

PHZ 4710 Introduction to Biological Physics Spring 2020 Professor Mark W. Meisel  
“*in vivo*” schedule (black text: past or projected and tentative; blue text: hotlinks;  
red text important announcements; green text: fixed final exam)  
Note: Schedule is “projection” and revisions will be announced in class and subsequently posted  
online.

Week 1 Jan 07

Cass Starts, Introduce the Course, Review Syllabus  
“Biological Physics” or “Biophysics”?

1. H. Frauenfelder, P.G. Wolynes, R.H. Austin, Rev. Mod. Phys. 71 (1999) S419-S430, [doi:10.1103/RevModPhys.71.S419](https://doi.org/10.1103/RevModPhys.71.S419)

**A story from yesteryear: “The eyeless gene”**

- 2a. [Cover Image](#), *Science* 267 (#5205) 24 Mar 1995., “[about the cover](#)”.
- 2b. *Research News*: M. Barinaga, *ibid.*, 1766-167, [doi:10.1126/science.7892596](https://doi.org/10.1126/science.7892596)
- 2c. *Research Article*: G. Halder, P. Callaerts, W.J. Gehring, *ibid.*, 1788-1792, [doi:10.1126/science.7892602](https://doi.org/10.1126/science.7892602)

**Second Place for “Discovery of the Year”?**

- 3a. *News*: “Runner Up: Eyes Everywhere”, *Science* 270 (#5244) 22 Dec 1995, 1903a, [doi10.1126/science.270.5244.1903a](https://doi.org/10.1126/science.270.5244.1903a)
- 3b. “From Transdetermination to Homeodomain at Atomic Resolution: An Interview with Walter J. Gehring”, N. Walter, *Int. J. Dev. Biol.* 46 (2002) 29-37, <http://www.ijdb.ehu.es/web/paper.php?doi=11902685>

**First Place for “Discovery of the Year”?**

4. *Editorial*: “Molecule of the Year 1995”, F.E. Bloom, *ibid.*, 1901, [doi:10.1126/science.270.5244.1901](https://doi.org/10.1126/science.270.5244.1901)

**“2108 Breakthrough of the Year”**

- 5a. *Special Issue*: *Science* 362 (#6421) 21 Dec 2018
- 5b. *Development cell by cell*: E. Pennisi, *ibid.*, 1344-1345, [doi:10.1126/science.362.6421.1344](https://doi.org/10.1126/science.362.6421.1344)
- 5c. *Runners-up*: E. Hand *et al.*, *ibid.*, 1346-1351, [doi:10.1126/science.362.6421.1346](https://doi.org/10.1126/science.362.6421.1346)
- 5d. *Breakdowns of the year.*, P. Voosen, H. Escobar, M. Enserink, *ibid.*, 1352-1353, [doi:10.1126/science.362.6421.1352](https://doi.org/10.1126/science.362.6421.1352)

[American Physical Society](#) statement on “[Code of Conduct for APS Meetings](#)”

Jan 09

**Assigned Reading Textbook: Ch. 1.**

**Discussion:** Reading a “science” paper? Figures/Captions, Equations...

**Attending a Seminar/Colloquium:** three “take home” messages?

**Template for your report** in [Word](#) and [PDF](#).

**Where to find schedule in Physics:** [Physics Homepage](#) or [Events](#)

**Other departments:** [one example](#)

**Lecture: Example of “biophysics” or “biological physics”:**

A.-L. Paul, R.J. Ferl, M.W. Meisel, *Biomagn. Res. Technol.* 4 (2006) 7, [doi:10.1186/1477-044X-4-7](https://doi.org/10.1186/1477-044X-4-7)

[UF Physics: Condensed Matter / Biophysics Seminars 2020](#)

Monday, 13 January 2020, [Juan Guan](#) (UF)

