## BIOGRAPHICAL SKETCH

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NAME: Oliver Banks

eRA COMMONS USER NAME (credential, e.g., agency login): ollybanks22

POSITION TITLE: Professor of Bioengineering

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

| INSTITUTION AND LOCATION | DEGREE *(if applicable)* | Completion Date MM/YYYY | FIELD OF STUDY |
|---|---|---|---|
| West Dakota State University | B.S. | 06/2000 | Chemical Engineering |
| Iowa Institute of Technology | M.S. | 06/2002 | Chemical Engineering |
| Iowa Institute of Technology | Ph.D. | 01/2004 | Chemical Engineering |

### A. Personal Statement

I am a Professor of Bioengineering at North Virginia State University. I have been developing materials for biomedical applications with an emphasis on drug, gene, and cell therapeutics. My research work has resulted in 8 issued patents and over 100 peer-reviewed manuscripts. I am one of the co-inventors of a technique that was the first CRISPR delivery system tested in human clinical trials. Since arriving at West Dakota State, I have been focused on identifying new aptamer and enzyme ligands and developing targeted materials for various biomedical applications. I have been recognized for this work through a Governor Early Career Award, designated as an NIH Innovator (2016) and am a fellow of the American Institute of Biological and Medical Engineering (AIMBE) and the National Academy of Inventors (NAI). I have experience successfully leading teams of researchers to develop relevant, translatable technologies. Pertinent to this grant, my group has demonstrated experience in aptamer discovery, cell isolation, and has worked with human primary B cells, leukocytes, and murine stem cells. In addition, I have collaborated harmoniously with consultants Dr. Daniel Mutharia (having co-mentored two Ph.D. students with him) and Dr. Leilani Iosua, with example publications between our groups noted below.

a. Liu, C.F., Lightfoot, B.R., Jensen, A.B., Mutharia, D.C., and Banks, O.N. (2015) B Cells, T Cells and Immunity. *PNAS,* v29:922-941.
b. Anais, N., Iosua, L.I., and Banks, O.N. (2019) Aptamers for Drug Design. *Nature*, v85:83-97. (Cover Article)
c. Cheng, C.W., Mutharia, D.C., and Banks, O.N. Manipulation of Stem Cells for Immune Response. (2020) *Bioengineering*, v58:124-138.
d. Smythe, M., Iosua, L.I, and Banks, O.N. Developments in Biotechnology. (2020) *Nature Biotechnology*, v3(12):1822406.

An ongoing project that I would like to highlight is:
R01 CB745852412
Banks and Iosua (Co-PIs)
9/05/21-5/28/26
An integrated monomeric carrier for coronavirus vaccines

**B. Positions, Scientific Appointments, and Honors**

**Positions and Scientific Appointments**

| | |
|---|---|
| 2015-present | Professor of Bioengineering and Adjunct Professor of Chemical Engineering, North Virginia State University |
| 2010-2015 | Associate Professor of Bioengineering and Adjunct Associate Professor of Chemical Engineering, North Virginia State University |
| 2007-2010 | Assistant Professor, Department of Bioengineering, North Virginia State University |
| 2004-2007 | Senior Scientist, Cure Therapeutics, Atlanta, GA |

**Selected Honors**

| | |
|---|---|
| 2021 | Peter Speier Award in Pharmaceutical Sciences, ETH |
| 2020 | North Virginia Academy of Sciences Fellow |
| 2019 | North Virginia State Distinguished Graduate Mentor Award |
| 2017 | National Academy of Inventors (NAI) Fellow |
| 2016 | American Institute of Biological and Medical Engineering Fellow |
| 2016 | NIH Innovator |
| 2015 | Young Investigator Award, Controlled Release Society |
| 2014 | *Bioengineering & Science* Lectureship |
| 2008 | North Virginia State College of Engineering Junior Faculty Innovator Award |
| 2007 | NSF CAREER Award |
| 2006 | Clarivate - Top 100 Global Innovators |
| 2004 | Diversity Foundation Doctoral Fellowship |

**C. Contributions to Science**

1. Identification and application of targeting ligands. Aptamers are a promising class of molecules that can be bioactive, easily synthesized, and produced at relatively large scale. We have identified new bioactive aptamers and enzymes by library screening techniques and applied the novel targeting ligands in various biomedical technologies. For example, we have used aptamers to isolate B cells from apheresis product, we have identified aptamers that target monocytes and leukocytes, and we have developed aptamers for SARS-CoV-2 detection and neutralization.
    a. Smythe, M., Iosua, L.I, and Banks, O.N. Identification and Application of Targeting Ligands. (2020) *Nature Biotechnology*, v3(12):1822406.
    a. Gomez, X.L, Smith, W.C., Alomar, R.N., Gustafson, H., Banks, O.N. (2021) The Promise of Aptamers and Enzymes. *Bioconjugate Chem*, v31:1899-1907.

2. Cell therapy. In addition to our aptamer-based cell isolation work, we have developed cell activation and gene transfer technologies for cell therapy applications. We developed a novel method for CRISPR-based transduction of primary cells. We have also developed polymers for efficient transfection of murine stem cells and secondary human B cells. These methods have been patented by North Virginia State University.
    a. Olsen, P.V., Chan, Q., Flores, P.A., and Banks, O.N. (2017) CRISPR-based transduction of primary cells. *Cell*, v279:225-252.
    b. Olsen, P.V., Perez, W.H., Flores, P.A., Lightfoot, G.J., and Banks, O.N. (2020) Advances in Cell Therapy *in vivo. Advances in Bioengineering*, v68 (5) 19027183.

3. Gene delivery. I am one of the co-inventors of the CRISPR delivery system used in the first targeted mRNA delivery system in human clinical trials. At North Virginia State University, my group has developed materials for efficient gene and mRNA delivery and have shared these materials to academic and industry laboratories around the world. We have developed gene transfer technologies for cell therapies, including aptamers for transfection of primary stem cells.
    a. Chan, Q., Otieno, R.L., and Banks, O.N. (2016) CRISPR mRNA Delivery in Humans. *Bioengineering,* v125(5):14053-14072.

b. Raven, A.W., Adams, J.Q., Aariak, W.E., Pearl, M.J., and Banks, O.N. (2019) Development of Aptamers for Transfection of Primary Stem Cells. *Cell*, v123:1112-1150.

4. Tumor delivery systems. We have developed and tested several anti-cancer drug delivery formulations and have significant experience in ovine tumor models. In addition to chemotherapeutics delivery, we have also developed formulations for cancer immunotherapy, such as for targeting tumor-associated leukocytes.
    a. Sesay, F., Diaz, H.H., Pineda, F.C., Ciscero, A.C., and Banks, O.N. (2016) Targeting of tumor-associated leukocytes. *Therapeutics,* v8(22):1322-1355.
    b. Lajoie, J.M., Nguyen, C.A., Banks, O.N., Coren, M.C., Rivera, D.R., and Simmons, D. (2021) Anti-Cancer Drug Delivery in Ovine Tumor Models. *Science*, v219:32-43.