

Workshop  
Report

# Defining the Future of Medical Education

Institute for the Future of Medical Education

Flad Architects

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of Medical Education

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Sponsorship

**Flad Architects** is honored to have sponsored and also actively participated in this far-reaching workshop. As leaders in the design of clinical health, academic medicine, and life science facilities, Flad is helping to advance public health and well-being.

## Overview

On March 18-20, 2015, a group of nearly two dozen leading medical educators and academic thought leaders throughout the United States were convened in Atlanta, Georgia, by the Institute for the Future of Medical Education to explore what innovative actions could reposition medical education to meet the many challenges in the future. The group explored the current state of medical education, challenges, and opportunities for the future, along with prioritized action needs for discussion and further development including:



A summary of the group's discussion including challenges and opportunities for the future of medical education is provided within.

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# Intro


In 1910, a research scholar and former educator from Louisville, Kentucky, named Abraham Flexner transformed American medical education with what is today known as the Flexner Report. Flexner's survey of American and Canadian medical schools was in response to a recognized change in medical education at the time that addressed a transformative need to integrate research with clinical care for medical training in university settings along the lines of the new Johns Hopkins School of Medicine in Baltimore, Maryland.

Flexner advocated a new four-year course of medical studies with a more rigorous curriculum comprised of the basic sciences during the first two years of medical school followed with clinical training at the bedside with post-graduate medical training to follow. It is the system American medicine follows to this day and has always centered on the study of disease; most often in the hospital setting with advanced disease. Within this setting osteopathic medicine (D.O. degree), a more holistic and personalized approach with wellness dimensions took a back seat in American medicine to allopathic medicine (M.D.) or disease-oriented medicine.



**For over a hundred years American medical education has flourished using the Flexner model but times have changed dramatically and now demand attention to powerful forces shaping health care delivery and medical education along with a renewed look at both disease and holistic/wellness approaches. While some of these forces are certainly political and economic, they are, in fact, secondary to the massive amount of data being produced each day in medical sciences and the inability of any human mind to contain all the data, information, and knowledge that is currently available along with the larger body of information that will become available.**

**Compelled by this tremendous increase in scientific discovery and rapid technological advancement, most agree there is a fundamental new sea change in medical education taking place that is already sweeping across the health care landscape with major implications on how we should educate and will need to train physicians for the future delivery of care. The sheer volume of new scientific knowledge now accumulating at an ever faster pace certainly exceeds our capacity to “know” and requires a google-like information system to be readily accessible by caregivers at every level.**



We must ask an essential question — is our present approach optimal for preparing the physician of the future and will this present approach realistically keep us ahead of the curve in a new digitized era of medical and communications technology — a cyber-infrastructure that is transforming society, health care delivery, and institutions of higher education in unprecedented ways?

**The answer to this overall question begs several additional questions:**

- What is the current state of medical education and what needs to change to train that ideal physician of the future?
- What is the current state of medical practice and what trends will affect the practice of medicine over the next decade and beyond?
- What are the personal characteristics that will define the ideal physician of the future?
- What is the understood difference between education versus training?
- What should be done to address the evolution of delivery of care?
- When should differentiation (i.e., generalist, specialist) begin?
- What are the challenges we face today and can we prioritize them?
- Most importantly, can we define innovative actions to reposition medical education to meet the challenges ahead?

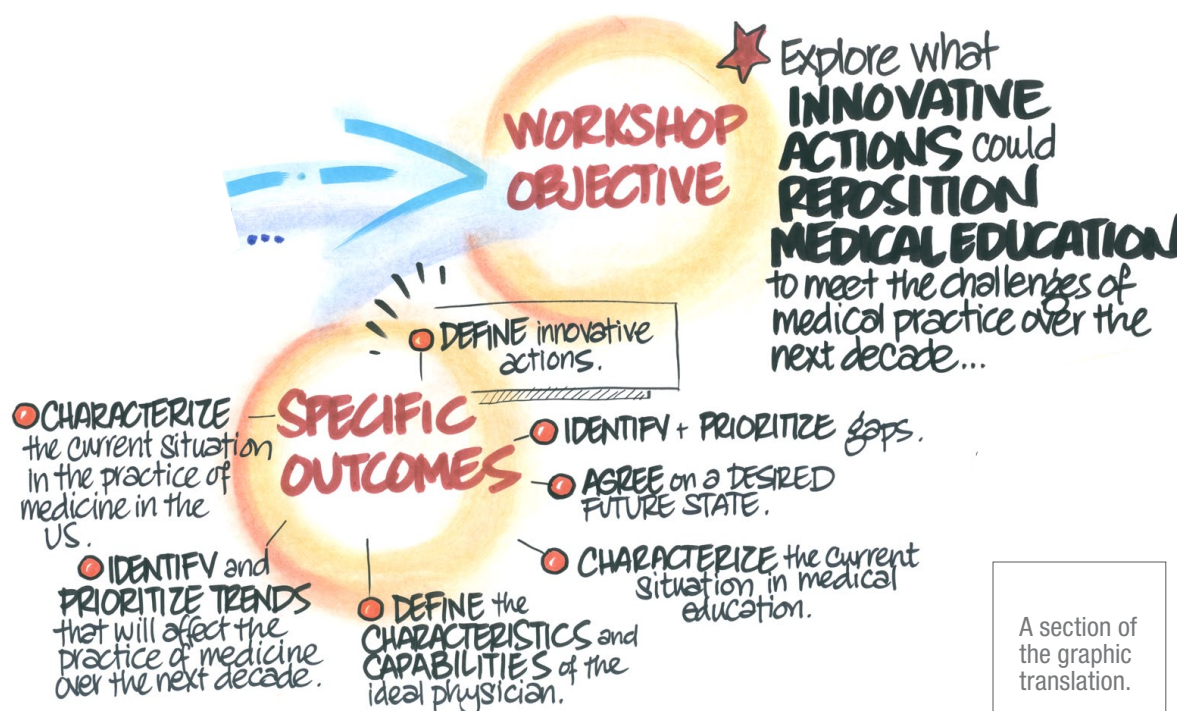
**These important questions are closely related and no attempt was made to address them in order. The group instead, dealt with each as they entered the normal flow of discussion and often on multiple occasions. As a result they are not addressed separately in this review.**

