SUMMARY

Event markers, e.g., ingestible event markers, having high reliability are provided. Disclosures of the event markers include a support, a control circuit physically associated with the support to control the highly reliable event marker, a first electrochemical material physically associated with the support and electrically coupled to the control circuit, a second electrochemical material electrically coupled to the control circuit and physically associated with the support at a location different from the location of the first material, such that the first and second electrochemical materials are electrically isolated from each other; and a membrane physically associated to the support and positioned relative to the first electrochemical and second electrochemical materials to generate a virtual dipole length larger than an actual dipole length defined by the first and the second electrochemical materials.

In one aspect, there is provided an ingestible event marker comprising: a circuitry element comprising: a control circuit comprising an upper surface and a lower surface; a first electrochemical material defining a first outer perimeter edge, the first electrochemical material electrically coupled to the upper surface of the control circuit; and a second electrochemical material defining a second outer perimeter edge, the second electrochemical material electrically coupled to the lower surface of the control circuit, wherein the first and second electrochemical materials are electrically isolated from each other; a membrane positioned between the first and second electrochemical materials comprising a signal amplification element comprising an insulating material positioned between the first and second electrochemical materials, the insulating material dimensioned to increase a length of the current path through conducting liquid in a body between the first and second electrochemical materials forming channels for the conducting fluid thereby boosting the conductance path therebetween, wherein the insulating material comprises a third outer edge extending beyond the first and second outer perimeter edges of the respective first and second electrochemical materials; wherein the first and second active electrode materials are configured to provide a voltage potential difference to the control circuit as a result of the first and second materials being in contact with the conducting liquid

within the body; and wherein upon application of the voltage potential to the control circuit, the circuitry element generates a conductively transmitted signal comprising the current path that employs the body as a conduction medium such that the signal is conducted between the circuitry element and a receiver through the body tissues.

In another aspect, there is provided a system comprising: an ingestible event marker comprising: a circuitry element comprising: a control circuit comprising an upper surface and a lower surface; a first electrochemical material defining a first outer perimeter edge, the first electrochemical material electrically coupled to the upper surface of the control circuit; and a second electrochemical material defining a second outer perimeter edge, the second electrochemical material electrically coupled to the lower surface of the control circuit, wherein the first and second electrochemical materials are electrically isolated from each other; a membrane positioned between the first and second electrochemical materials comprising a signal amplification element comprising an insulating material positioned between the first and second electrochemical materials, the insulating material dimensioned to increase a length of the current path through conducting liquid in a body between the first and second electrochemical materials forming channels for the conducting fluid thereby boosting the conductance path therebetween, wherein the insulating material comprises a third outer edge extending beyond the first and second outer perimeter edges of the respective first and second electrochemical materials wherein the first and second active electrode materials are configured to provide a voltage potential difference to the control circuit as a result of the first and second materials being in contact with the conducting liquid within the body; and wherein upon application of the voltage potential to the control circuit, the circuitry element generates a conductively transmitted signal comprising the current path that employs the body as a conduction medium such that the signal is conducted between the circuitry element and a receiver through the body tissues.

BRIEF DESCRIPTION OF THE FIGURES

FIGS. 1A to 1F provide views of various IEM configurations according to different aspects of the invention.

FIGS. 2A and 2B provide illustrations of an IEM that includes a membrane having deployable arms.

FIG. 3 provides a view of an IEM in which the IEM component is positioned off-center relative to the membrane.

FIG. 4 provides a view of an IEM having a weight positioned on one side of the membrane.

FIG. 5 provides a view of an IEM having a water-swellable component positioned on side of the membrane.

FIGS. 6A and 6B provide views of different IEM configurations which incorporate effervescent structures.

FIGS. 7A, 7B and 8 provide different views IEMs having a tablet configuration.

