

# COMMENTARY

## The Value of Scientific Drivers to Enhance Learning for Basic Science Clinicians, Faculty, and Students

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Diabetes mellitus currently affects 17 million people in the United States, with the vast majority, 8% of the adult population, having Type 2 Diabetes Mellitus (T<sub>2</sub>DM). It has become epidemic in the past several decades due to the advancing age of the population, increased prevalence of obesity and decreased physical activity. Diabetes causes considerable morbidity and mortality. The major complications are related to the micro- and macrovascular complications of the disease. The major macrovascular complication is atherosclerosis with an increased risk of a cerebrovascular accident and/or a myocardial infarction. The major microvascular complications are retinopathy, nephropathy, and neuropathy. Type 2 diabetes contributes to more cases of adult onset loss of vision, renal failure and amputation than any other disease. Patients with Type 2 diabetes have two to four times the risk of cardiovascular disease and 70% die of cardiovascular disease.<sup>1</sup>

The scientific literature was examined and key points abstracted as scientific drivers for learning and enhanced patient care. With a national advisory board and unrestricted grant support, five T<sub>2</sub>DM scientific drivers were stated. A scientific driver is a brief statement based on the most current medical literature, medical faculty review, clinicians' approval, and consensus statement of U.S. medical specialties. Scientific drivers usually focus on therapeutic areas. The drivers for T<sub>2</sub>DM were defined as:

- **Driver One** - Reducing blood glucose levels and HbA1c levels reduces the risk of diabetic complications. Intensive therapy has been shown to be superior to conventional therapy in terms of reducing glycemia and diabetic complications.
- **Driver Two** - When monotherapy with an oral agent is no longer adequate, combination therapy with 2 or more oral agents has been shown to significantly improve glycemic control.

- **Driver Three** - When oral monotherapy or combination oral therapy is no longer adequate, insulin can be added to the regimen to significantly improve glycemic control.
- **Driver Four** - Benefits of insulin therapy, such as improved outcomes and glycemic control, outweigh risks such as the potential for inducing hypoglycemia.
- **Driver Five** - Type 2 Diabetes Mellitus is a disease consisting of two components, insulin resistance and insulin deficiency.

A case-based learning module was written as part of the project. Priority groups are basic science faculty and students, clinical faculty, clinical students, and clinicians. U.S. medical schools were surveyed to determine the extent to which the five drivers were taught in Years 1, 2, 3, or 4. The five drivers seem to integrate the learning across the curriculum.<sup>2</sup> The clinical faculty each teach the treatment of T<sub>2</sub>DM, the oral hypoglycemic agents, and the side effects of these drugs instead of insulin.

According to the Association of American Medical Colleges' (AAMC's) CurrMIT<sup>3</sup> database, 58 medical schools report the teaching of diabetes at some point during the basic sciences or clinical years. Although some have integrated basic sciences and clinical materials, there remains a deficiency on how schools view scientific evidence based medicine content for T<sub>2</sub>DM. Examples of doing so may be found in the CurrMIT database. U.S. medical schools have an assigned password from the Association of American Medical Colleges to access this data.

In interviews with faculty, it was suggested that T<sub>2</sub>DM could be better taught in a coordinated and integrated manner that spans the four years of medical school. At this time, however, it appears that in most cases they are only being

taught in single courses. It does not appear that they are being taught across all four years of medical school. Faculty may select the order of the drivers and perhaps begin with driver 5, learning about pathology conditions first. Biochemical parameters (driver 2) and pharmacological treatments (driver 2, 3, and 4) could follow. The intent of this curriculum should provide the students an appropriate knowledge base to adequately treat patients.<sup>4</sup>

A poster presentation was provided attendees at the July 2003 International Association of Medical Science Educators annual meeting held at Georgetown. Several schools had extensive diabetes curriculum and formally commented about the intrinsic value of the five drivers. A summary of the schools that are successfully teaching the five drivers is listed in Table 1, "Schools Teaching T<sub>2</sub>DM Scientific Drivers." A summary table of the schools' representatives attending the July 2003 International Association of Medical Science Educators was developed from interviews and written surveys of the attendees. The attendees participated voluntarily. The results of these 18 representatives is summarized in Table 1, "Schools Teaching T<sub>2</sub>DM Scientific Drivers." Based on interviews, the drivers are not taught in most of health sciences institutions internationally. There were 18 institutions where most of the drivers are taught. The best examples for the health sciences are listed in the table. These institutions serve as role models.