## Convening a Workshop to Examine the Future of Medical Education

On March 18-20, 2015, a group of nearly two dozen leading medical educators and academic thought leaders throughout the United States were convened in Atlanta, Georgia, by the Institute for the Future of Medical Education (IFME) to address these fundamental

questions. The IFME is a non-profit foundation formed to, where possible, lead discussions and develop opportunities for designing medical education to better prepare physicians for next generation health care. The questions noted above are central to the overall objective of this workshop to explore what innovative actions could reposition medical education to meet the many challenges identified by the workshop's participants.

For two days this group of medical school deans, leaders of universities and academic health consortia, as well as key thought leaders in such areas as informatics, human genomics, hospital and care setting design, and multidisciplinary systems thinking came together to take a collective look at the current and the future state of medical practice and education.



They were led by Robert Mittman, an experienced strategic planning consultant with international experience working with the health sector.

Throughout the workshop Mittman was supported by a graphic facilitator who translated the lively and ongoing discussion into a series of engaging graphic drawings illustrating in real-time a colorful visual map of the collective group think.

This report is an attempt to capture the important ideas and visions of the participants and includes selected presentations of those illustrations to provide the reader an overview of the highlights of the meeting. In no way was this workshop intended to send a message that

What the Institute asked of these leaders are the hard questions — are we doing enough with a full appreciation of the scope of change taking place around us?

ongoing innovations in medical school curricula are nonexistent and ineffective. There are numerous and impressive innovations in medical school curricula taking place every day in academic health centers and universities throughout the country.

What the Institute asked of these leaders are the hard questions — are we doing enough with a full appreciation of the scope of change taking place around us?

The group's responses characterizing the current and predicted future state of medicine and medical education in the United States, along with challenges, opportunities, and innovative actions, are revealing and presented on the pages that follow.

In preparing this white paper, the IFME shares with the reader highlights of this two-day workshop that demonstrated a collective sense of pride in all that American medical education has accomplished in the last century since Flexner's report. The state of medical education may be good for now but how must it adapt to meet the needs of future practice? Just as health is a state of delicate equilibrium involving dimensions of physical, mental, and social well-being; medical education is constantly challenged to maintain its own state of equilibrium in tune with constant change.

While change and response to change were readily accepted as a norm, the participants conveyed a certain sense of urgency that we are in an era of phenomenal and accelerated change in the content, technology, and context of medical practice. We must be willing to think transformatively with

bold, innovative ideas to assure that the physicians of the future have the competencies and the educational "scaffolding" based upon a variety of intellectual platforms necessary for new ways of learning and new team-based approaches to care delivery in a digital age monumentally different on multiple levels from the early 1900s when Flexner released his report.

## Addressing Change and the Current State of Medicine

One way to address the current state of medical education is to ask thought leaders experienced in the academic health sector a seemingly simple question, “If you could make one change to medical education that would most prepare new physicians for the future, what



“If you could make one change to medical education what would it be?”

would that one change be?” A selected summary of the themes across the group’s collective responses says a great deal about the current state of medical education and how participants would like to see it evolve:

### Restructure the Learning Experience –

As one member of the group clearly expressed, “If we remain dedicated to minor revisions of past educational approaches, our prospects will be dim indeed.” Conventional education is simply too static and too passive. Students can no longer be viewed as empty

vessels that we simply fill with information. We must develop a continuous learning system that constantly revises to meet our ever-changing health care environment; not one that is static and revisited/ revised every decade or more. We need to rethink the curricula and pedagogical approaches while sharing innovative models that move medical students to competencies with patient contact earlier in their training. Likewise, we must employ assessment tools that evaluate and guide improvement for both the student as a future medical professional and the organization as a center of learning.

As Flexner insisted, students must be problem solvers. Too often, noted participants, they are taught with a primary focus on passing national board exams rather than with a central focus on problem solving. In this accelerating age of informatics and sub-specialization, we need to rethink how students learn in

the information cloud in which they (and their patients) now exist. We must shift from testing for knowledge to teaching and evaluating skill-based competencies. We must begin patient contact earlier in their training, supported by positive role models in the patient setting who demonstrate both complex problem solving, professionalism, and patient centeredness on a continual basis.

We must ask hard questions regarding how the current four-year curriculum is organized or even if the curriculum should continue to be set somewhat arbitrarily at four years. We must ask if there are better “systems” approaches to revising the curriculum with

special attention to how and when the basic sciences are taught. Perhaps these courses are moved to undergraduate studies or taught in a year of intense post-college curriculum with the focus on preparing students for medical school. Participants also raised the question, are we making the best use of the fourth year of the medical school program?

