

Decoders 1.0: Microfabricated Decoders

Style: *Flexible*; Individual projects (teamwork can also be possible upon the wish of students).

This class is graded P/D/F. To pass, you must: (i) attend at least 3/4 of the class sessions, (ii) participate in all of the invited speaker lectures, and (iii) complete the summary articles, which leads to the final perspective article. By the end of Class #1, students must decide whether to register or drop the course.

Overview: *Decoders 1.0* is the core class that sets up the foundation for *D1.1* and *D1.2*. The lecture series plant seeds of question and curiosity in the minds of students. Invited speakers present the recent advances in their particular field once every other week. The website and selected publications of the speakers are featured on the course website. The individual project is to write a summary paper based on three papers of the invited speaker. Prepared questions and a draft of the summary papers are to be submitted prior to the speaker's lecture. It is mandatory for students to ask questions during guest lectures. After the guest lecture, students submit the final summary paper and discuss it in the class. The final project is to write a perspective article consisting of the written summary papers. At the end of the course, a booklet of all of the perspective articles is to be uploaded on the class website. This course is taught once every five years to update what has been accomplished in the field. The perspective articles are a resource for future students, who take the following *D1.1* and *D1.2*.

Objectives:

1. To gain knowledge from experts in the field,
2. To encourage participation in class by the asking of questions to the invited speakers,
3. To understand the impact of microfabricated devices on society,
4. To foster interest in mechanically adaptive microfabricated devices and their purposes,
5. To write a perspective article based on the knowledge gained by the students.

Schedule:

Class 1: February 8th, 2018

- a. Introduction Class and provide the agenda of the semester
 - i. Class Engagement: Turkish lunch with students.
 - ii. Provide the representative papers of Speaker#1 and encourage students to prepare questions to ask during the presentation in the following week.
- b. Course Materials
 - i. **Paper 1:** [Materials and Mechanics for Stretchable Electronics](#).
Rogers, J.A., *Science*, 327, 5973, 1603-1607, 2010.
 - ii. **Paper 2:** [Epidermal Electronics](#).
Rogers, J.A., *Science*, 333, 6044, 838-843, 2011.
 - iii. **Paper 3:** [Stretchable, Multiplexed pH Sensors with Demonstrations on Rabbit and Human Hearts Undergoing Ischemia](#).

Rogers, J.A., *Advanced Healthcare Materials*, 3, 1, 59-68, 2014.

Class 2: February 15th, 2018

- c. Invited Speaker #1: [Dr. John Rogers](#)

Class 3: February 22nd, 2018

- d. Class Discussions
- Discuss & evaluate the summary paper.
 - Provide the representative papers of Speaker#2 and encourage students to prepare questions to ask during the presentation in the following week.
- e. Course Materials
- Paper 1:** [Self-Powered, One-Stop, and Multifunctional Implantable Triboelectric Active Sensor for Real-Time Biomedical Monitoring.](#)
Wang, Z.L., *Nano Letters*, 16, 10, 6042-6051, 2016.
 - Paper 2:** [Sustainably powering wearable electronics solely by biomechanical energy.](#)
Wang, Z.L., *Nature Communications*, 7, 12744, 2016.
 - Paper 3:** [Single-Thread-Based Wearable and Highly Stretchable Triboelectric Nanogenerators and Their Applications in Cloth-Based Self-Powered Human-Interactive and Biomedical Sensing.](#)
Wang, Z.L., *Advanced Functional Materials*, 27, 1, 16044462 2017.

Class 4: March 1st, 2018

- f. Invited speaker#2: [Dr. Zhong Lin Wang](#)

Class 5: March 8th, 2018

- g. Class Discussions
- Discuss & evaluate the summary paper.
 - Provide the representative papers of Speaker#3 and encourage students to prepare questions to ask during the presentation in the following week.
- h. Course Materials
- Paper 1:** [Flexible and Transparent Silicon-on-Polymer Based Sub-20 nm Non-planar 3D FinFET for Brain-Architecture Inspired Computation.](#)
Hussain, M. M., *Advanced Materials*, 26, 18, 2794-2799, 2014.
 - Paper 2:** [Transformational Silicon Electronics.](#)
Hussain, M. M., *ACS Nano*, 8, 2, 1468-1474, 2014.
 - Paper 3:** [Paper Skin Multisensory Platform for Simultaneous Environmental Monitoring.](#)
Hussain, M. M., *Advanced Materials Technologies*, 1, 1, 1600004, 2016.