- Week 2** Jan 14 **“Business”**: start time? **“Modern Topics?”**: [PiTP2019](#) and [email](#) “topics”?  
Finish the Lecture of Jan 09: Lecture:  
**Example of “biophysics” or “biological physics”**  
and Class Discussion  
**Assigned Reading Textbook: Ch.2.**
- Jan 16 **HW1 (10 points) due at start of class, as mentioned during Week 1 and as described in detail on Jan 14. “Sketch” of Eq. 17 on p. 28 in Ch. 2 and comment on your result.**  
**“Business”**: start time?  
[E-Learning](#) Gradebook now has entries for the 3 reports.  
Check [Physics Homepage](#) for “Seminars” that list talks. **Friendly reminder:** several biological physics talks **before** spring break.  
**NOTE:** best to write and submit report within a week after attending.  
[E-Learning](#) Files for this course how as PDF of slides for the “Intro/Warm-up” discussion “ending” today.  
**Do we need: To be clarified next time “tool/mechanism”?**  
Example: What is gene expression?  
**Assigned Reading Textbook: Ch.2.**  
**Discussion and Classroom Activity:** Building a “Model/Hypothesis” or Identifying a “Problem”? Driven by Hypothesis, Curiosity, Device-Inspired, Other? Then, next step: how to test, what to design/build?  
**Designing an appropriate “control”?**  
“Researchers Show Parachutes Don't Work, But There's A Catch”  
Richard Harris, 22 Dec 2018, [Hardcopy and Audio Link](#)  
**Discussion:** Outcomes? Insight? Ah-Ha moments?
- Week 3** Jan 21 **“Business”**: Not too early to start about paper. Student membership in professional society? Covers of science-oriented magazines, topics everywhere, e.g. ....  
*“Digging the trenches of biological physics”*, by Pietro Cicuta, **Physics Today** 71 (Dec2018) #12, p54-55. Book Review. doi: 10.1063/PT.3.4094  
**Some Critical Questions in Biological Physics: A guided tour around the bugbears**, Thomas Waigh, [IOPScience ebook](#).  
HW2 assignment “mentioned” but not assigned.  
**Assigned Reading Textbook Ch. 3. Get started on Ch. 4 too!**
- Jan 23 **“Business”**: Ch.2 slides posted on E-Learning.  
Biological Physics colloquia/seminars/talks for the next week.  
**Dr. Mahmut Demir, Yale University, 28 Jan, 4:00-5:00 pm, NPB 2205.**  
**Sensing & Navigating Naturalistic Odor Plumes**, [abstract](#).  
Discussion of Ch. 3.  
Start discussion of Ch. 4: potential discussion topics for 28 Jan?  
Start: “Form follows Function” (FF) theme. X-ray determination overview.  
**Assign HW2 (5 points), due 28 Jan, hardcopy, separate sheet, start of class.** Molecule template [Word](#) and [PDF](#).  
**Assigned Reading Textbook Ch. 3.**  
**Assigned Reading Textbook Ch. 4.**