Considerable discussion revolved around building a “scaffolding” approach to the curriculum that transforms how we teach, when we teach, and where we teach with a systems approach that without fail includes and positions the patient and patient experience at the center of training. As a reminder, “instructional scaffolding” and the “Scaffolding Theory” of education had its origins



in the 1950s and early 1960s when it was initially introduced by Jerome Bruner, a cognitive psychologist, to describe the process by which young children first learn to speak. In the context of the group’s discussions regarding medical curriculum, “instructional scaffolding” referred to the strategies our current expert faculty use to devise learning and instructional processes to assist

the student’s progress to a new level of achievement by creating a potential for learning rather than delivering information.

Participants commented that there was increasing implementation of the small group instructor-student sessions where the instructor models or demonstrates a problem and illustrates a problem-solving process. The instructor then steps back from the process to allow the small interactive group of learners to accomplish the task. The instructor offers support as needed along the path. This is certainly an example of classic instructional scaffolding as it has developed in the world of education over the years. It was felt that efforts to increase this form of learning in the first

years of the curriculum seemed advisable and in fact were being introduced in many medical school curricula.

As the discussion noted, historically most of the early instruction in medical school has occurred as lecture presentation of material to be learned by the student in an “instructor-centered” format. In this environment the student is a passive learner. Today, the lecture

format has moved from the large lecture hall and student “note-taking” to the lecture as “online homework” to be consumed at the student’s pace.

The disruptive changes of information technology and social media are also impacting the instructor-student

learning environment in other ways. It was noted that iPad and handheld devices provide the student with easy and rapid access to vast resources of information changing the learning environment to being web-based, opportunistic, and collaborative. Simulation laboratories not only train pilots and commercial boat captains but are now available to medical students, residents, fellows, and allied health professionals.

It was duly noted that in medicine, as the student begins the direct interaction with patients, the learning process continues to be heavily driven by a “need to know” and to be confidently viewed by the patient as knowledgeable. In medical education, this remains



“In this age of science, our students need to develop strong tools to think holistically, to think in terms of all individual parts of the problem and to become confident in understanding the relationships that tie all the elements together as a system.”

Workshop Participant

a strong driver for a learning environment enabled by skilled faculty – certainly an example of “instructional scaffolding” and a systems approach to problem solving. Comments emphasized the strong role of the “question answer” evaluation sequence (known as professor

rounds) and how any student would tell you an event that not only provided maximum stress but also more learning than any format in their education experience. These types of guided learning experiences, built on strong social interaction and visible role models of expertise have proven essential to learning and skill development in medicine.

### **Adopt Systems Approaches –**

Several attendees note that our current system of medical education was most often too reductionistic in its approach. Even during the exposure of

the student to disease, these experiences still occurred almost exclusively in the acute care hospital setting and with a focus on a clinical specialty and often a single organ system. It was noted that we need to consider a “systems biology” approach to disease which leads naturally to a concept of systems medicine and the conviction that medicine of the future must be predictive, preventive, personalized,

and participatory (P4 medicine). In recent years, much has been written regarding personalized or precision medicine and P4 medicine. In fact, personalized health care is a clinical working model that embraces systems biology and the tenants of P4 medicine and brings them into practice.

Do we really understand what systems approaches are and how we can integrate this approach into medical school curriculum? Considerable conversation ensued regarding the need to place more emphasis in educating our students to develop the strong habits of approaching the problem in hand by not simply defining its parts but rigorously understanding its composite integrated character and how to use the power of available computational tools based on large- scale data to derive best use of existing knowledge.

For example, we need to train our students to automatically understand that the patient exists in an environment; that they have unique behaviors and



stresses and a unique family history. As one person with an engineering background stated, in this age of science, our students need to develop strong tools to think holistically, to think in terms of all the individual parts of the problem, and to become confident in understanding the relationships that tie all the

elements together as a system. Thus, it is the application of this “systems approach” to the extremely complex aspects of a functioning genome, the intricate and elaborate pathways of intercellular and intracellular communication, of interactive organ system functions that are the “systems biology” of a “systems thinking” approach to caring for the individual. This approach to health care deserves further attention as we envision the physician of the future. We cannot, however, do so without selecting compassionate individuals to train that will clearly understand that our progress in science and our need to apply “systems thinking” must be done understanding the human in the context of their psychological, social, and environmental content.

These are aspects of human wellness and disease often more difficult to quantify and integrate into an increasingly digital care environment.

### **Quantify Wellness and Demystify Disease –**

Within the framework of systems biology, personalized health care and P4 medicine is the call to make wellness a greater part of the equation. In recent years, attention has focused on integrating therapeutic approaches to the

treatment of disease with holistic strategies to better meet the needs of patients to successfully navigate difficult clinical challenges. Integrative approaches are also designed to improve health and well-being. Moving beyond disease care to health care is a promised goal of personalized medicine and characterizes the practice

approach of personalized health care. Nonetheless, today's students spend the majority of their medical curriculum teaching and patient contact hours in the hospital environment focused on disease and intensive care of the sickest patients. Granted these environments are a great place to see and experience normal/ abnormal physiology and to learn direct applications of pharmacology principles. Some would say there is no place like the ICU to really learn how the organs of the body function and how they must work together.

While current health care models address the patient only after they become sick, we need to integrate wellness models from public health with medical models to optimize human health and provide fundamental changes in how we address patient care and disease

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“They [physicians] must be committed to staying in the stream, despite its fast current.”