| Summary of Table 1 |              |
|--------------------|--------------|
| Driver 1           | 18 out of 18 |
| Driver 2           | 18 out of 18 |
| Driver 3           | 17 out of 18 |
| Driver 4           | 13 out of 18 |
| Driver 5           | 16 out of 18 |

The T<sub>2</sub>DM health crisis can be improved by these learning activities. The five drivers are based on scientific evidence based medicine and can facilitate curriculum planning, integration, deployment, and evaluation. However, it is suggested basic science and clinical faculty learning teams be assembled to address chronic and end stage disease states. For each of these conditions, scientific drivers can be identified to guide integrated learning, curriculum and assessment across therapeutic areas.

## REFERENCES

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2. Norris, T., Cullison, J.W., and Fihn, J.D. Teaching Procedural Skills. *Journal of General Internal Medicine*. 1997; 12 (suppl2) S64-S70.
3. Association of American Medical Colleges CurrMit Database. Washington, D.C. 2003.
4. Gunzburger, L. Integrating Basic and Clinical Sciences via Type 2 Diabetes Mellitus. 7<sup>th</sup> Annual Meeting of the Int Assoc Med Science Educators. July 19-22, 2003. Washington, D.C. U.S.A.

**TABLE 1.** Schools Teaching T<sub>2</sub>DM Scientific Drivers

| College                                   | Driver       | Driver Being Taught? | Course(s)  |
|---|--------------|----------------------|--|
| U of Nebraska College of Medicine         | Driver One   | Yes                  | Pharmacology                                     |
|   | Driver Two   | Yes                  | Pharmacology                                     |
|   | Driver Three | Yes                  | Pharmacology                                     |
|   | Driver Four  | No                   | Should   |
|   | Driver Five  | Yes                  |  |
| U of Texas Medical Branch , Galveston, TX | Driver One   | Yes                  | Molecules, Cells, Tissues, Endocrine             |
|   | Driver Two   | Yes                  | Molecules, Cells, Tissues, Endocrine             |
|   | Driver Three | No                   | Should/Endocrine                                 |
|   | Driver Four  | No                   | Should   |
|   | Driver Five  | Yes                  | Molecules, Cells, Tissues, Endocrine             |
| Brody School of Medicine                  | Driver One   | Yes                  | Biochemistry; Physiology; Pharmacology           |
|   | Driver Two   | Yes                  | Pharmacology                                     |
|   | Driver Three | Yes                  | Pharmacology                                     |
|   | Driver Four  | No                   |  |
|   | Driver Five  | Yes                  | Pharmacology                                     |
| U of Health Sciences (Kansas City)        | Driver One   | Yes                  | Endocrine  |
|   | Driver Two   | Yes                  | Endocrine  |
|   | Driver Three | Yes                  | Endocrine  |
|   | Driver Four  | Yes                  | Endocrine  |
|   | Driver Five  | Yes                  | Endocrine  |
| U of Oslo, Norway                         | Driver One   | Yes                  | Semester 2-Cell Biology<br>Semester 4-G1-tractus |
|   | Driver Two   | Yes                  | Semester 4                                       |
|   | Driver Three | Yes                  | Semester 4                                       |
|   | Driver Four  | Yes                  | Semester 4                                       |
|   | Driver Five  | Yes                  | Semesters 2 & 4                                  |
| Sackler School of Med. Tel-Aviv U         | Driver One   | Yes                  |  |
|   | Driver Two   | Yes                  |  |
|   | Driver Three | Yes                  |  |
|   | Driver Four  | Yes                  |  |
|   | Driver Five  | Yes                  |  |
| Florida State University                  | Driver One   | Yes                  | Pathology, Doctoring                             |
|   | Driver Two   | Yes                  | Pharmacology                                     |
|   | Driver Three | Yes                  | Pharmacology                                     |
|   | Driver Four  | Yes                  | Pathology  |
|   | Driver Five  | Yes                  | Pathology  |
| Drexel U College of Medicine              | Driver One   | Yes                  | Year 1 Biochemistry                              |
|   | Driver Two   | Yes                  | Pathology<br>Pharmacology                        |
|   | Driver Three | Yes                  | Biochemistry                                     |
|   | Driver Four  | Yes                  | Biochemistry                                     |
|   | Driver Five  | Yes                  | Biochemistry                                     |
| UMDNJ-RW Johnson Medical Schoo            | Driver One   | Yes                  | Biochemistry                                     |
|   | Driver Two   | Yes                  | Biochemistry                                     |
|   | Driver Three | Yes                  | Biochemistry                                     |
|   | Driver Four  | Yes                  | Biochemistry                                     |
|   | Driver Five  | Yes                  | Biochemistry; Physiology                         |