- Week 4** Jan 28 **Due at start of class: HW2 (5 points), hardcopy.**  
 Note: HW1 now posted on E-Learning, as previously promised.  
 “Form follows Function” (FfF) theme. X-ray determination finish.  
 Initiate NMR basics?  
**Assigned continue Reading Textbook Ch. 4.**  
**Required Reading for NEXT LECTURE: Ch. 7 (pp 120-123, not Sec. 7.1.2)**
- Jan 30 **Guest Lecture: Professor BingKan Xue, UF, [homepage](#).**  
 Title of Lecture: **“Bet-hedging and Information in Biology”**  
**Required Reading: Ch. 7 (pp 120-123, not Sec. 7.1.2)**
- Week 5** Feb 04 **Return/Discuss HW2:** PDB Molecule of the Month or other bio-complex.  
 Common writing issues. In-class exercise of Ch. 4.  
 Debriefing of Lecture on 30 Jan and What is biological bet-hedging?  
 Find a “Biological Bet-Hedging” review article?  
 If you do not find a suitable article, *maybe* consider:  
 “Bet-hedging as an evolutionary game: the trade-off between egg size and number”, H. Olofsson, J. Ripa, N. Jonzen, Proc. R. Soc. 276 (2009) 2963-2969, doi:[10.1098/rspb.2009.0500](https://doi.org/10.1098/rspb.2009.0500)  
**But** be aware of associated *Comment* and *Invited Reply*:  
 “*Comment*: Bet-hedging as an evolutionary game: the trade-off between egg size and number”, M. Rees, C. Jessica, E. Metcalf, D.Z. Childs, Proc. R. Soc. B 277 (2010) 1149-1151, doi:[10.1098/rspb.2009.1541](https://doi.org/10.1098/rspb.2009.1541)  
 “*Invited Reply*: What is bet-hedging, really?”, J. Ripa, H. Olofsson, N. Jonzen, Proc. R. Soc. B 277 (2010) 1153-1154, doi:[10.1098/rspb.2009.2023](https://doi.org/10.1098/rspb.2009.2023)  
**Assigned Reading Textbook Ch. 4.**  
**Prepare for 06 Feb discussion, what do you want to cover?**
- Feb 06 **Formal discussion of where course is and where you want it to go?**  
 Return Ch. 4 In-class exercise. NMR? More/other TBA....  
 Discuss term paper topic approval process.  
**HW3 assignment (15 points) email to instructor by 5 pm (17:00 hrs) 14 Feb:**  
 Identify “main” article for your class paper. Generate “one-pager” in “standard format” with the following elements:  
 (i) bibliographic information of the paper and doi with hotlink,  
 (ii) prospective title,  
 (iii) potential outline of major sections,  
 (iv) first attempt at abstract.  
**Generate PDF and name in appropriate manner, then email to Instructor by 5 pm (17:00 hrs) 14 Feb with “standard” subject line for the email!**  
**“Business”:** **Deadline of February 25 for submitting first report on “biophysics” Seminar/Colloquium that you attended, see Jan 09.**

- Week 6** Feb 11 **Assigned Reading Textbook Ch. 5.**  
**Brownian Motion – overview.**  
**Video:** Illustrating the movement of particles in Brownian motion, Institute of Physics (IOP) 08 Feb 2019 posted on **YouTube:** [link](#).  
**Video:** Observing Brownian motion of micro beads, Forrest Charnock, 04 Aug 2016 posted on **YouTube:** [link](#).  
**Reference:** D. Jia, J. Hamilton, L. M. Zaman, A. Goonewardene, “The time, size, viscosity, and temperature dependence of the Brownian motion of polystyrene microspheres”, Am. J. Phys. 75 (2007) 11-115, [doi:10.1119/1.2386163](#)  
**Code:** [John Burkardt at FSU, Brownian Motion Simulation](#) (04 Dec 2018), usable under [GNU LGPL license](#).  
**Video:** NIH NIBIB .gov (15 Mar 2013) “Macrophage engulfs foreign cells” posted on YouTube: [link](#).  
 Webpage: M.A. Hill (21 Feb 2019) “Movie – Neutrophil chasing bacteria” [https://embryology.med.unsw.edu.au/embryology/index.php/Movie\\_-\\_Neutrophil\\_chasing\\_bacteria](https://embryology.med.unsw.edu.au/embryology/index.php/Movie_-_Neutrophil_chasing_bacteria)  
**Assigned Reading Textbook Ch. 5.**  
 Albert Libchaber, “From Biology to Physics and Back: The Problem of Brownian Motion”, Annual Review of Condensed Matter Physics 10 (2019) 275-293, [doi:10.1146/annurev-conmatphys-031218-013318](#)
- Feb 13 **Assigned Reading Textbook Ch. 5.**  
 Brownian Motion “practical” start **BRING “LAPTOP” to class.**  
**[Feb. 14: HW3 assignment (15 points) email to instructor by 5 pm (17:00 hrs)]**
- Week 7** Feb 18 Long Day this week. **Assigned Reading Textbook Ch. 5.**  
 Brownian Motion “practical 1” end **BRING “LAPTOP” to class**  
**HW4 (20 pts) REPORT due by end of class period, PDF emailed to instructor.**
- Feb 20 Short Day this week. **Debriefing of Brownian Motion “practical” HW4.**  
**Assigned Reading Textbook Ch. 5.**
- Week 8** Feb 25 **By start of class: Deadline of February 25 for submitting first report on “biophysics” Seminar/Colloquium that you attended, see Feb. 06.**  
 “The origin of icosahedral symmetry in viruses” slides posted online.
- Feb 27 No formal class period. Individual work and appointments with Instructor. 1:1 meetings in NPB B133 as scheduled in advance.  
**18:00 hrs (as discussed in class on Feb 20 and 25):**  
**Deadline for resubmission of HW3 for approval of paper topic and main resource reference.**
- Week 9** Mar 03 No Class, UF Spring Break.  
 Mar 07 No Class, UF Spring Break.