Workshop Participant

prevention. Current research suggests that health is made up of a number of social determinants including healthcare, shelter, meaningful work, social belonging, and education. Today in the USA we are over invested in medical care as though it is the sole social determinant of health, and our health professionals are only partly aware of what their imbalanced approach is extracting

from the budget that otherwise could substantially improve the health status of both individuals and populations. If one is not convinced of the truth of the prior assertion, at least medical students and future physicians should be able to scientifically engage this question since it strikes to the ethics of why the profession of medicine exists. Surely going forward in a world populated with billions and billions of human beings, medicine has the responsibility for seeking to support long and healthy lives, not simply to relieve the suffering of those fortunate enough to find your clinical office.

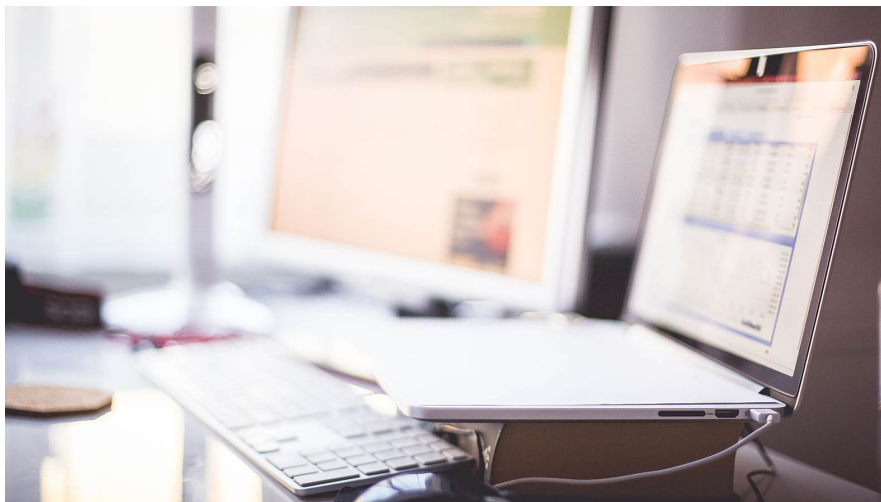
The power of information management available in so many areas of the business world is yet to be unleashed in full measure in the world of health care. Health

care has yet to accomplish the task of deploying the wealth of new knowledge available by integrating each individual's health records; genome, proteome, and other 'omics maps; records of exposures to health risks;

and other data with a goal of resolving their disease and of optimizing their opportunity for lifelong health. At this moment, we are at the doorstep of a new era of personalized medicine based upon the continued development of predictive and personalized technologies and by collecting health data to better predict health risks, prevent and minimize disease, and customize care.

Medical education must move forward concomitantly in step in this dynamic and proactive approach to care.

Addressing wellness requires that we truly understand that health is a continuum of individual physical, mental, and social well-being. Working with sensitivity to the life goals of each patient is essential, along with an understanding that each patient has his/her own perception of what wellness is. Prevention is not just identifying risk factors, it also requires partnering with patients and facilitating their knowledge and engagement in their own health and health care. A preventive and wellness outlook must be addressed in the medical curriculum as well as the patient's care in a systematic and longitudinal way with the patient centered within the dialog. This powerful and potentially transformative



approach deserves further attention as we envision the physician workforce of the future. Will M.D.s provide the oversight and leadership? Will we train in greater numbers more of a new integrated team of health care

professionals such as life coaches, nutritionists, fitness trainers, and specially trained physician assistants to assist in optimal wellness and the managing of routine everyday acute illnesses?

### **Manage Information –**

Information and communications technology is a game changer. Learners must be able to use technology to access and organize critical data, information, and knowledge and integrate it into the care of their individual patients. As one participant noted, the practice of medicine is full of complexities and uncertainties and the pace of new knowledge and instant access requires both equanimity and resilience. “They [physicians] must

be committed to staying in the stream, despite its fast current.”

Already today, students in increasing numbers are learning through multiple streaming channels and social networks along with MOOCs (Massive Open Online Courses) and other forms of web-based learning that are increasing in popularity and utilization. But even more important, accessing information instantly is increasingly the norm for provider and patient alike. Centers of medical education must create and support new

methodologies for how the physicians of the future learn and practice using the “clouds” of data, information, and knowledge that are increasingly part of their

working environments. How to interpret and use these resources is a recognized challenge now addressed through emerging departments of informatics who are increasingly becoming essential members of the multidisciplinary team supporting all aspects of health and health care. Medical curricula must address relevant competencies, including as one participant noted, the ability to recognize when a physician is at the end of his/her personal knowledge and must consult a knowledge or information resource in order to provide the best possible care. Other key competencies will

to one that is personalized and individually tailored. Physicians increasingly in the future will be team-based and empowered through the information at their fingertips. Technology, as noted, will facilitate the health team's reach to patients at any location at any time but the physician-patient relationship will be essential to the art and science of care. Health educators across the spectrum of medical care including medical, nursing, pharmacy, physical therapy, public health, dental, health care administration, medical law, and health care informatics/analytics will increasingly need to develop

training opportunities that support the continued evolution of a new multidisciplinary team approach to patient care, heavily supported by an increasingly digital medical world. Innovations addressing this need are already taking place and should be evaluated, shared, and supported as important models for the future.



“Medicine is a calling that will exercise your heart and your mind equally.”

Sir William Osler (1849-1919)

include communication approaches that take advantage of shared access to information and knowledge between patients and providers.

