target region of a bladder wall to provide therapy to the target region; and a plurality of sensing tips arranged in a networked array and electrically and mechanically coupled with the delivery member, configured to interface with one or more tissue surfaces of the bladder wall and/or the urethra, the sensing tips configured to measure one or more electrophysiological signals associated with the tissue surfaces before, during, and/or after the therapy; a microcircuit , the microcircuit being electrically coupled to the networked array of sensing tips, the microcircuit being configured to multiplex signals from the networked array of sensing tips prior to conveying the measured electrophysiological signals to an extracorporeal system; and a degradable support structure configured to dissolve in the presence of a liquid; wherein at least one of the sensing tips includes one or more electrodes on a tissue-interfacing surface thereof; wherein the degradable support structure is arranged relative to the tissue-interfacing surface of the at least one sensing tip such that the degradable support structure may be placed beside the bladder wall and wetted to dissolve the degradable support structure causing one or more of the electrodes on the tissue-interfacing surface of the at least one sensing tip to contact the bladder wall.

[0013] In aspects, the electrophysiological signals may be related to one or more of water concentration, tissue tone, evoked potential, remotely stimulated nervous activity, a pressure stimulated nervous response, an electrically stimulated movement, sympathetic nervous activity, an electromyographic signal [EMG], a mechanomyographic signal [MMG], a local field potential, an electroacoustic event, vasodialation, bladder wall stiffness, muscle sympathetic nerve activity [MSNA], central sympathetic drive, nerve traffic, or combinations thereof, or the like.

[0014] In aspects, one or more of the sensing tips comprise the therapy delivery element. In aspects, at least one of the tissue surfaces is substantially coincident with the target region.

[0026A] In aspects, the surgical tool comprises a hook-shaped structure, and at least one of the sensing tips is disposed on an inner surface of the hook-shaped structure.

[0026B] In aspects, the one or more electrodes are configured to monitor a local electromyographic (EMG) signal at a given portion of the tissue surface of the bladder wall.

[0026C] In aspects, the tissue-interfacing surface of the at least one sensing tip contours to the given portion of the tissue surface to read local neurological signals without interfering mechanically with signal transmission of the local neurological signals.

[0026D] In aspects, the surgical tool further includes a housing in which the at least one sensing tip is disposed, the housing including a bioadhesive configured to bond the tissue-interfacing surface to the bladder wall, the bioadhesive being biodegradable such that the housing bonds to the bladder wall for a limited period of time.

[0026E] In aspects, the microcircuit is locally placed proximate to the networked array of sensing tips and configured to communicate with the networked array of sensing tips and the extracorporeal system via digital means such that the microcircuit is configured to exchange data pertaining to selected ones of the plurality of sensing tips in the networked array, switch data, control data and radio frequency pulse routing.

[0026F] In aspects, at least one of the sensing tips comprises one or more electrodes and one or more whisker structures extending from the electrodes.

[0026G] In aspects, at least one of the whisker structures comprises a carbon structure, the carbon structure comprising one of a carbon fiber and a carbon nanotube.

[0026H] In aspects, said at least one whisker structure is insulated along a portion of its length and has an electrically exposed region at a tip thereof.

[0026I] In aspects, said at least one whisker structure is configured with sufficient strength to penetrate into the tissue surface of the bladder wall.

Claims

1. A surgical tool for neuromodulating bladder function, comprising:

an elongate delivery member configured and dimensioned to be inserted into a bladder through a urethra;

a therapy delivery element coupled with the delivery member, configured to interface with a tissue in a target region of a bladder wall to provide therapy to the target region; and

a plurality of sensing tips arranged in a networked array and electrically and mechanically coupled with the delivery member, configured to interface with one or more tissue surfaces of the bladder wall and/or the urethra, the sensing tips configured to measure one or more electrophysiological signals associated with the tissue surfaces before, during, and/or after the therapy;

a microcircuit, the microcircuit being electrically coupled to the networked array of sensing tips, the microcircuit being configured to multiplex signals from the networked array of sensing tips prior to conveying the measured electrophysiological signals to an extracorporeal system; and

a degradable support structure configured to dissolve in the presence of a liquid;

wherein at least one of the sensing tips comprises one or more electrodes on a tissue-interfacing surface thereof;

wherein the degradable support structure is arranged relative to the tissue-interfacing surface of the at least one sensing tip such that the degradable support structure may be placed beside the bladder wall and wetted to dissolve the degradable support structure causing one or more of the electrodes on the tissue-interfacing surface of the at least one sensing tip to contact the bladder wall.