**Week 10** Mar 10 **In class meeting and discussion: COVID-19 impact on everything**  
Evolving UF COVID-19 Updates at [UF COVID-19 HOME](#)  
Yesterday: [March 9 Update – COVID-19 and Online Classes](#)  
Note: all students have topic and main resource paper approved (HW3).  
Discussion on moving to “online” course.

**1. Term paper deadline and deadline for all work remains the same as originally posted:**

**Final Exam:** The Final Exam is not tentative and is listed as “5/1/2020 @ 12:30 PM - 2:30 PM”.  
There is no final exam for this course, but any “make-up” work must be completed and submitted by the end of this Final Exam window, which is Friday, 01 May 2020, 12:30 hrs to 14:30 hrs.

**TERM PAPER DEADLINE: Friday, 01 May 2020, 2:30 PM (14:30 hrs) is the deadline for the time-stamp on the email transmitting the TERM PAPER in PDF format.**

**2. Seminar/Colloquia One-pager Reports (see 09 Jan).**

Now acceptable to choose one from online search.  
Next class period dedicated to this process.

Mar 12 **No formal in-class meeting.** Time for “attending” seminar or lecture for one-page report 2 or 3. Note: report due (either 2 or 3) by start of class on 19 March.

**NOTE:** Today, I was testing my ability to manage Zoom sessions from my Canvas account, and I started a session from nominally Noon to 13:00 hrs. I enjoyed discussions with several students, and if you did not attend, then you did not miss anything that was not covered during Tuesday (10 March) class.

**NOTE:** I failed to record today’s session, but I think I know how to do it in the future.

**NOTE:** If you want to have any discussions with me that cannot be handled by email, then please send me an email about your potential availability and I will configure a Zoom meeting that also fits my schedule.

If you are still looking for an online seminar or talk to use for report 2 or 3, consider:

***Prospects in Theoretical Physics 2019: Great Problems in Biology for Physicists*** ([link](#))  
Program Schedule ([link](#)) on Wed, 17 July, was dedicated to “Viruses”.

There is a talk entitled “**Viruses Overview**” ([link](#)) was delivered by Tom Shenk ([link](#)).

**Note:** I have not watched the entire talk, yet, but the title caught my eye vis-à-vis the reason that we are online now, and I was wondering if he predicted such an event!

***“Biophysical Society 2012 National Lecture: Shedding Light on Single Molecules”*** ([link](#))  
by Steven Block ([link](#)). Note: I have not watched the entire talk, yet, but I have heard him deliver a couple of invited talks in the past. When I was a graduate student, I took a particle physics course taught by his father, Martin Block ([link](#)), who once roomed with Richard Feynman, as told to me and recounted by “In Memory of Martin M. Block” ([link](#)).

**HIGHLY RECOMMENDED LECTURE.**

**Week 11** Mar 17 Start with a “Welcome” to my assimilation by the “*Borg*” and a discussion of the mechanics for the rest of the course, at least as we know it on this day. Specifically, the lectures will no longer be “short” (typically on Tuesdays) and “long” (typically on Thursdays). Instead, the lecture window will be nominally 75 min on each day, meaning a 150 min per week, thereby meeting the expectation of a 3 credit class (3 X 50 min per week). Start at 11:45 hrs and end by 13:00 hrs.