### **Embrace the Team Approach to Health Care Delivery –**

We are moving from a physician-led, hospital-centric health system to one that is team-led and consumer-centric. We are shifting from a condition-based approach

There is a big difference between treating a patient and caring for a person, noted several participants in the workshop. For disciplines of medicine that involve a longitudinal interaction with the patient, understanding the role of the physician to include that of the “healer” is important. Healers see the whole patient and involve the patient as a part of the health care team. Indeed, as we enter an age focused on health enhancement and disease prevention, it is an increasingly informed and engaged patient that plays the most important role in effecting best outcomes. To this end, healers are

### **Educate Healers –**

privileged, patient listeners and students are educated to this aspect of medicine, often called the art of medicine, through the role models they train beside. We must make every effort to eliminate the often hidden lessons between classroom and bedside that have been prevalent in medical training where the humanistic caring side of the physician is overwhelmed by the technology, as well as the demands on time and throughput. Far too often, idealistic medical students lose their patient-centered ideals when thrust from a patient-sheltered first two years of course work into the clinical settings where the message is a business model that teaches one to see more patients, faster.

As Sir William Osler (1849-1919) said so many years ago, “Medicine is a calling that will exercise your heart



and your mind equally.” Today, health care is anywhere and everywhere with the internet a leading source of health information, and we need to emphasize the value for preparing future physicians in a cyber-world

of technology when the human touch and capacity for compassion remains a timeless and essential element of health care not to be sacrificed.

### **Define Professionalism –**

Professionalism is a major buzzword in medical education. Accreditation organizations are applauded for adding, in recent years, competency criteria including professionalism into graduate medical education. Yet, are we doing enough, and do we have an agreed normative definition of what medical professionalism is and how to measure it? More than defining the attributes of professionalism, are we modeling professionalism throughout the care process? This is an important

topic participants cited as “essential” and deserving much more attention and development within the medical curriculum of the future.

### **Prepare Students for the New Business of Medicine –**

Are we training physicians to be caregivers while ignoring the health care environment they must negotiate as practicing professionals? The transition from medical school into the practice world of health care delivery and reimbursement models – that alphabet soup of HMOs, PPOs, and DRGs that symbolize

the care system management dimension of medicine – is one that few medical students encounter in a formalized way during their formative training. There exists a real disconnect between training future

current fourth-year curriculum and whether adjustments should be made during the final year of medical school to address that disconnect. The challenge, of course, is to make them aware of the system management side of healthcare without turning them into profiteers.



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“...ten thousand baby boomers in this country are turning 65 every day”

Workshop Participant

physicians in medicine and the reality of the patient care environment they will encounter following their medical school training. Questions were raised concerning the

in this country are turning 65 every day. Aging and longevity just isn't what it used to be as people are well at much older ages than they were even a decade or

### **Address Our Aging Population –**

We are all aging and there are dramatic shifts in our patient population as we live longer, often with chronic diseases. There is a growing divide in the number of physicians training in geriatrics and the needs of our rapidly increasing elderly population. That divide must be addressed and should not be overlooked as we look to the future of medical education. We must provide the geriatric training and develop integrated teams of care givers addressing the many and special needs of our elder population. As one participant noted, ten thousand baby boomers

two ago; e.g., eighty is the new seventy. Engaging these populations to understand and care for their own issues is more likely to impact on health and happiness than simply ‘treating them’ as passive patients.

### **Think Globally –**

Health care and disease know no geographic boundaries. We increasingly live in a global village. Infectious diseases, like Ebola, once geographically isolated are today only a plane ride away from any nation at any time. Medical education must address the value and critical need for physicians within health care teams addressing diverse and global health needs. Several participants even raised the discussion of required service dimensions for all medical students prior to completing their medical degree. At a minimum, we need to better integrate the global perspective into

the curricula and identify existing success stories and models that can be disseminated and adopted. Cultural competency and global health are increasingly essential elements within the mix of preparing physicians of the future. This includes not only the ethics of caring for those with new life-threatening illnesses but also the responsibility of care institutions to be prepared to help in the event of new outbreaks in terms of both policies, disaster training, and equipment.

### **Address External Drivers of Medical Education –**

Student debt and the cost of a medical education which is growing faster than health care costs was a topic of considerable discussion throughout the two-day workshop. Participants additionally outlined a number of social issues impacting the training of physicians as well as the delivery of care. Widening gaps in health outcomes and socio-economic status along with “political dysfunction” that disinvests in social goods such as health care, research funding, and education are strong headwinds that must be continually addressed by academic medical leaders.



## Future Physicians

### What will the physicians of tomorrow look like?

Addressing desired changes to the current state of medical education is one thing. Envisioning what the physician of the future might look like is perhaps a more difficult task. Each participant was asked to take a single sheet of paper and draw their personal vision of the physician of the future (stick figures allowed). Each member of the workshop was then asked to present to the group their physician of the future.

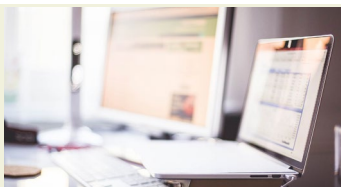
The results were revealing as each thought leader imagined and created their personal vision of a successful physician for the future. Each of the two dozen newly created physicians of the future, both male and female, represented a unique and highly trained individual presented by their creators with great pride and enthusiasm. Some had creative names; all were the beneficiaries of a medical education system sensitive to the future needs and desired changes of medical education as discussed in the previous section of this report. Using the premise that today's first-year medical student will not enter practice for another decade or more, three examples of a future medical doctor are provided:



#### Physician A

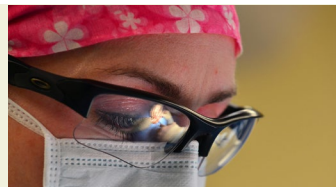
is a community-based physician. She works in the community, not in the hospital and is a member of an interprofessional team. She is happy and has a strong set of values. She is a systems engineer, knowledge manager, and interacts well with her team and her patients. She lives in the knowledge cloud and is comfortable working directly with a patient or sitting in front of a dashboard monitoring multiple patients at remote settings including the home. A knowledge manager, she interprets data and distributes tasks to team members knowing that each team member has a skill set necessary to provide the full scope of personalized care the patient needs. This physician of the future readily toggles between individual patient, population issues, and systems issues.

