March 1, 2018

Martha J. Somerman, DDS, PhD
Director, National Institute of Dental and Craniofacial Research
National Institutes of Health
Building 31, Room 2C39
31 Center Dr
Bethesda, MD 20814

Re: Accelerating the Development of Oral Biodevices by Advancing Technologies

Dear Dr. Somerman:

On behalf of the 3400 individual and 103 institutional members of the American Association for Dental Research (AADR), thank you for the opportunity to provide input on the NIDCR 2030 proposed research initiative, “Accelerating the Development of Oral Biodevices by Advancing Technologies”. AADR commends NIDCR for leading the way on this initiative, which has the potential to improve both oral health and overall health. AADR welcomes the opportunity to participate in this brainstorming exercise to imagine the many possibilities of this future technology.

A variety of oral biodevices with a range of applications should be developed. For example, biodevices could use electrochemical sensors to monitor oral and systemic conditions by detecting electrolytes, minerals or other analytes. It may also be useful to track parameters such as pH, temperature, chewing, swallowing or salivary flow. External monitoring systems could wirelessly interface with the biodevice for real-time assessment and detection. The ability to monitor the oral and overall health of patients through oral biodevices could be useful for both clinical and research purposes.

Oral biodevices may also be useful for drug delivery, sensing and diagnostics. Researchers have also explored the possibility of using biodevices for wound treatment and sealing, which could have implications in oral surgery (Nanomaterials (Basel) 2017 Sep 7(9): 246). Biodevices may be removable or reside semi-permanently in a dental implant.

Researchers may want to investigate the use of bionanointerfaces made of “stimuli-responsive polymers” that change in response to temperature, pH or any number of parameters of interest (ACS Appl Mater Interfaces 2015 Nov 4; 7(43): 23837-47). Other possible signals in response to oral or systemic changes include sound, light or small vibrations.

Successful acceleration of the development of oral biodevices will require multidisciplinary teams, which should include oral researchers, hardware and software engineers, chemists and materials scientists among
others. NIDCR can help facilitate interaction among researchers in different fields by creating funding opportunities that encourage and reward multidisciplinary teams and collaboration between departments and institutions. Dental, oral and craniofacial researchers should learn from other fields where advancements have already been made and include those researchers in future NIDCR workshops on oral biodevices. Bioethicists and social scientists should also be invited to the table to explore the social implications and ethical questions related to privacy and other possible consequences of the widespread use of biodevices.

To generate support for the necessity of this technology, researchers should have a rationale for having an oral biodevice as opposed to a wearable device by defining situations in which oral biosensors would provide the user or clinician with greater capabilities and quality of care than would be possible with a wearable device. Researchers should consider properties such as comfort, discreetness and interference with daily functions of the oral cavity such as eating, speaking, swallowing, etc. which could all affect compliance.

Development of oral biodevices will require researchers to overcome many challenges. Such devices may require an energy source and need to be sufficiently small. For example, in 2014, researchers published the creation of self-powered devices (PLoS 2014 Oct. 139(10)). Other disciplines are investigating nanosheets for clinical use (Nanomaterials (Basel) 2017 Sep 7(9): 246). The properties of nanosheets may be able to address the challenges of adhesion and flexibility of biodevices in the oral cavity. Researchers may need to find ways to miniaturize current technology to be suitable for use in biodevices. Researchers will also need to achieve a useful level of sensitivity for the various sensing mechanisms employed by devices.

Future workshops will help further develop these ideas, define what is possible and identify research gaps. Once again, thank you for the opportunity to provide input. AADR members stand ready to work with NIDCR leadership and researchers to accelerate the development of oral biodevices for the improvement of oral and overall health. If you have any further questions, please contact Dr. Seun Ajiboye, Director of Science Policy and Government Affairs, at sajiboye@iadr.org.

Sincerely,

Christopher H. Fox, DMD, DMSc  
Executive Director

Raul Garcia, DMD, MMedSc, FACD  
President