The Zoom invitations will be configured from 11:45 hrs to 13:00 hrs.

**Reminder about Report 2 due by 11:45 hrs on Thursday, 19 March.**

**Topic for today and Thursday?** Cryo-EM, [Nobel Prize in Chemistry 2017](#) was awarded jointly to Jacques Dubochet, Joachim Frank, and Richard Henderson “for developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution.

**Lecture materials will provide “preamble” to plunge into:**

“Correlative three-dimensional super-resolution and block-face electron microscopy of whole vitreously frozen cells”, D.P Hoffman *et al.*, *Science* [367](#) (2020) 265.

**NOTE:** the hardcopy is a “one-pager” Research Article Summary, and the full paper is online as D.P. Hoffman *et al.*, *Science* 367 (2020) eaaz5357, doi:10.1126/science.aaz5357.

Mar 19 **Seminar Report 2 due by the start of this class time, in other words email needs to be time stamped by 11:45 hrs -19 March.**  
Expectation is that this class period will be the finish of Cryo-EM discussion.

**Week 12** Mar 24 [Biophysics Week](#) (23-27 March 2020)

**NOTE:** Very few students were in attendance, and a couple, who did attend the live lecture, suggested that they had problems finding the Zoom link. The Zoom links for Tuesdays and Thursdays were configured as “recurring” meetings, so Tuesdays’ link and Thursdays’ link would remain the same for the rest of the semester, and they should have been found on the Canvas calendar. **Since there was apparently so much confusion on these links, I have cancelled them. Now I will configure each lecture with its own Zoom meeting.** I hope this step clears any possible confusion about how to link to the live broadcasts.

Recap and Questions about studying dynamics with cryo-EM?

Comments on the Term paper.

Discussion of Science vs non-Science? Social media and news?

Universal Flu Vaccine? Part 1

NIH site: [Universal Influenza Vaccine Research](#)

National Institute of Allergy and Infectious Diseases

Director, Anthony Fauci, MD

**A One-Size-Fits-All Flu Vaccine?** by J. Kaiser, *Science* [312](#) (2006) 380, doi:10.1126/science.312.5772.380

**Universal flu vaccine remains ‘an alchemist’s dream’** by J. Cohen, *Science* [362](#) (2018) 1094, doi:10.1126/science.362.6419.1094

**Netflix’s ‘Pandemic’ Highlights The Need for a Universal Flu Vaccine (So Why Don’t We Have One Yet?** (A universal flu vaccine could offer protection against even unknown strains—but will another pandemic hit before it’s developed?) by Leah Growth

<https://www.health.com/condition/cold-flu-sinus/what-to-eat-when-you-have-a-cold>

**News Release 27 Feb 2020: Outsmarting pathogens**, press release from the American Physical Society, AAAS EurekAlert!

[https://www.eurekalert.org/pub\\_releases/2020-02/aps-op022720.php](https://www.eurekalert.org/pub_releases/2020-02/aps-op022720.php)

Mar 26 Universal Flu Vaccine? Part 2 as a continuation of above.



**Week 13** Mar 31 **First Lecture Delivered from my home (previous lectures from three different sites on campus), so... *Internet lags/lapses may be an issue.***  
 Review of Where the Course is and may be going,  
 e.g. 3 minute presentation on your Course Paper for 21 April?  
 Discuss grade options, delivery of material, use of red pen, and more.  
 Recap of UFV (Universal Flu Vaccine) and answer emailed questions.  
**Assign HW5 (5 points) Due before start of 02 April lecture:**  
**One slide or sheet on “how you would << attack the problem >>”,**  
 Replaces the previously posted:  
*InClass Pretest – Come Prepared to “attack the problem”*  
 Neuron Part 1: Background on the noninvasive measurement science,  
 Signal, noise, Inverse Problem, more.

Apr 02 **Due at start of this Lecture: HW5 (5 points) One slide or sheet on “how you would << attack the problem >>”.**  
 Neuron Part 2: finish the review of the electromagnetic measuring science,  
 Get on with the neuron, and one model.