2. The surgical tool in accordance with claim 1, wherein the electrophysiological signals are related to one or more of water concentration, tissue tone, evoked potential, remotely stimulated nervous activity, a pressure stimulated nervous response, an electrically stimulated movement, sympathetic nervous activity, an electromyographic signal [EMG], a mechanomyographic signal [MMG], a local field potential, an electroacoustic event, vasodialation, bladder wall stiffness, muscle sympathetic nerve activity [MSNA], central sympathetic drive, nerve traffic, or combinations thereof.

3. The surgical tool in accordance with claim 1 or 2, wherein: one or more of the sensing tips comprise the therapeutic delivery element and at least one of the tissue surfaces is substantially coincident with the target region.

4. The surgical tool in accordance with any preceding claim, wherein one or more of the sensing tips comprises one or more electrodes configured to interface with the associated tissue surface and wherein one or more of the electrodes comprises embossed, plated, and/or filament loaded structures thereupon configured to protrude into the associated tissue surface when biased there against.

5. The surgical tool in accordance with any preceding claim, wherein the microcircuit is configured to condition the signal.

6. The surgical tool in accordance with claim 5, wherein at least a portion of the electrical coupling of the microcircuit is provided via the delivery member.

7. The surgical tool in accordance with any preceding claim, wherein one or more sensing tips comprise one or more needle electrodes and/or one or more whiskers each of which having a characteristic length and a tip, the needle electrode and/or whiskers arranged so as to extend from the sensing tip into the associated tissue surface.

8. The surgical tool in accordance with any preceding claim, wherein one or more sensing tips comprise at least one of a mechanomyographic (MMG) sensing element configured to generate a mechanomyographic signal (MMG) from the associated tissue surface and a compliance sensor, configured to generate a tissue tone signal.

9. The surgical tool in accordance with any preceding claim, wherein one or more sensing tips comprise a microelectrode configured to interface with the associated tissue surface, the microelectrode having a surface 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, wherein one or more sensing tips and/or the therapy delivery element are configured to electrically stimulate and/or ablate the associated tissue surface and/or target region respectively.

11. The surgical tool in accordance with any preceding claim, wherein one or more of the sensing tips and/or the therapy delivery element are configured to mechanically stimulate and/or ultrasonically ablate the associated tissue surface and/or target region respectively.

12. The surgical tool in accordance with any preceding claim wherein: the therapy delivery element configured to deliver a therapeutic substance to the target region.

13. The surgical tool in accordance with claim 12 wherein one or more of the sensing tips are configured to monitor the effect of the therapeutic substance on the target region.

14. The surgical tool in accordance with claim 12 or 13, wherein the therapeutic substance is selected from a chemical, a bladder-treating drug substance, a neuromodulating substance, a neuroblocking substance, a bladder-treating acid, a bladder-treating base, a denervating agent, or a combination thereof.

15. The surgical tool in accordance with any one of claims 12 – 14, 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.

16. The surgical tool in accordance with any preceding claim, wherein the therapy delivery element is configured to modulate at least one of micturition, incontinence, urinary frequency, pain, nocturia, or bladder capacity.

17. The surgical tool in accordance with claim 1, wherein the surgical tool comprises a hook-shaped structure, and at least one of the sensing tips is disposed on an inner surface of the hook-shaped structure.

18. The surgical tool in accordance with claim 1, wherein the one or more electrodes are configured to monitor a local electromyographic (EMG) signal at a given portion of the tissue surface of the bladder wall.

19. The surgical tool in accordance with claim 1, wherein the tissue-interfacing surface of the at least one sensing tip contours to the given portion of the tissue surface to read local neurological signals without interfering mechanically with signal transmission of the local neurological signals.

20. The surgical tool in accordance with claim 1, further comprising a housing in which the at least one sensing tip is disposed, the housing comprising a bioadhesive configured to bond the tissue-interfacing surface to the bladder wall, the bioadhesive being biodegradable such that the housing bonds to the bladder wall for a limited period of time.

21. The surgical tool in accordance with any of the preceding claims, wherein the microcircuit is locally placed proximate to the networked array of sensing tips and configured to communicate with the networked array of sensing tips and the extracorporeal system via digital means such that the microcircuit is configured to exchange data pertaining to selected ones of the plurality of sensing tips in the networked array, switch data, control data and radio frequency pulse routing.

22. The surgical tool in accordance with claim 1, wherein at least one of the sensing tips comprises one or more electrodes and one or more whisker structures extending from the electrodes.

23. The surgical tool in accordance with claim 22, wherein at least one of the whisker structures comprises a carbon structure, the carbon structure comprising one of a carbon fiber and a carbon nanotube.

24. The surgical tool in accordance with claim 22 or claim 23, wherein said at least one whisker structure is insulated along a portion of its length and has an electrically exposed region at a tip thereof.

25. The surgical tool in accordance with any one of claims 22-24, wherein said at least one whisker structure is configured with sufficient strength to penetrate into the tissue surface of the bladder wall.