**These three visions of future physicians represent a microcosm** of the collective attributes assigned to the physicians of the future that participants presented. Across all of the physicians of the future presented, one can distill the following skill sets and attributes:



### Physician B

is a good communicator, understands datasets and has problem-solving as well as project management skills. He is a member of a team and trained in the systems approach to medicine. That translates to highly personalized medicine that is proactive, preventive and based on a wellness perspective. He is a good listener to his patients and includes the patient's personal goals in personalized care management. Through it all he is compassionate and humanistic. He knows how to integrate multiple channels of incoming information and seeks knowledge over information and knows the difference.



### Physician C

manages multiple teams of interdisciplinary care givers. She is specialized in acute care whether the medical issue is an infectious disease or a broken leg. She assimilates patient data remotely and directs care to multiple teams for multiple patients. Chronic conditions and patient follow-up are skill sets her other physician colleagues specialize in. Acute care is her passion and her focus. Because of this focused approach, she is able to assimilate large volumes of evidence-based knowledge specific to her acute care interests. She is culturally competent, trilingual, and integrated in her approach to teamwork.

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Interdisciplinary

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Interprofessional

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Life-long/continuous collaborative learning

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Professional – a culture of professionalism in a setting of interprofessional teamwork

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Out of the box thinker

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Inquisitive

---

Listener

---

Continuously challenging the hypothesis

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Systems approach to problem solving

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Dedication to performance improvement with the humility to recognize one can always be better

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Compassionate, dedicated

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Resilient

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Optimistic

---

Tech savvy

---

Positive role model

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Intuitive and integrative

## How Do We Teach and Prepare the Physician of Tomorrow?

The Flexner Report in 1910 provided a well-used template for how and where medical education takes place to this day. Using his four-year model, the first two years of medical school were assigned to learning science in the laboratory and classroom and the second two years were for applying that



knowledge in clinical settings. How we teach and prepare the physicians of tomorrow such as those newly created physicians of the future presented in the previous section of this report requires a paradigm shift. Participants offered the following suggestions recognizing the learning environment of the future will be different from the present.

**Learning and how we learn must adapt to new settings and change-directed ways of learning as itemized:**

**Health care is already shifting away from the traditional settings of the hospital and doctor's office.** A more realistic reading of the future is that the conventional channels of care will continue to exist, including hospitals, clinics, doctors, nurses, and support professionals with supplementation by

mobile medicine accessible at home, in the workplace, and on the go. The rapid development and popularity of CVS "Minute Clinics" is a sign of these changing times with Walgreens and other corporate entities moving into the marketplace with acute and chronic care services.

**Health care will be personalized,** proactive and patient-driven.

**Patients will continually monitor their personal**

**health data,** much of it stored in their smart phones, and sent to the cloud to be crowd sourced and analyzed. This will be a dynamic situation and the physicians of tomorrow must be adept at managing large amounts of data and working in teams. Such a paradigm shift in the delivery of care requires an equally dramatic change in how we educate and prepare physicians for this future.

The impact of information and communications technology, both the use of information for patient care and for the access and utilization of information for learning in medical school and throughout one's professional career, is only beginning and will be central to how we teach, learn, and deliver medical care and services.

Equally important, the basic sciences have changed dramatically to focus much more heavily on cultural anthropology, human cognition (strengths and weaknesses), informatics including decision support and data management, communication science, psychology of groups, leadership, organizational behavior and group dynamics, and public policy relating to health.

Students will learn in different ways beyond the traditional classroom and large lecture setting. Early patient contact in a variety of settings throughout their training is essential just as providing the clinical experiences in diverse settings that reflect the future practice of medicine.

**Already innovative experimentation is taking place** to revise curricula in medical schools across the country and there is much to be learned through rigorous assessment of new approaches in order to identify proven models moving forward. Innovations

in curricula must be assessed rigorously and will provide proven models moving forward. Top-down learning approaches will increasingly yield to bottom-up teaching models where learners have flexibility and creative ways to learn at their own pace with demonstrated competencies central to the desired teaching outcomes.

**How the basic science curriculum is addressed is a topic of great interest** to

the participants of this workshop and hard questions were asked regarding what parts of this curriculum should be mandatory. The term "scaffolding" has multi-dimensional meanings beyond the scope of this discussion but relevant to the group's discussion regarding

mechanisms for what and how to best integrate the basic science and clinical care dimensions of medical education throughout the student's formative medical school years and throughout that physician's career. Equally important, the basic sciences have changed dramatically to focus much more heavily on cultural anthropology, human cognition (strengths and weaknesses), informatics including decision support and data management, communication science, psychology of groups, leadership, organizational behavior and group dynamics, and public policy relating to health. Indeed, if it came down to

making a choice, the curriculum would be 2/3rds this newer sciences and 1/3 or less traditional basic sciences. Pre-residency medical education in other words should be very broad in general with the student expected to really drill down into a couple of issues in depth in order to learn how discovery works and how to discipline both their minds and writing and speaking capabilities. Residency training would then really teach them how to become whatever kind of specialist they become; e.g., family care, public health doctor, or surgeon.