**Week 14** Apr 07 **NOTE: early this morning I added PW (password) for the Lecture due to increased “Zoombombing” Events**  
 Finish Neuron (Part 3) discussion, Recap, and Sketch some extensions.  
 Discuss the Grade Book (almost up to date) and need for Seminar Report 3  
 Discuss mechanics of “3minTopicOverview (3minTO)” for “last class”.

**Presently posted on Canvas: 3minTopicOverview (3minTO) Assignment**

0. Practice in advance.
1. Setup a Zoom Meeting just for yourself. Use password. Use share Zoom video to local computer.
2. Configure your screen to share for the use of 1 or 2 slides. NO MORE THAN 2.
3. Start video recording and make your presentation spanning 2:45 - 3:00 min. DO NOT RUN LONG.
4. Stop recording after a duration of 2:45 - 3:00 min. Leave meeting.
5. Zoom will run a script to generate mp4 file.
6. Review your mp4 file to see if you are satisfied.
7. Upload to Canvas for this assignment.

Instructor will review the content and make the arrangements to share the contents with the class during the last lecture for the course. Any issues? Email Meisel.

Apr 09 **Comments on “What happens when the stay-at-home order ends?”**  
 Think and discuss now to prepare yourself, your family, your sphere.  
 Dr. Fauci: **“Identify. Isolate. Contact Trace.”**  
 Discuss the Grade Book (almost up to date): Brownian Motion Lab (added and to be graded), **Seminar Report 3, Last HW, and Term Paper!**  
**Student Evaluations Online** (soon/already?) *please engage in the process!*

**Potpourri of Topics**

Optogenetics - Cartoon

**Sidebar:** Is “it” biological physics?

**Sidebar:** Watson and Crick, professional behavior for inclusiveness,  
 and cycle back to Ch. 2 of Hagen’s *Notes*?

Optogenetics Intro (bis) versus other approaches?

Decadal Survey of Biological Physics, an Invitation & Seminar Opportunity?

**Sidebar:** William Bialek, and Biological Physics is...

Optical Tweezers in a Nutshell “now”

Statistical Mechanics snapshots of applications to

Nonequilibrium fluctuations and Brownian Motors

Gene Regulation, Chromatin Structure, Gene Expression: TOE?

**Week 15** Apr 14: (Video?) Chat with Dr. Anna-Lisa Paul, [Director of UF ICBR](#) and one of the Principal Investigators of [UF Space Plants Lab](#)

Apr 16 **Open Office Hour discussions about Term Paper and 3minTO.**  
Please email for advance appointments, if possible.  
Time for attending/finishing Seminar Report 3.

**Week 16 Apr 20 (Monday) NOON Deadline for uploading, to Canvas, "3minTO" \*.mp4 file.**  
Name of your file: \* = PHZ4710-3minTO-Lastname.mp4  
**HW-LastOne (10 points)**

Apr 21 Last Class. **3minTopicOverview (3minTO)** (in the spirit of ["3MT – 3 minute thesis, University of Queensland"](#)).

Apr 23 **No Class, Reading Day. Office Hour by appointment.**

**NOTE Added: 23 April, 12:30 hrs,** 8 of 12 submissions to GATOREVALS, please engage in this important process, see the following paragraph associated with the logo.

**PLUS,** still looking for a third talk for your seminar report OR just have intellectual curiosity about the virus associated with the COVID-19 pandemic (SARSCoV-2)? You may be interested in the talk by Dr. Britt Glaunsinger, Professor at UC-Berkeley and Investigator in IGI (Innovative Genomics Institute), "Coronaviruses 101: Focus on Molecular Virology", posted on YouTube at [https://www.youtube.com/watch?v=8\\_bOhZd6ieM](https://www.youtube.com/watch?v=8_bOhZd6ieM)

**Lastly,** many thanks for engaging in this course during this extraordinary semester. Your participation in the course and your comments about the content and its online delivery have been exceedingly helpful to me. I hope you enjoy safe, healthy paths through the summer and on to the next stage of your life. MWM



Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

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