical tool in accordance with any preceding claim, wherein the plurality of energy delivery elements are configured to be individually controlled by adjusting current flow to respective ones of the plurality of energy delivery elements.

20. The surgical tool in accordance with claim 18 or 19, further comprising a microcircuit embedded in the distal tip comprises one or more switches for directing current flow to respective ones of the energy delivery elements.

21. The surgical tool in accordance with any preceding claim, wherein the distal tip comprises a dual tip and the surgical tool further comprises a deployment mechanism which when actuated adjusts a positioning of the dual tips to cup a target organ.

22. The surgical tool in accordance with claim 21, wherein each of the dual tips comprises:

a first region arranged on a face thereof comprising one or more imaging elements and one or more sensing elements; and

a second region arranged on the face thereof comprising one or more energy delivery elements.

23. The surgical tool in accordance with claim 22, wherein the deployment mechanism when actuated moves one or more of the first and second regions on one or more of the dual tips towards a target location.

24. The surgical tool in accordance with claim 23, wherein movement of the first and second regions on one or more of the dual tips comprises in-plane and out-of-plane movement.

25. The surgical tool in accordance with any preceding claim, further comprising a cooling subsystem comprising:

one or more temperature sensors arranged on the face of the distal tip to monitor temperature rise during energy delivery via the plurality of energy delivery elements; and

one or more fluid delivery elements arranged on the face of the distal tip configured to deliver fluid to one or more portions of the face of the distal tip to cool a wall of the rectum during energy delivery via the plurality of energy delivery elements

based on feedback from one or more of the temperature sensors arranged on the face of the distal tip.

26. The surgical tool in accordance with any preceding claim, wherein one or more of the electrodes comprises a non-stick coating.