**Systems biology along with creative curricular redesign** offers a new approach to the learning style and content for the physician of the future that facilitates the integration of knowledge of the basic sciences including human genomics with patient care. This approach also incorporates a much needed wellness dimension that includes a predictive, preventive, personalized, and proactive systems approach to delivering individualized care.

- Within this systems approach to learning and delivering patient care, cross-disciplinary biology

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is already bringing together biologists, chemists, computer scientists, engineers, mathematicians, physicists, and physicians under one roof to solve very complex biological problems in new ways with new technologies that will increasingly translate into care settings tailored to the individual rather than generalized from the population. Similarly, systems learning focused on population health and behavior change would bring another appropriate mix of scientists and clinicians together in order to create the 'best cure for the problem at hand.'

- in medical education is the importance of the team approach to medical care and that calls for innovative approaches to train interdisciplinary health care teams working in multiple settings.
- Applying systems science and interdisciplinary team approaches to medical education is no easy task. Systems approaches and working as part of a multidisciplinary team is clearly in the future of medical education and for the purposes of this two-day workshop, appropriately flagged and highlighted as critical areas of need deserving continued

thought and discussion.

It was noted there are innovative models already in place that deserve renewed attention.

**Students of the future are not going to learn in large lecture halls**

having information poured

into their heads for the primary purpose of answering multiple choice questions on tests of their knowledge retention. They are going to learn on the move through social media and online content delivery systems with instant access to a variety of data points (both noise and knowledge) – a virtual cloud of patient and knowledge data – and they must be



given the structure and guidance, yet the freedom, to develop their own learning paths and flourish.

### **The pipeline of students coming into the medical education system deserves careful attention**

to identify and select students comfortable with technology yet service-oriented, compassionate, and humanistic in approach to all they do. Considerable attention to the admission process for choosing future physicians will be essential in order to build the diverse medical workforce required to match the needs and work environment of the future.

### **Attention to the cost of medical education**

and cooperative alliances between medical school leadership and accrediting organizations is also essential. Across all of these discussions, participants emphasized that good assessment of the educational programs is critical. These are powerful external forces that impact how and where physicians at

present practice and select their practice focus. Likewise, accreditation standards exert positive and negative forces on how the curriculum is structured at present and needs to work in harmony with the changing needs of medical education in these rapidly evolving times.

### **Across all of these discussions,**

**participants emphasized the importance of rigorous assessment** of the educational programs and new teaching innovations. Individual studies need to yield to multi-center collaborations with an eye on greater sophistication using theory and conceptual frameworks that develop predictive models for broader adoption and application.



“You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete.”

Buckminster Fuller (1895-1983), American neo-futurist and systems theorist

## Opportunities and Prioritized Action

Participants were asked to identify and discuss the gaps they perceive between the current state of medical education and the future state they envision as summarized above in their vision of the physician of the future. As a group, they preferred not to address gaps but reframe the discussion in a more constructive manner as opportunities to build a new model for medical education moving forward.

Opportunities begin by accepting change. Participants in this workshop represent experienced and accomplished academic thought leaders who

clearly expressed the sentiment that change is ongoing and should be accepted and viewed as the catalyst for opportunities. Medical education is never going to be in a steady state and will always be addressing ways to find the best equilibrium to train the best physicians we can to meet the needs of a changing health care environment. There will always be a bit of chaos and state of fluctuation in medical education as in society as a whole said one participant – that is the norm and we must work with it and through it.

Buckminster Fuller’s quote seen above especially resounded with the participants in this workshop who voiced a collective spirit of creative thinking; recognizing that tweaking the edges of existing

approaches to medical education is not going to move the future of medical education forward in ways that keep physicians of the future in step with the rapidly evolving world in which we live.

At the same time, participants noted with no small amount of pride that medical education today has many strengths and numerous innovations are taking place throughout academic medicine that we can evaluate, learn from, share, adopt, reinvent as needed, and utilize for the future. Change will come about in incremental steps except in those environments who throw caution more to the wind and dare to create very new models. Some of the

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“There will always be a bit of chaos and state of fluctuation in medical education as in society as a whole said one participant – that is the norm, and we must work with it and through it.”

Workshop participant

newest medical schools offer such a ‘green field’ opportunity. The key will be evaluating and identifying those programs that work while identifying gaps in medical education that need to be filled and develop new initiatives/pilot programs to move forward in needed directions.

## Action Items

Given the workshop’s primary objective was to explore what innovative actions could reposition medical education to meet the challenges of medical practice over the next decade, participants recommended two specific areas of attention to be addressed. Two working groups evolved from this process to address these two prioritized opportunities at hand.

## Leadership Development Initiative

This working group will address the need to develop a new generation of leaders in academic medicine who are technologically savvy and creatively adept at working within complex systems. Participants in the workshop, while experienced and thoughtful leaders of the present, recognize that the future of medical education requires a new cohort of leaders with the skills and expertise to embrace,

to guide, and to research innovative approaches to next generation education and training.

Participants identified the Robert Wood Johnson Clinical Scholars Program launched three decades ago as a good example of a program that served medicine well by providing the resources for developing a new leadership. A similar program could be established to incentivize the training of the leadership required to address and research the needs of the multiple and complex issues discussed throughout this two-day workshop.

A working group self-selected to further discuss and elaborate a developmental plan with goals, outcomes, and assessment elements.

