

BME 695 Engineering Nanomedical Systems

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Lecture 1: 28186"Need for New Perspectives on Medicine"

- 1.1 Nanotechnology – Why is something so small so big?
 - 1.1.1 Definitions of nanotechnology based on size
 - 1.1.2 A “bottoms up” rather than “tops down” approach
 - 1.1.3 The nanoworld challenges our perspectives on size
- 1.2 The Progression of Medicine
 - 1.2.1 Conventional "modern" medicine
 - 1.2.2 "Personalized" or "molecular" medicine
 - 1.2.3 Nanomedicine "single-cell" medicine
- 1.3 How Conventional Medicine Works for Diagnosis of Disease
 - 1.3.1 Identification of the "diseased state"
 - 1.3.2 Simple measurements of body structure and function
 - 1.3.3 Follow-up clinical tests
 - 1.3.4 Internal examinations by non-invasive in-vivo imaging
 - 1.3.5 Molecular tests for specific gene properties
 - 1.3.6 Comparison of individual results with "normal ranges"
- 1.4 How Conventional Medicine Works for Treatment of Disease
 - 1.4.1 Stabilization of patient – "heal thyself"
 - 1.4.2 Surgical repair of injuries
 - 1.4.3 Treatment with drugs locally
 - 1.4.4 Treatment with drugs systemically
 - 1.4.5 Treatment with targeted therapies
- 1.5 Factors Limiting the Progress of Medicine
 - 1.5.1 Economics
 - 1.5.2 Politics
 - 1.5.3 Regulation
- 1.6 Some Specific Problems with Conventional Medicine
 - 1.6.1 Consequences of waiting for patient symptoms
 - 1.6.2 Trained people and modern drugs are expensive
 - 1.6.3 Diagnostic technologies, if available, are still relatively primitive and/or expensive
 - 1.6.4 Crude targeting of drugs
- 1.7 What is the Basis for Nanomedicine?
 - 1.7.1 Creation of nano-sized tools
 - 1.7.2 These nanotools permit single-cell medicine
 - 1.7.3 These “nanomedical systems” can be “smart” devices
- 1.8 Some ways that nanotechnologies will impact on healthcare
 - 1.8.1 Nanomedicine will be “pro-active” rather than “reactive” medicine
 - 1.8.2 Possibility of "regenerative medicine"
 - 1.8.3 Blurring of distinction between prevention and treatment

Lecture 1: References

1. Leary, J.F. "Nanotechnology: What is it and why is small so big" *Canadian Journal of Ophthalmology* 45(5): 449-456 (2010).
2. Haglund, E., Seale-Goldsmith, M-M., Leary, J. F. "Design of Multifunctional Nanomedical Systems" *Annals of Biomedical Engineering* *Annals of Biomedical Engineering*, Vol. 37, No. 10, pp. 2048–2063 (2009).
3. Seale, M-M, Leary, J.F. "Nanobiosystems" in *Wiley Interdisciplinary Reviews: Nanomedicine and Nanobiotechnology*, J.R. Baker, Editor, Wiley Press, NY 1: 553–567 (2009).