Class 6: March 15th, 2018

- i. Invited Speaker #3: [Dr. Muhammad Mustafa Hussain](#)

Class 7: March 22nd, 2018

- j. Class Discussions
 - i. Discuss & evaluate the summary paper.
 - ii. Provide the representative papers of Speaker#4 and encourage students to prepare questions to ask during the presentation in the following week.
- k. Course Materials
 - i. **Paper 1:** [Conformal Piezoelectric Energy Harvesting and Storage from Motions of the Heart, Lung, and Diaphragm.](#)
Dagdeviren, C., *PNAS*, 111, 5, 1927-1932, 2014.
 - ii. **Paper 2:** [Conformal piezoelectric systems for clinical and experimental characterization of soft tissue biomechanics.](#)
Dagdeviren, C., *Nature Materials*, 14, 728-736, 2015.
 - iii. **Paper 3:** [Energy Harvesting from the Animal/Human Body for Self-Powered Electronics.](#)
Dagdeviren, C., *Annual Review of Biomedical Engineering*, 19, 1, 85-108, 2017.

Class 8: April 5th, 2018

- l. Invited Speaker #4: [Dr. Canan Dagdeviren](#)

Class 9: April 12th, 2018

- m. Class Discussions
 - i. Discuss & evaluate the summary paper.
 - ii. Provide the representative papers of Speaker#5 and encourage students to prepare questions to ask during the presentation in the following week.
- n. Course Materials
 - i. **Paper 1:** [Printable elastic conductors with a high conductivity for electronic textile applications.](#)
Someya, T., *Nature Communications*, 6, 7461, 2015.
 - ii. **Paper 2:** [A Transparent Bending-Insensitive Pressure Sensor.](#)
Someya, T., *Nature Nanotechnology*, 11, 472-478, 2016.
 - iii. **Paper 3:** [Ultraflexible Organic Photonic Skin.](#)
Someya, T., *Science Advances*, 2, 4, 2016.

Class 10: April 19th, 2018

- o. Invited Speaker #5: [Dr. Takao Someya](#)

Class 11: April 26th, 2018

- p. Class Discussions
 - i. Discuss & evaluate the summary paper.
 - ii. Provide the representative papers of Speaker#6 and encourage students to prepare questions to ask during the presentation in the following week.
- q. Course Materials
 - i. **Paper 1:** [Piezoelectric Ribbons Printed onto Rubber for Flexible Energy Conversion](#).
McAlpine, M., *Nano Letters*, 10, 2, 524-528, 2010.
 - ii. **Paper 2:** [Enhanced Piezoelectricity and Stretchability in Energy Harvesting Devices Fabricated from Buckled PZT Ribbons](#).
McAlpine, M., *Nano Letters*, 11, 3, 1331-1336, 2011.
 - iii. **Paper 3:** [Graphene-based Wireless Bacteria Detection on Tooth Enamel](#).
McAlpine, M., *Nature Communications*, 3, 763, 2011.

Class 12: May 3rd, 2018

- r. Invited Speaker #6: [Dr. Michael McAlpine](#)

Class 13: May 10th, 2018

- s. Class Discussions
 - i. Discuss & evaluate the summary paper.
 - ii. Provide the perspective papers of invited speakers
- t. Course Materials
 - i. **Paper 1:** [A Clear Advance in Soft Actuators](#).
Rogers, J.A., *Science*, 341, 6149, 968-969, 2013.
 - ii. **Paper 2:** [Electronics for the Human Body](#).
Rogers, J.A., *Journal of the American Medical Association*, 313, 6, 561-562, 2015.
 - iii. **Paper 3:** [Wearable Electronics: Nanomesh On-Skin Electronics](#).
Rogers, J.A., *Nature Nanotechnology*, 12, 839-840, 2017.
 - iv. **Paper 4:** [Toward Self-Powered Sensor Networks](#).
Wang, Z.L., *Nano Today*, 5, 512-514, 2010.
 - v. **Paper 5:** [Preface to the Special Section on Piezotronics](#).
Wang, Z.L., *Advanced Materials*, 24, 34, 4629, 2012.
 - vi. **Paper 6:** [New Wave Power](#).
Wang, Z.L., *Nature*, 542, 159-160, 2017.
 - vii. **Paper 7:** [Epidermal Electronics: Skin Health Monitoring](#).
Lacour, S.P., *Nature Materials*, 14, 659-660, 2015.
 - viii. **Paper 8:** [Flexible Electronics: Tiny Lamps to Illuminate the Body](#).
Someya, T., *Nature Materials*, 9, 879-880, 2010.
 - ix. **Paper 9:** [Bionic Skin for a Cyborg You](#).

Someya, T., *IEEE Spectrum*, 51-56, 2013.

- x. **Paper 10:** [The Rise of Plastic Bioelectronics](#).
Someya, T., *Nature*, 540, 379-385, 2016.
- xi. **Paper 11:** [Nanopiezoelectric Biointerfaces](#).
McAlpine, M., *SPIE*, 2013.
- xii. **Paper 12:** [Sensing Gastrointestinal Motility](#).
McAlpine, M., *Nature Biomedical Engineering*, 1, 775-776, 2017.

Class 14: May 17th, 2018

- u. Class Discussions
 - i. Discuss & evaluate the summary paper
 - ii. Final: Perspective article due

Calendar

February 2018

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28			

March 2018

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

April 2018

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

May 2018

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		