### **Development of a New Learning Platform with a Systems Approach**

A second working group self-selected to continue the discussion and address further the creation of a working model for what a “scaffolding” approach to the medical curriculum would look like. Such a model would address how the basic sciences are integrated and expanded to include a strong background in a systems approach to problem resolution and to the management of a diverse team of variously trained care providers. The student of the future certainly will need to be well grounded in the systems biology approach to disease and comfortable in the use of “omics” and the application of such knowledge to

wellness and P4 medicine. He/she will be trained to lead interdisciplinary care team development and be a leader in the use of information and communication infrastructures (often termed the “learning health care system”).

### **A Final Thought**

There was general consensus that the challenge before the current leadership of academic medicine is not simply to generate a “best guess,” albeit an educated one, regarding the health care system a decade or more from now and the skills that will be required by the physician in this new environment, but rather to develop the model education and training system that has the required flexibility to adapt rapidly to the changes imposed by advances in science and technology. A constant underlying current in the dialogue was the ever increasing speed with which science and technology are progressing and generating an overwhelming amount of new knowledge that will impact all physician decision making. Thus, it is not possible to design the perfect education environment and curriculum to meet the speed of change. The challenge is to design the system of the future that has the flexibility and easy adaptability of multiple learning pathways needed to develop the varied skill sets required by the future world of medical care delivery. Indeed, adapting well to change and at times actively driving it may prove to be the most critical personal and system attribute for future health professionals.

### **Selected Readings**

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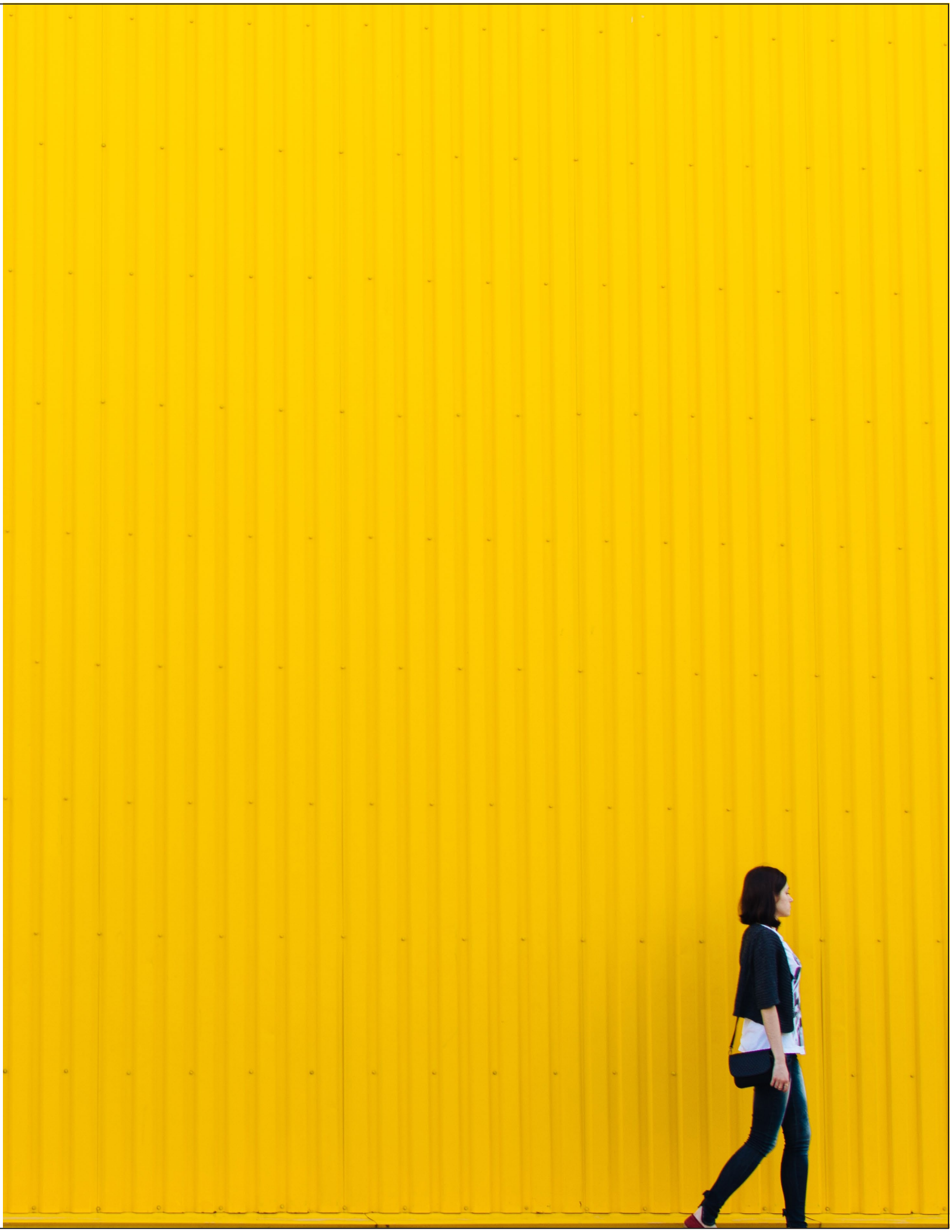
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The background of the entire page is a dark, out-of-focus photograph of light sources, creating a bokeh effect. There are several large, overlapping circles of light in various colors, including red, orange, yellow, green, blue, and purple. The circles vary in size and brightness, with some appearing as sharp, bright spots and others as softer, more diffused glows. The overall effect is a vibrant, abstract pattern of light against a black background.

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