| College                                    | Driver       | Driver Being Taught? | Course(s)                                   |
|--|--------------|----------------------|---|
| Lake Erie College of Osteopathic Medicine  | Driver One   | Yes                  | Endocrine System                            |
|  | Driver Two   | Yes                  | Endocrine System                            |
|  | Driver Three | Yes                  | Endocrine System                            |
|  | Driver Four  | No                   | Endocrine System                            |
|  | Driver Five  | No                   | Endocrine System                            |
| Florida State U College of Medicine        | Driver One   | Yes                  | Biochemistry                                |
|  | Driver Two   | Yes                  | Pharmacology                                |
|  | Driver Three | Yes                  | Biochemistry; Pharmacology                  |
|  | Driver Four  | No                   |   |
|  | Driver Five  | No                   |   |
| Southern Illinois University               | Driver One   | Yes                  | Year 2 Endocrinology (all drivers)          |
|  | Driver Two   | Yes                  |   |
|  | Driver Three | Yes                  |   |
|  | Driver Four  | Yes                  |   |
|  | Driver Five  | Yes                  |   |
|  | Driver One   | Yes                  | Lecture                                     |
| New York College of Podiatric Medicine     | Driver Two   | Yes                  | Pharmacology Lecture                        |
|  | Driver Three | Yes                  |   |
|  | Driver Four  | Yes                  | Internal Medicine                           |
|  | Driver Five  | Yes                  | Lecture/Guest Lecture                       |
| East Tennessee State University            | Driver One   | Yes                  | Biochemistry; Physiology                    |
|  | Driver Two   | Yes                  | Biochemistry; Physiology                    |
|  | Driver Three | Yes                  | Biochemistry; Physiology                    |
|  | Driver Four  | Yes                  | Biochemistry; Physiology                    |
|  | Driver Five  | Yes                  | Biochemistry                                |
| Indiana Univ School of Medicine            | Driver One   | Yes                  | Pharmacology, Physiology                    |
|  | Driver Two   | Yes                  | Pharmacology                                |
|  | Driver Three | Yes                  | Pharmacology                                |
|  | Driver Four  | Yes                  | Pharmacology                                |
|  | Driver Five  | Yes                  | Pharmacology                                |
| Philadelphia. College Osteopathic Medicine | Driver One   | Yes                  | Cell & Tissue                               |
|  | Driver Two   | Yes                  | Cell & Tissue                               |
|  | Driver Three | Yes                  | Cell, Tissue & Pharmacology                 |
|  | Driver Four  | Yes                  | Cell, Tissue & Endocrine                    |
|  | Driver Five  | Yes                  | Cell, Tissue, & Endocrine                   |
| Texas Tech Univ Health Science Center      | Driver One   | Yes                  | Intro Clinical Medicine                     |
|  | Driver Two   | Yes                  | Pharmacology                                |
|  | Driver Three | Yes                  | Pharmacology                                |
|  | Driver Four  | Yes                  | ICM Pharmacology                            |
|  | Driver Five  | Yes                  | Physiology                                  |
| Loma Linda U, CA                           | Driver One   | Yes                  | 2nd Year Pathology; Pathophysiology         |
|  | Driver Two   | Yes                  | 2nd Year Pathophysiology; 3rd Year Medicine |
|  | Driver Three | Yes                  | 2nd Year Pathophysiology; 3rd Year Medicine |
|  | Driver Four  | Yes                  | 2nd Year Pathophysiology                    |
|  | Driver Five  | Yes                  | 2nd Year Pathophysiology                    |