WHAT IS CLAIMED IS:

1. An ingestible event marker comprising: a circuitry element comprising: a control circuit comprising an upper surface and a lower surface; a first electrochemical material defining a first outer perimeter edge, the first electrochemical material electrically coupled to the upper surface of the control circuit; and a second electrochemical material defining a second outer perimeter edge, the second electrochemical material electrically coupled to the lower surface of the control circuit, wherein the first and second electrochemical materials are electrically isolated from each other; a membrane positioned between the first and second electrochemical materials comprising a signal amplification element comprising an insulating material positioned between the first and second electrochemical materials, the insulating material dimensioned to increase a length of the current path through conducting liquid in a body between the first and second electrochemical materials forming channels for the conducting fluid thereby boosting the conductance path therebetween, wherein the insulating material comprises a third outer edge extending beyond the first and second outer perimeter edges of the respective first and second electrochemical materials; wherein the first and second active electrode materials are configured to provide a voltage potential difference to the control circuit as a result of the first and second materials being in contact with the conducting liquid within the body; and wherein upon application of the voltage potential to the control circuit, the circuitry element generates a conductively transmitted signal comprising the current path that employs the body as a conduction medium such that the signal is conducted between the circuitry element and a receiver through the body tissues.

2. The ingestible event marker of claim 1 wherein the control circuit is electrically coupled to the first and second electrochemical materials, wherein the control circuit is configured to control a voltage potential difference between the first and second electrochemical materials.

3. The ingestible event marker according to claim 1 wherein the first and second electrochemical materials are configured to provide a voltage potential difference when in contact with a conducting liquid at a target physiological site, wherein the potential difference provides power for communication.

4. The ingestible event marker according to claim 1 wherein the membrane is a planar structure

5. The ingestible event marker according to claim 1 wherein the membrane comprises at least one of multiple coatings and multiple layers.

6. The ingestible event marker of claim 1 further comprising at least one controlled activation element.

7. The ingestible event marker of claim 1 further comprising at least one of a non-active agent salt, an anti-foaming agent, a micro-environment modification agent and a soluble component comprising a weight equal or greater to 90% of the overall weight of the event marker.

8. The ingestible event marker according to claim 1 wherein the membrane comprises at least one of opposing curved edges, one or more projections, or one or more deployable elements.

9. The ingestible event marker of claim 1 further comprising a weight non-centrically positioned on the membrane.

10. The ingestible event marker of claim 1 further comprising a water-swellable component non-centrically positioned on the membrane.

11. The ingestible event marker according to claim 1, wherein the event marker comprises an active agent.

12. The ingestible event marker according to claim 11, wherein the membrane comprises the active agent.

13. The ingestible event marker according to claim 11, wherein the membrane is configured to controllably release the active agent.

14. The ingestible event marker according to claim 1, further comprising a solid component having a tablet configuration, wherein the tablet comprises at least one fluid passageway.

15. A system comprising: an ingestible event marker comprising: a circuitry element comprising: a control circuit comprising an upper surface and a lower surface; a first electrochemical material defining a first outer perimeter edge, the first electrochemical material electrically coupled to the upper surface of the control circuit; and a second electrochemical material defining a second outer perimeter edge, the second electrochemical material electrically coupled to the lower surface of the control circuit, wherein the first and second electrochemical materials are electrically isolated from each other; a membrane positioned between the first and second electrochemical materials comprising a signal amplification element comprising an insulating material positioned between the first and second electrochemical materials, the insulating material dimensioned to increase a length of the current path through conducting liquid in a body between the first and second electrochemical materials forming channels for the conducting fluid thereby boosting the conductance path therebetween, wherein

the insulating material comprises a third outer edge extending beyond the first and second outer perimeter edges of the respective first and second electrochemical materials wherein the first and second active electrode materials are configured to provide a voltage potential difference to the control circuit as a result of the first and second materials being in contact with the conducting liquid within the body; and wherein upon application of the voltage potential to the control circuit, the circuitry element generates a conductively transmitted signal comprising the current path that employs the body as a conduction medium such that the signal is conducted between the circuitry element and a receiver through the body tissues.

16. The system of claim 15 wherein the ingestible event marker comprises an active agent.

17. The system of claim 15 wherein the active agent is located on the membrane.

18. The system of claim 15 wherein the event marker further comprises at least one of a non-active agent salt, an anti-foaming agent, a micro-environment modification agent and a soluble component having a weight equal or greater to 90% of the overall weight of the event marker.

19. The system of claim 15 wherein the membrane is a planar structure.

20. The system of claim 15 wherein the membrane comprises at least one of opposing curved edges, one or more projections, or one or more deployable elements.